FINAL REPORT:
Regional Assessment of Offshore Wind Development in Newfoundland and Labrador

January 23, 2025

Committee for the Regional Assessment of Offshore Wind Development in Newfoundland and Labrador: Shayne McDonald (Chair), Glenn Blackwood, Leslie Grattan, Brian Power, and Paul W. Saunders

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List of Abbreviations

Abbreviation	Definition
ACPA	Aboriginal Conservation Protected Areas
ATIA	Access to Information Act
AMIK	Agence Mamu Innu Kaikusseht
APEI	Air Pollutant Emissions Inventory
AQHI	Air Quality Health Index
AC	Alternating Current
AOI	Area Of Interest
asl	Above sea level
AGC	Atlantic Groundfish Council
AUV	Autonomous Underwater Vehicle
AZMP	Atlantic Zone Monitoring Program
AIS	Automatic Identification Systems
AOL	Aviation Obstruction Light
BACI	Before-After-Control-Impact
BRI	Biodiversity Research Institute
BLM	Bureau of Land Management
BOEM	Bureau of Ocean Energy Management
The Atlas	Canada Marine Planning Atlas - Atlantic
C-NLOPB	Canada-Newfoundland and Labrador Offshore Petroleum Board
CEPA	Canadian Environmental Protection Act
CER Act	Canadian Energy Regulator Act
CRIAW	Canadian Research Institute for the Advancement of Women
CWS	Canadian Wildlife Service

Abbreviation	Definition
CO_2	Carbon dioxide
CO	Carbon monoxide
CORER	Canada Offshore Renewable Energy Regulations
CIL	Cold Intermediate Layer
CCRI	Community-based Coastal Resource Inventory
CEA	Cumulative Effects Assessment
CEMS	Cumulative Effects of Marine Shipping
DOECC	Newfoundland and Labrador Department of Environment and Climate Change
DND	Department of National Defence
DC	Direct Current
ECSAS	Eastern Canada Seabirds at-Sea
EBSA	Ecologically and Biologically Significant Areas
EEZ	Economic Exclusion Zone
EMF	Electromagnetic Frequency
ECCC	Environment and Climate Change Canada
FSDS	Federal Sustainable Development Strategy
FFAW	Fish, Food and Allied Workers
DFO	Fisheries and Oceans Canada
FSC	Food, Social, Ceremonial
GBA Plus	Gender Based Analysis Plus
GIS	Geographical Information Systems
GBS	Gravity-based Systems
GHGs	Greenhouse Gases
GMNP	Gros Morne National Park
GDP	Gross domestic product

Abbreviation	Definition
GPS	Global positioning system/satellite
GSL	Gulf of St Lawrence
HANL	Health Accord for Newfoundland and Labrador
HPAI	Highly Pathogenic Avian Influenza
HVDC	High-Voltage Direct Current
HFCs	Hydrofluorocarbons
IAA	Impact Assessment Act
IAAC	Impact Assessment Agency of Canada
IBA	Important Bird Areas
IHFN	Indian Head First Nation
ICE	Indigenous Circle of Experts
IPP	Indigenous Participation Plan
IPCA	Indigenous Protected and conserved area
IIP	International Ice Patrol
IUCN	International Union for Conservation of Nature
KBA	Key Biodiversity Areas
kt	kilotonnes
kt CO_2 eq	kt of CO_2 equivalent
KMKNO	Kwilmu'kw Maw-klusuaqn Negotiation Office
LFA	Lobster Fishing Areas
MAB	Man and the Biosphere Programme
MNWA	Marine National Wildlife Areas
MPA	Marine Protected Area
MRC	Marine Renewables Canada
MSP	Marine Spatial Planning

Abbreviation	Definition
MS Teams	Microsoft Teams
Mt CO_2 eq	Megatonnes of CO_2 equivalent
MW	Megawatt
MOU	Memorandum of Understanding
CH_4	Methane
MTI	Mi'gmawe'l Tplu'taqnn Inc.
MMS	Mi'gmawei Mawiomi Secretariat
MFN	Miawpukek First Nation
MBR 2022	Migratory Bird Regulations, 2022
MBS	Migratory Bird Sanctuaries
VBME	Mine Expansion project at Voisey's Bay
NRA	NAFO Regulatory Area
NAPS	National Air Pollution Surveillance
NIR	National Inventory Report
NMCA	National Marine Conservation Area
NOAA	National Oceanic and Atmospheric Administration
NPRI	National Pollutant Release Inventory
NWA	National Wildlife Areas
NRCan	Natural Resources Canada
nm	Nautical mile
NFL	Netukulimk Fisheries Limited
NYSERDA	New York State Energy Research and Development Authority
NAWN	Newfoundland Aboriginal Women's Network
NCLI	Newfoundland and Labrador Climate Index
NLHS	Newfoundland and Labrador Health Services

Abbreviation	Definition
NLS	Newfoundland and Labrador Shelves
NLSA	Newfoundland and Labrador Statistics Agency
nGSL	Northern part of the Gulf of St Lawrence
NO	Nitric oxide
NO_2	Nitrogen dioxide
N_2O	Nitrous oxide
NITS	Noise Induced Threshold Shift
2SLGBTQQIA+	non-Indigenous racialized people, 2-Spirit, lesbian, gay, bisexual, transgender, queer, questioning, intersex, asexual, and more
NAFO	Northwest Atlantic Fisheries Organization
NCC	NunatuKavut Community Council
OWDP	Offshore Wind Predevelopment Program
OSDP	Open Science and Data Platform
OEABCM	Other Effective Area-Based Conservation Measures
OUV	Outstanding Universal Values
NO_x	Oxides of nitrogen
O_3	Ozone
PP	Participation Plan
PM_x	Particulate Matter
ppb	Parts Per Billion
PoE	Pathways of Effects
PTS	Permanent Threshold Shift
PTT	Platform Terminal Transmitters
PHC	Primary Health Care
QFN	Qalipu First Nation

Abbreviation	Definition
RSL	Relative Sea Levels
ROVs	Remotely Operated Vehicles
RMA	Representative Marine Area
R&D	Research and Development
SFA	Shrimp Fishing Area
SBA	Significant Benthic Areas
SEL	Sound Exposure Levels
SPL	Sound Pressure Levels
SARA	*Species At Risk Act*
SO_2	Sulfur dioxide
SCC	Supreme Court of Canada
TTS	Temporary Threshold Shift
TAC	Total Allowable Catch
TPM	Total Particulate Matter
TC	Transport Canada
UXO	Unexploded Ordinance
U.K.	United Kingdom of Great Britain and Northern Ireland
UNCBD.	United Nations Convention on Biological Diversity
UNDRIP	United Nations Declaration to the Rights of Indigenous Peoples
UNESCO	United Nations Educational, Scientific and Cultural Organization
U.S. EPA	United States Environmental Protection Agency
U.S.	United States of America
VMS.	Vessel Monitoring Systems
VOCs	Volatile Organic Compounds
WHSRN	Western Hemisphere Shorebird Reserve Network

Abbreviation	Definition
WER Act	Wilderness and Ecological Reserves Act
WERAC	Wilderness and Ecological Reserves Advisory Council
WNNB	Wolastoqey Nation in New Brunswick
WAGE	Women and Gender Equality Canada
WHS	World Heritage Site
WRB	World Network of Biosphere Reserves

Acknowledgements

This Regional Assessment Report is a starting point for planning offshore wind development in Newfoundland and Labrador. Much work remains to inform future offshore and licensing and impact assessment processes in the Canada-Newfoundland and Labrador Offshore Area. However, the delivery of this Report marks the end of our mandate, and we wish to acknowledge all who have contributed to this Regional Assessment. We are grateful for the involvement of all participants whose diverse viewpoints and expertise were invaluable to this process.

We thank all Indigenous peoples, communities, and organizations, especially Miawpukek First Nation and Qalipu First Nation given their proximity to the Focus Area, for sharing their time, knowledge, and expertise with us.

We appreciate the participation of fish harvesters and their representative bodies in this process. We recognize their concern that another marine industry will further add to the pressures they already face.

We benefitted from the information shared by participants in jurisdictions where offshore wind is an established industry. Their insights and lessons learned will continue to provide valuable information as Newfoundland and Labrador and Canada work towards developing the industry here at home.

We thank all federal and provincial authorities who provided their expertise on matters relevant to this Regional Assessment. We recognize in particular the significant contributions of Environment and Climate Change Canada, Fisheries and Oceans Canada, Natural Resources Canada, and Parks Canada. We also thank staff at the Impact Assessment Agency of Canada (Communications, Language Services, Canadian Impact Assessment Registry), Natural Resources Canada (Open Science and Data Platform), and Fisheries and Oceans Canada (Canada Marine Planning Atlas - Atlantic) who helped us uphold our commitment to public-accessibility and transparency.

Our thanks to Feaver's Lane for the GIS support, and to the Canadian Research Institute for the Advancement of Women for their GBA expertise.

Finally, thank you to our Secretariat. This Report would not have been possible without them. Their input was invaluable. We truly appreciated and admired their work ethic and dedication.

Since our appointment in March 2023, we have learned so much from everyone who has shared their knowledge, voiced their concerns, provided their expertise, and responded to our questions. We thank you for helping us complete this Regional Assessment.

Wela'lin, Thank you,

Shayne McDonald (Chair), Glenn Blackwood, Leslie Grattan, Brian Power, and Paul W. Saunders.
Committee for the Regional Assessment of Offshore Wind Development in Newfoundland and Labrador

1. Introduction

On March 23, 2023, the governments of Canada and Newfoundland and Labrador launched the Regional Assessment of Offshore Wind Development in Newfoundland and Labrador (the Regional Assessment). The federal and provincial Ministers released an Agreement and Terms of Reference between the governments of Canada and Newfoundland and Labrador to conduct the Regional Assessment (the original Agreement) and appointed the Committee responsible for conducting the assessment.[1] In response to the Committee's October 18, 2023, request for amendments to the original Agreement, the Ministers issued amendments to the Agreement on March 15, 2024 (the Agreement). The Committee conducted the Regional Assessment in a phased manner, in accordance with the Agreement.[2]

1.1 Purpose of and Need for Offshore Wind Development

In announcing this Regional Assessment, the federal and provincial governments indicated the Canada-Newfoundland and Labrador Offshore Area (the Offshore Area) has an abundance of offshore renewable energy resources. Offshore wind has the potential to help Canada and Newfoundland and Labrador achieve its climate change commitments by contributing to the global transition to a low-carbon energy system, while creating jobs and building on Canada's and Newfoundland and Labrador's existing expertise in marine industries. These and other benefits of offshore wind development are described throughout this Report.

It is not within the scope of this Regional Assessment to determine *if* there is a need for offshore wind development in Newfoundland and Labrador; the Committee proceeded on the message from governments that offshore wind is needed. Consequently, the Committee did not evaluate whether offshore wind energy is needed. However, over the course of this Regional Assessment, participants questioned the need for and economic viability of offshore wind in this province. [3] Where participants shared completed (or plans for) studies that address these topics, the Committee has provided that information in this

[1] The term "Ministers" refers collectively to the federal Ministers of Environment and of Natural Resources, and the provincial Ministers of Industry, Energy and Technology, of Environment and Climate Change, and of Intergovernmental Affairs (i.e. the signatories to the Agreement).
[2] The Committee sent a letter to the Ministers in October 2023 requesting amendments to the original Agreement, document reference number 181. The Ministers sent a response on March 15, 2024, document reference number 228, along with the amendments to the original Agreement.
[3] Throughout this Report, the term "participant" refers broadly to any Indigenous peoples and organizations, stakeholder groups, federal and provincial authorities, and members of the public participating in the Regional Assessment process.

Report to support a more comprehensive understanding of the opportunities for offshore wind development.[4]

1.2 Purpose of the Regional Assessment

The main purpose of a regional assessment under the *Impact Assessment Act* (IAA) is to contribute to the efficiency and effectiveness of future impact assessments of projects that are subject to the IAA. As stated in the Agreement, the purpose of this Regional Assessment is:

> To provide information, knowledge and analysis regarding future offshore wind development activities in the Study Area and their potential effects, in order to inform and improve future planning, licencing and impact assessment processes for these activities in a way that helps protect the environment and health, social and economic conditions while also creating opportunities for sustainable economic development.

It is important to note this purpose indicates that this Regional Assessment contributes to future impact assessments of offshore wind projects under the IAA, *and* to future offshore wind planning and licencing processes. This dual goal greatly influenced the phased approach to and scoping of this Regional Assessment.

The Agreement specifies four objectives to support the overarching goal:

> A) Provide information, knowledge and analysis related to environmental, health, social and economic conditions and the potential effects (including cumulative effects) of offshore wind development activities in the Study Area, with consideration of Indigenous knowledge, Community knowledge and scientific information throughout.
>
> B) Provide an understanding of the regional context that can be used in considering and evaluating the potential effects (including cumulative effects) of future offshore wind development activities to inform future planning and licencing processes and impact assessments.
>
> C) Identify and recommend mitigation and follow-up measures and other approaches for addressing potential positive and adverse effects (both project-

[4] In their comments on the Draft Report, participants noted the following: Leasing and auction design: Canada Offshore Wind Analysis of Global Offshore Wind Seabed Leasing/Auction Frameworks and Recommendations for the Canadian Context (managed by Canada's Ocean Supercluster and MRC; October 2024); Supply chain: Atlantic Canada Wind Energy Supply Chain Assessment and Analysis (managed by MRC; targeted publication March 2025); Ports: Assessment of Atlantic Canadian Ports to Support Offshore Wind Development (managed by Net Zero Atlantic; in progress); Electrical Grid Integration: Atlantic Canada Offshore Wind Grid Integration and Transmission Study (managed by Net Zero Atlantic; in progress).

specific and cumulative) as part of future decision-making for offshore wind development activities.

D) Describe how the findings or recommendations of the Regional Assessment could be used to inform future planning and licencing processes for these activities in a manner that fosters sustainability and enhances the effectiveness and efficiency of their impact assessments.

1.3 Phased Approach to the Regional Assessment

The Agreement allowed the Committee to complete the Regional Assessment in a phased manner, producing first an Interim Report, followed by the Regional Assessment Report (this Report).

1.3.1 Interim Report

The Committee first focused their efforts on providing preliminary information, knowledge, and analysis to help inform and improve planning and licencing of offshore wind development projects. This included identifying a preliminary version of the initial offshore wind energy licencing areas presented in this Report.[5]

As described in Section 1.4 of this Report, the federal and provincial governments were well into developing the regulatory framework for offshore wind farms when this Regional Assessment was established. The Agreement specified a 12-month (i.e., March 2024) deadline for the Committee's first report, the Interim Report, so that governments could consider preliminary Regional Assessment outcomes as they develop the regulatory regime. The Committee published the Interim Report on the Canadian Impact Assessment Registry (the Registry) in March 2024.[6]

As per the Agreement, the Interim Report included:

- the Committee's preliminary recommendations of particular locations that may and may not be feasible for future licencing processes for offshore wind development activities, and the rationale behind these recommendations;
- any information and knowledge gaps identified to date with relevance to and implications for future licencing processes, and preliminary recommendations to address such information and knowledge gaps as appropriate;
- engagement outcomes to date with relevance to and implications for future licencing processes.

[5] Section 6 of this Report includes more information on the identification of initial offshore wind energy licencing areas. The Committee's term "*initial* offshore wind energy licencing areas" is intended to highlight that these areas are provided to the Ministers for consideration as a starting point to identifying offshore wind energy licencing areas.

[6] The Committee's use of the Registry is described further in Section 2 of this Report.

The Interim Report was preliminary in nature. The Committee continued to engage with participants on planning and licencing matters, as reflected in this Report. This Report supersedes the Interim Report.

1.3.2 Purpose of this Report

This Report contains information, knowledge, and analysis to help inform and improve future planning and licencing, and impact assessment processes for offshore wind projects in the Study Area (i.e., the Committee's findings in support of Objectives A through D). This Report supersedes the Interim Report and is intended to be a standalone document addressing all aspects of the Regional Assessment from its initiation in March 2023.

1.4 Regulatory Context

This section provides information on the regulatory context for offshore wind development in the Offshore Area. This context is important for understanding the dual purpose of this Regional Assessment, the rationale behind the phased approach, and key assumptions informing the Committee's work.

1.4.1 Regulating Offshore Wind Development in the Offshore Area

The first goal of this Regional Assessment is to inform future planning and licencing processes for offshore wind in the Offshore Area.

As per the *Canada – Newfoundland and Labrador Atlantic Accord Implementation Act* (1987), (the Accord Act) the governments of Canada and Newfoundland and Labrador jointly manage offshore petroleum resources. The federal and provincial governments are also planning a joint management framework for offshore renewable energy, including offshore wind. The governments of Canada and Newfoundland and Labrador established this Regional Assessment partly to provide timely information and recommendations to help inform the development of that framework.

In May 2023, the federal Minister of Energy and Natural Resources sponsored *Bill C-49, An Act to amend the Canada—Newfoundland and Labrador Atlantic Accord Implementation Act and the Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act and to make consequential amendments to other Acts* (Bill C-49) at the House of Commons. This bill received royal assent on October 3, 2024.

Key amendments related to the joint management of offshore renewable energy in the Offshore Area include:

- changing the name of the Canada–Newfoundland and Labrador Offshore Petroleum Board to the Canada–Newfoundland and Labrador Offshore Energy Regulator (C-NLOER) (the Regulator);
- establishing the Regulator as the regulating body for offshore renewable energy projects (including the ability to conduct regional and strategic assessments);
- establishing a land tenure regime for the issuance of submerged land licences to carry out offshore renewable energy projects, as well as the revenues regime associated with those licences and projects;

- establishing a ministerial decision-making process respecting the issuance of submerged land licences and the Regulators' exercise of certain powers or performance of certain duties;
- expanding the application of the safety and environmental protection regime and its enforcement powers to include offshore renewable energy projects;
- providing that the Governor in Council may make regulations to prohibit the commencement or continuation of renewable energy activities, or the issuance of interests, in respect of any portion of the offshore area that is located in an area that has been or may be identified as an area for environmental or wildlife conservation or protection;[7] and,
- establishing the regulatory and liability regime for abandoned facilities relating to offshore renewable energy projects.

1.4.1.1 Re-defining the Jointly Managed Offshore Area

On December 6, 2023, the Honourable Dr. Andrew Furey, Premier of Newfoundland and Labrador, and the Honourable Jonathan Wilkinson, Minister of Energy and Natural Resources, signed a Memorandum of Understanding (MOU) on offshore wind to enable Newfoundland and Labrador to take the regulatory lead on offshore wind projects within 16 inland bays (i.e., to remove those 16 bays from the jointly-managed Offshore Area and make them solely provincial jurisdiction, thereby changing the definition of the offshore area in the Accord Act). The MOU did not affect the Committee's work.

1.4.1.2 Offshore Renewable Energy Regulations

The Canada Offshore Renewable Energy Regulations (CORER) were published in the *Canada Gazette, Part II,* at the end of 2024 and are now in force. These regulations establish comprehensive safety, security, and environmental protection requirements for offshore renewable energy projects and offshore power lines in Canada's federally regulated offshore areas. To ensure consistency between Canada's three offshore administrative regimes, future regulations under the Accord Acts will largely replicate the CORER. The Government of Canada, together with its provincial partners (Newfoundland and Labrador and Nova Scotia), will engage with Canadians on the proposed Canada-Newfoundland and Labrador Offshore Renewable Energy Regulations and the proposed Canada-Nova Scotia Offshore Renewable Energy Regulations when those regulations are pre-published in the *Canada Gazette*, *Part I*, which is anticipated in Spring 2024.[8]

[7] It is important to note that such regulations can only be made with the Provincial Minister's approval.
[8] Natural Resources Canada (NRCan) leads the CORER Initiative. The CORER initiative is separate from this Regional Assessment.

1.4.1.3 Establishing Offshore Wind Licencing Areas

The Committee understands the governments of Canada and Newfoundland and Labrador have no immediate plans to identify Wind Energy Areas[9] or begin a process towards a Call for Bids.[10]

1.4.2 Offshore Wind Projects under the IAA

The Committee's work is based on offshore wind projects consisting of 10 or more turbines. This is specified in the Agreement and aligns with the description of offshore wind projects under the IAA. Offshore wind projects are designated projects under the IAA. Sections 45 and 46 of the Schedule to the *Physical Activities Regulations* (the Project List) include:

- The construction, operation, decommissioning, and abandonment in an offshore area or in boundary water of a new wind power generating facility that has 10 or more wind turbines.
- The expansion in an offshore area or in boundary water of an existing wind power generating facility, if the expansion would result in an increase in production capacity of 50% or more and a total number of wind turbines of 10 or more.

The Committee is aware of the Supreme Court of Canada (SCC) opinion on the IAA and the resulting amendments to the IAA that were brought into force on June 20, 2024.[11] The Committee is also aware that the IAA requires the Impact Assessment Agency of Canada (IAAC) to review the Project List five years after the day on which these Regulations came into force (i.e. by August 2024).[12] While temporarily delayed pending legislative amendments to the IAA, the IAAC has since resumed the review. In July 2024, the IAAC issued a discussion paper and invited feedback from the public from July 30, 2024, - September 27, 2024 (IAAC, 2024a). Proposed regulatory changes resulting from the Project List review will follow the usual regulatory development and approval process for Governor in Council Regulations, including publishing draft regulatory text through *Canada Gazette, Part I* for further engagement opportunities. Neither the IAA amendments nor the Project List review affected the Committee's work.[13]

[9] NRCan uses the term "Wind Energy Areas" to refer to areas in which offshore wind licenses would be available.
[10] NRCan provided this update to the Committee in December 2024. In the Draft Report (October 1, 2024), the Committee's understanding was that the governments of Canada and Newfoundland and Labrador anticipated identifying Strategic Priorities for the Call for Bids in early 2025, followed by the Call for Bids for Offshore Wind Areas sometime in 2025.
[11] On June 20, 2024, the *Budget Implementation Act, 2024*, received Royal Assent and brought into force amendments to IAA.
[12] This Report uses "IAAC" instead of "Agency" when referring to the Impact Assessment Agency of Canada, based on recent direction from IAAC to its employees. "Agency" is used when quoting the Agreement.
[13] Agreement, "Interpretation", pg. 3.

1.4.2.1 Exclusion Regulations

The Committee's work is based on the key assumption that an exclusion regulation is not an outcome of this Regional Assessment, and that offshore wind projects would be assessed under the IAA.

Under the IAA, (s. 109 and s. 112, s.s.2(2) of the Physical Activities Regulations) the Minister may make regulations that would designate offshore wind development activities that, under established conditions, would be excluded from having to undergo an impact assessment, after considering a regional assessment (Impact Assessment Act, 2019). The Committee has not been mandated to conduct this Regional Assessment to inform the development of a regulation excluding offshore wind projects from IAA requirements. The Committee wrote the Minister in October 2023 regarding his intent to develop such a regulation, and the Minister replied there is no regulation being developed at this time.[14,15]

1.5 Scope of the Regional Assessment

This section provides the definition of offshore wind development activities for the purposes of this Regional Assessment, as well as spatial and temporal scope.

1.5.1 Offshore Wind Development Activities

The Agreement provides the following definition:

> "Offshore wind development activities" means the physical activities associated with the construction, including expansion, operation, decommissioning and abandonment of an offshore wind power generation facility that has 10 or more wind turbines. These physical activities include the transmission of electricity and any other ancillary or supporting activities that are specific to that wind power generation facility. It does not include the associated and eventual use of the electricity produced by that offshore wind power generation facility.

This Regional Assessment therefore considers the potential effects (including cumulative effects), and interactions of those effects, of activities in the construction/expansion, operation, and decommissioning and abandonment phases of an offshore wind power generation facility itself and associated subsea infrastructure and offshore substations. [16] It does not assess any activities associated with the development of land-based infrastructure that may be included in the design of a specific offshore wind project (i.e., onshore substations, port facilities, and transmission lines on land). Project impact assessments would consider any land-based infrastructure associated with an offshore

[14] Letter from Shayne McDonald, Chair of the Regional Assessment Committee to The Honourable Steven Guilbeault, Minister of Environment and Climate Change, October 4, 2023, document reference number 173.
[15] Letter from The Honourable Steven Guilbeault to Shayne McDonald, Chair of the Regional Assessment Committee, November 16, 2023, document reference number 195.
[16] Section 4 of this Report provides a generic description of offshore wind development activities throughout the construction/expansion, operations, and decommissioning and abandonment phases.

wind development. That said, this Regional Assessment does consider land-based effects of offshore wind development activities (see Section 1.5.2.2 of this Report).

The definition of offshore wind development activities is also clear that this Committee is not tasked with considering the eventual use of the electricity produced by an offshore wind project. Participants have rightly observed that eventual use of the electricity dictates project design and location, and potential effects are tied to design elements (e.g., foundation type) and location.

1.5.2 Spatial Scope

The Study Area and Focus Area for the Regional Assessment are presented in Figure 1.1.

Figure 1.1. Study Area and Focus Area

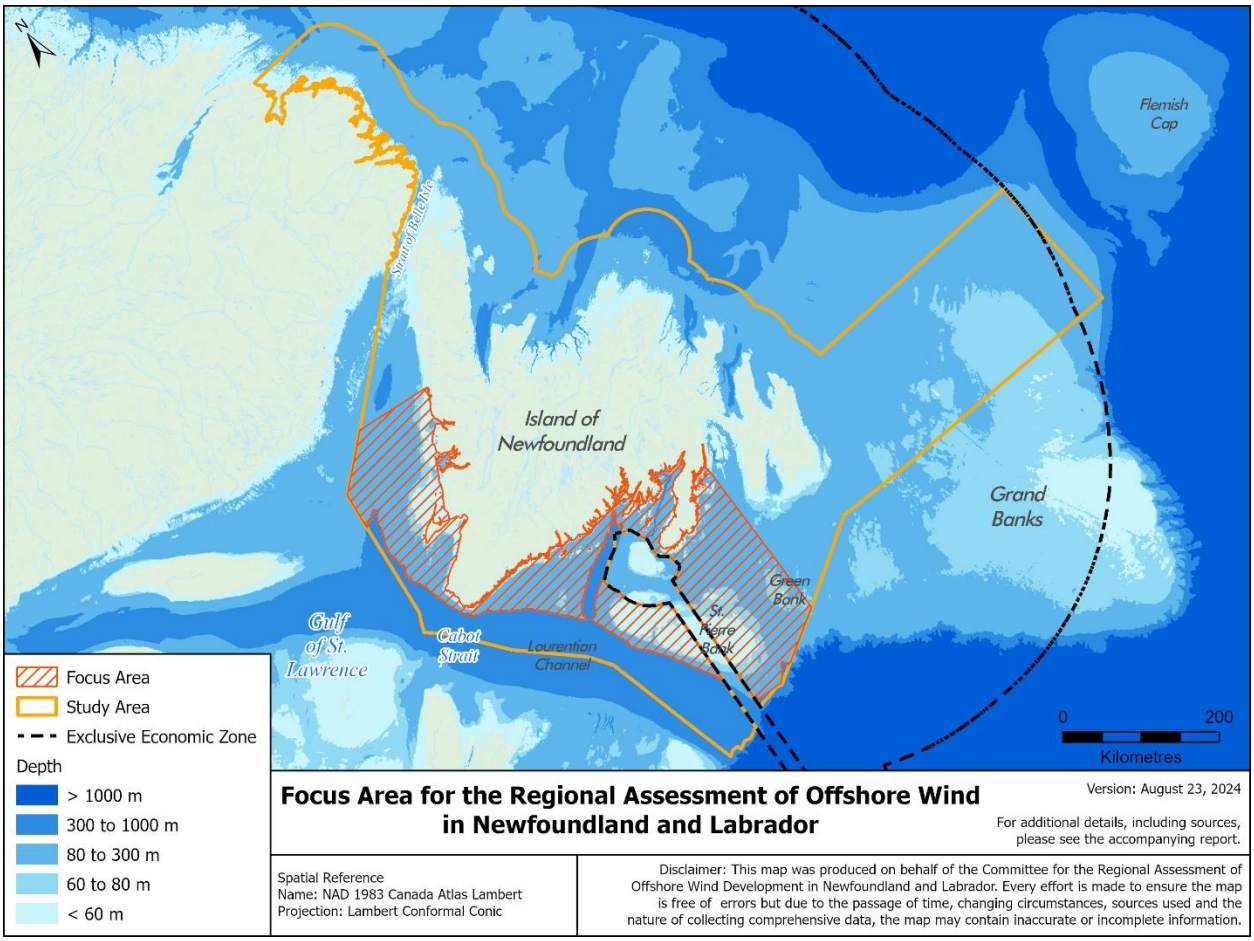


Figure Description: This figure shows the Island of Newfoundland, southern Labrador, and parts of Quebec and the Maritimes. The Study Area surrounds the Island of Newfoundland and southern Labrador. The Focus Area is generally around the south and west coasts of the Island of Newfoundland. The figure also shows the Exclusive Economic Zone, and water depths ranging from 0 - > 1,000 m deep.
Data Sources: GEBCO Compilation Group, 2024; IAAC, 2023a; b; NRCan, 2023.

1.5.2.1 Study Area

As per the Agreement,

> The Study Area comprises portions of the Offshore Area where future offshore wind development activities may be technically and economically feasible, based on current and foreseeable technologies. It does not include or exclude specific locations or features based on potential environmental, health, social or economic effects, in order to allow the Regional Assessment to provide a complete and fulsome analysis of these issues across this region, to inform future decision-making. For greater clarity, the inclusion or exclusion of specific portions of the Offshore Area in the Study Area does not reflect whether particular locations will or should be subject to future offshore wind development activities. The Study Area therefore comprises the geographic region within which the Regional Assessment will help inform future decisions around whether particular locations may be subject to future licencing processes for offshore wind development activities, as well as the impact assessments of any such development activities.

1.5.2.2 Focus Area

Following an analysis of the Study Area based on current technical feasibility criteria, the Committee identified a Focus Area as the portion of the Study Area more likely to see offshore wind development (of 10 turbines or more) in the foreseeable future.[17]

Section 5 of this Report details the Committee's process for defining the Focus Area. The Committee then carried out their information gathering and analysis within this area.

The Committee's recommendations of locations that may and may not be feasible for future licencing processes for offshore wind development activities are all within this Focus Area.

However, the Committee is of the opinion that portions of the Study Area outside the Focus Area may become feasible for offshore wind development as information and data gaps are filled and as technology advances.

The assessment (i.e., description of existing conditions and consideration of effects across environmental, health, social, cultural, and economic components under Section 7 of this Report) is also scoped to the Focus Area. Where the potential effect of an offshore wind project in the Focus Area extends beyond Focus Area boundaries, it is considered (e.g., a

[17] The Committee interprets foreseeable to mean there is evidence available now showing offshore wind development is feasible (i.e., technically possible and commercially viable) and likely to occur within 10 years.

project in the Focus Area will have economic benefits for the province, and a positive contribution to Canada's climate change goals).

While the Committee has defined a Focus Area, all geospatial data the Committee used in this Report is available (or will soon be available) for the full extent of the Study Area on the Canada Marine Planning Atlas - Atlantic (the Atlas) (refer to Section 2 of this Report for more information on the Atlas), or through additional open-source websites. Natural Resources Canada (NRCan) is also curating a publicly available content collection of Resources to Understand Potential Effects from Future Offshore Wind Development in Atlantic Canada.

Finally, it is important to acknowledge the high-level nature of regional assessments and the absence of an offshore wind industry in Canada. The effects and mitigation information presented in this Report and the Committee's recommendations are useful for informing planning and licencing on a regional scale, and for providing a general overview for consideration when scoping impact assessments of offshore wind development. It does not, however, replace the need for identifying and assessing effects and mitigation at a local level through project impact assessments.

This Regional Assessment does not replace the need for project impact assessments.

1.5.3 Temporal Scope

Offshore wind turbine technologies are ever-changing. As turbines increase in size, fewer of them are required to produce the same energy output, while floating technologies are feasible in increasingly greater depths. The rapid pace at which technology changes presented a challenge for scoping, as the Committee was tasked with providing information and analysis to inform decisions around whether particular locations may be subject to future licencing processes for offshore wind development activities.

Since determining potential locations for offshore wind projects is very much dictated by technical feasibility (which in turn influences commercial viability), the Committee found it prudent to focus on offshore wind technologies that may be in use in the reasonably foreseeable future.[18] The Committee believes that portions of the Study Area not identified as feasible for offshore wind development at this time may become feasible in time.

[18] Though technically possible, Committee discussions with offshore wind developers to date suggest floating options may not be commercially feasible at this time and sites suitable for fixed turbines or concrete gravity-based structures (tested to withstand pack ice) which are more economical, are preferred in Newfoundland and Labrador.

1.6 Use of the Regional Assessment

The Committee's findings and recommendations may be used to inform future planning, licencing, and impact assessment processes.

Regional assessments must be taken into account in any relevant impact assessment (*IAA,* 2019, c.28, s.22(1)). The IAAC specifies the following in the Tailored Impact Statement Guidelines:[19]

> In their impact statements, proponents (IAAC, 2022):
>
> - Must identify any relevant regional assessments and their implications.
> - Must describe how and relevant regional assessment was considered in determining baseline conditions.
> - Must define spatial and temporal boundaries for each valued component, taking into account (among other factors) any relevant regional assessment.
> - Must describe how any relevant regional assessment was considered in the effects assessment.
> - Should use information generated through relevant regional assessment processes to inform possible mitigation and enhancement measures.
> - Must consider the results of any relevant regional assessments in the cumulative effects assessment.

It is important to acknowledge that the Committee's recommendations are not binding.

1.7 Committee Conclusions and Recommendations

The Committee recommends:

- The governments of Canada and Newfoundland and Labrador, in collaboration with experts in offshore wind development in emerging markets, undertake initiatives to demonstrate need for an offshore wind industry in Newfoundland and Labrador, including:
  - use of electricity (e.g., expansion of domestic energy supply, replacement of domestic energy supplied by fossil fuel, hydrogen production, electrification of offshore oil and gas industry, etc.);
  - infrastructure readiness (e.g., grid capacity);
  - economics (e.g., levelized cost of energy, market demand, supply chain readiness, etc.);
  - how offshore wind fits into the province's overall energy and economic strategy.
- The governments of Canada and Newfoundland and Labrador communicate the results of these studies with the public to increase public knowledge of the role of offshore wind in the province's energy mix and economy.

[19] The Tailored Impact Statement Guidelines is a draft document. Contents may change as a result of ongoing engagement and feedback received. Further, they have not been updated since amendments to the IAA in 2024.

1.8 Agreement Requirements

Table 1.1 indicates the Regional Assessment requirements (the Agreement, Appendix A, Terms of Reference) and where in the Report the Committee demonstrates meeting each requirement.

Table 1.1. Concordance of Report Contents with the Agreement

Regional Assessment Requirements (Terms of Reference)	**Report Section(s)**
A1.1 The Committee will conduct a Regional Assessment in accordance with the IAA, the Agreement and these Terms of Reference	Section 1, Table 1
Indigenous Knowledge and Aboriginal and Treaty Rights	
A1.2 The Committee is mandated to receive information from Indigenous peoples on the nature and scope of any Aboriginal or Treaty rights protected by section 35 of the *Constitution Act* (1982) in the Study Area, as well as information on potential adverse impacts that future offshore wind development activities in the Study Area may (individually or cumulatively) have on these rights. Information provided to the Committee as part of this process may also inform Crown efforts to develop and implement meaningful consultation processes with Indigenous peoples in future project-specific impact assessments and other regulatory and decision-making processes. The Committee will consider any such information received regarding Aboriginal or Treaty rights and will consider that information in its analysis and the development of its recommendations.	Sections 3, 5, 6, 7, 8 Appendices A, C, E
A1.3 The Committee is not mandated or empowered by this Agreement to make any determination as to the existence or validity of Aboriginal or Treaty rights, the probability of adverse impacts upon any such rights, or whether any duty to consult has arisen and been discharged in any particular context.	Section 3
A1.4 In conducting its work, the Committee will recognize that, for the purposes of the Regional Assessment, Indigenous knowledge is an important component of understanding existing conditions, potential effects (both positive and adverse, including cumulative effects) and mitigation measures and other measures for addressing them, and that regional assessments can provide a means of gathering and presenting Indigenous knowledge, Community knowledge, and scientific information to inform future impact assessments.	Sections 3, 5, 6, 7, 8 Appendices A, C
A1.5 Any Indigenous knowledge that is provided in confidence is considered confidential and will not knowingly be, or be permitted to be, disclosed without written consent in accordance with section 119 of the IAA.	Section 3 Appendices A, C
A1.6 Indigenous, Public, and Stakeholder Participation	
a) Ensure that Indigenous peoples and the public are provided with opportunities to participate meaningfully in the Regional Assessment.	Section 3 Appendices A, B, C, D, E
b) Engage with Indigenous peoples and governmental and non-governmental organizations and individuals that have information, knowledge or interests relevant to the Regional Assessment. This will include members of the public, industry, environmental and community organizations and any other person or	Section 3 Appendices A, B, C, D, E

Regional Assessment Requirements (Terms of Reference)	**Report Section(s)**
group with information and interests related to the Regional Assessment and who wishes to participate in it.	
c) Develop and implement a Public, Fisheries and Stakeholder Participation Plan and an Indigenous Participation Plan, with advice from the advisory groups referred to in Section 4.0 of the Agreement and described below. The Committee will further collaborate with Indigenous peoples on the development and implementation of the Indigenous Participation Plan. Once completed these Participation Plans will be posted to the Registry and updated regularly by the Committee, with advice from the advisory groups, to ensure that participants are aware of planned participation approaches and upcoming activities.	Section 3 Appendices A, B, C, D
A1.6 Advisory Groups	
d) Establish and seek information and advice from advisory groups during the conduct of the Regional Assessment, as outlined in Section 4.0 of the Agreement and in the sections that follow. In addition to the three advisory groups listed in Section 4.0 and below, the Committee may choose to establish additional advisory groups as it deems necessary, and to combine or integrate the activities of two or more advisory groups, as applicable. Individuals or organizations may participate in more than one advisory group. These advisory groups will be comprised of individuals and organizations from within or outside government, including Indigenous peoples, who have knowledge or experience deemed relevant to the Regional Assessment by the Committee. The Committee will establish these advisory groups with a view to ensuring they are inclusive and diverse in their membership. The Committee will make a public call for interest through which interested persons and organizations will provide information on their relevant interests, qualifications and affiliations to the Committee. In order to have this information ready for the Committee's consideration as they establish the advisory groups, the Agency may issue an initial public call for interest in advance of the appointment of the Committee. Interested persons may also come forward at any time during the Regional Assessment to express their interest in participating in one or more advisory groups. The composition and activities of these advisory groups may vary from time to time in relation to the needs, work or expertise required and requested by the Committee during the course of the Regional Assessment.	Section 3 Appendices A, B, C, D
e) Seek assistance from these advisory groups in identifying, accessing, analyzing and using information and knowledge that is relevant to the Regional Assessment, as well as in identifying and evaluating information and knowledge gaps and recommending approaches to address any knowledge gaps. The advisory groups will identify, provide and support the consideration and use of Indigenous knowledge, Community knowledge, and scientific information in the conduct of the Regional Assessment, as appropriate. Each of the advisory groups described below will provide information and advice to the Committee on the topics outlined below, as required and requested: a. Environmental, health, social and economic conditions; b. Information and knowledge gaps, and potential opportunities to address these during or following the completion of the Regional Assessment; c. Future offshore wind development activities in the Study Area, including their: i. Need and purpose;	Section 3 Appendices A, B, C, D

Regional Assessment Requirements (Terms of Reference)	**Report Section(s)**
ii. Physical activities associated with their construction, including expansion, operation, decommissioning and abandonment; iii. Key locations of interest for future offshore wind development activities in the Study Area (to help focus the Committee's work on areas which are most likely to see future development interest, based on technical and economic factors); iv. Regulatory requirements; v. Potential positive and adverse effects, including cumulative effects and associated sustainability considerations; vi. Mitigation, and other approaches for avoiding or reducing potential adverse effects and creating and maximizing potential positive effects; and vii. Follow-up requirements. d. Other topics relevant to the Regional Assessment, as requested by the Committee.	
A 1.6 Advisory Group: Indigenous Knowledge	
f) Seek knowledge and perspectives from Indigenous peoples on matters relevant to the conduct of the Regional Assessment, including through the advisory group described in this section. This will include seeking Indigenous knowledge and perspectives on some or all of the topics listed above during the conduct of the Regional Assessment, in accordance with established Indigenous protocols and procedures as applicable. This advisory group will also provide information, knowledge and perspectives on Indigenous peoples and their communities, activities and other interests, including Aboriginal or Treaty rights protected by section 35 of the Constitution Act, 1982. This advisory group will also advise the Committee on approaches for the collection, sharing and consideration of such knowledge and its incorporation into the Regional Assessment.	Section 3 Appendices A, B, C, D
A1.6 Advisory Group: Scientific Information and Community Knowledge	
g) Seek scientific information, including technical information and advice, and Community knowledge from representatives of federal and provincial government departments and agencies and non-governmental organizations and individuals (both Indigenous and non-Indigenous) on matters relevant to the conduct of the Regional Assessment. This will include information and advice related to environmental, health, social and economic components and issues. This advisory group will assist the Committee in gathering and analyzing relevant data and information and in conducting analyses, and will provide expertise in relation to the Regional Assessment. This will include sharing information and expertise on some or all of the topics listed above, as requested by the Committee during the conduct of the Regional Assessment	Section 3 Appendices A, B, C, D

Regional Assessment Requirements (Terms of Reference)	**Report Section(s)**
A 1.6 Advisory Group: Fisheries and Other Ocean Uses	
h) Seek knowledge, information and advice from fishing organizations, fishing industry representatives and fishers (both Indigenous and non-Indigenous) regarding current and potential fishing activity (commercial, traditional, recreational – including inshore, midshore, and offshore fisheries), as well as potential interactions between fishing activity and offshore wind development activities in the Study Area. This advisory group will also include organizations and individuals that are involved in and/or otherwise have expertise regarding other ocean uses including, but not limited to, tourism, marine shipping, offshore energy, research, aquaculture, infrastructure, and other components and activities. This advisory group will also provide advice to the Committee on approaches for avoiding or minimizing adverse effects and creating or maximizing opportunities for positive effects on fisheries and other ocean uses.	Section 3 Appendices A, B, C, D
A 1.6 Information and Analysis – Description of Existing Conditions	
i) Identify, compile, review and present information on existing environmental, health, social and economic conditions within the Study Area. This will include consideration of any recent and on-going variability in baseline conditions and associated trends due to natural or anthropogenic influences, as identifiable through information and knowledge that is made available to the Committee. As noted in Section 3.5 of the Agreement, this will include information contained in any past or ongoing impact or environmental assessments (including strategic environmental assessments), and information provided by government, industry (offshore energy, fisheries, others), academia, Indigenous peoples, or the public.	Sections 5, 6, 7, 9
A 1.6 Information and Analysis – Identification of Information and Knowledge Gaps	
j) Identify and evaluate information and knowledge gaps, with a focus on any associated gaps with relevance to, and implications for, future planning, licencing and impact assessments for offshore wind development activities in the Study Area.	Sections 5, 6, 7, 8, 9, 10, 11 Appendix G
k) Make recommendations to address such information and knowledge gaps as appropriate.	Sections 5, 6, 7, 8, 9, 10, 11 Appendix G
A 1.6 Information and Analysis – Analysis of Effects, Mitigation and Follow-up	
l) Identify and consider the potential positive and adverse effects, including cumulative effects of future offshore wind development activities in the Study Area. This will include consideration of: i. The potential effects of planned physical activities associated with offshore wind development activities in the Study Area; ii. The potential effects of possible malfunctions or accidents; iii. Any cumulative effects that may result from the effects of offshore wind development activities in the Study Area in combination with other physical activities that have been or will be carried out; and iv. The result of any interaction between the effects referenced above.	Sections 5, 6, 7, 8, 9, 10, 11 Appendix G

Regional Assessment Requirements (Terms of Reference)	**Report Section(s)**
A 1.6 m) In identifying and considering potential positive and adverse effects, the Committee will focus on the following environmental, health, social and economic components:	
i. Air Quality and Greenhouse Gases (GHGs)	Section 7
ii. Marine Fish and Fish Habitat (including species at risk)	Section 7
iii. Avifauna (including birds, bats, and associated species at risk)	Section 7
iv. Marine Mammals and Sea Turtles (including species at risk)	Section 7
v. Protected and Special Areas (established and proposed)	Section 7
vi. Indigenous Communities, Activities, Interests, and Rights	Section 7
vii. Fisheries and Other Ocean Uses	Section 7
viii. Visual Aesthetics / Viewscapes and Acoustic Environments	Section 7
ix. Physical and Cultural Heritage (including structures, sites or things of historical, archaeological, paleontological, or architectural significance)	Section 7
x. Health	Section 7
xi. Communities	Section 7
xii. Economy	Section 7
The Committee will also consider the interactions and interrelationships between these components, as applicable, and associated environmental, health, social and economic systems based on the information and knowledge that is made available to the Committee.	Section 7
The Committee may, based on its analysis and engagement activity, further refine or add to the list of components listed above. If that is the case, the Committee will clearly document in its Report the rationale for doing so, including how public, stakeholder and/or Indigenous input have informed and influenced this.	Section 7
A 1.6 Information and Analysis – Analysis of Effects, Mitigation and Follow-up	
n) Identify and consider the effects, both positive and adverse, that offshore wind development activities in the Study Area may have on any Indigenous peoples, and any impact that they may have on the rights of the Indigenous peoples recognized and affirmed by section 35 of the *Constitution Act* (1982).	Section 7
o) Identify and consider technically and economically feasible mitigation measures and other approaches for eliminating, reducing, controlling or offsetting potential adverse effects and creating and maximizing potential positive effects resulting from offshore wind development activities in the Study Area.	Sections 5, 6, 7, 10
p) Identify and consider existing legislation, regulations, guidelines and standards, and associated approvals or authorizations, that are relevant to avoiding or reducing adverse effects or creating and maximizing potential positive effects resulting from offshore wind development activities in the Study Area.	Sections 6, 7, 8, 9, 10

Regional Assessment Requirements (Terms of Reference)	**Report Section(s)**
A 1.6 Other Considerations and Requirements	
q) Identify and consider the extent to which offshore wind development activities in the Study Area and their potential effects, would: a) contribute to sustainability; and b) hinder or contribute to the federal and provincial governments' ability to meet their environmental obligations and commitments in respect of climate change, and make recommendations on the manner in which future licencing decisions and/or impact assessments should consider and address these factors.	Section 10
r) Consider the intersection of sex and gender with other identity factors and make recommendations on the manner in which future impact assessments should consider and address these factors.	Section 11 Appendix G
s) Take into account any scientific information, Indigenous knowledge — including the knowledge of Indigenous women — and Community knowledge provided with respect to the Regional Assessment, as per the requirements of subsection 97(2) of the IAA.	Sections 3, 5, 6, 7, 8, 10, 11 Appendices A, C, G
t) Ensure that the information that it uses in conducting the Regional Assessment is accessible to the public through the Canadian Impact Assessment Registry or by other means, unless it is required to keep certain information confidential by law.	Section 2
A 2.3, Objective A: Provide information, knowledge and analysis related to environmental, health, social and economic conditions and the potential effects (including cumulative effects) of offshore wind development activities in the Study Area, with consideration of Indigenous knowledge, Community knowledge and scientific information throughout.	
a) A description of environmental, health, social and economic conditions of the Study Area, based on the identification, compilation and review of existing and publicly accessible information. This description will be presented in a manner to be determined by the Committee.	Sections 5, 6, 7, 8, 9
b) An identification and analysis of key information gaps, requirements and opportunities, with a focus on those with relevance to, and implications for, future planning, licencing and impact assessments for offshore wind development activities in the Study Area.	Sections 5, 6, 7, 8, 9, 11 Appendix G
c) Recommendations to address such information and knowledge gaps as appropriate.	Sections 5, 6, 7, 8, 9, 11 Appendix G
d) Identification of potential changes to the environment or to health, social or economic conditions that may result from offshore wind development activities in the Study Area, and the potential positive or adverse consequences of these changes. This will include consideration of the nature, degree and distribution of potential effects at the local, regional, national and international scales, as applicable. In doing so, the Committee will review and consider the experiences of other jurisdictions with offshore wind development activities.	Sections 5, 6, 7, 8, 9, 10, 11 Appendix G

Regional Assessment Requirements (Terms of Reference)	**Report Section(s)**
A 2.3, Objective B: Provide an understanding of the regional context that can be used in considering and evaluating the potential effects (including cumulative effects) of future offshore wind development activities to inform future planning and licencing processes and impact assessments.	
a) An identification and analysis of key environmental, health, social or economic components in the Study Area that should be considered in future licencing or impact assessments for offshore wind development activities in the Study Area. This will include identifying and highlighting: i. Any components, values, locations or times that may be susceptible to effects (direct or indirect, positive or adverse) from future offshore wind development activities in the Study Area and/or from other past, on-going or future activities and other natural or human-induced disturbances; and ii. Any circumstances where the nature, location, timing and potential accumulation of these effects may result in potential cumulative effects (positive or adverse).	Sections 5, 6, 7, 8, 9, 10, 11 Appendix G
A 2.3, Objective C: Identifying and recommending mitigation and follow-up measures and other approaches for addressing potential positive and adverse effects (both project-specific and cumulative) as part of future decision-making for offshore wind development activities.	
a) Recommendations on potential mitigation measures and other approaches that are technically and economically feasible for addressing the potential adverse effects of future offshore wind development activities in the Study Area or creating and maximizing their potential positive effects and the equitable distribution of these benefits. This may include standard measures as well as other potential approaches, technologies and measures that may be required to address particular issues identified through the Regional Assessment. This will also include recommendations on required follow-up as applicable. In doing so, the Committee will review and consider the experiences of other jurisdictions in offshore wind development activities, including the implementation and effectiveness of such measures.	Sections 6, 7, 8, 9, 11 Appendix G
b) Recommendations on potential approaches and measures to address regional-scale and non-project specific (including cumulative) effects. This may include potential policy, plan, program, regulatory or other initiatives by governments or other relevant parties.	Sections 6, 7, 8, 9
A 2.3, Objective D: Describe how the findings or recommendations of the Regional Assessment could be used to inform future planning and licencing processes for these activities in a manner that fosters sustainability and enhances the effectiveness and efficiency of their impact assessments.	
a) Recommendations on how to consider, implement or otherwise address the Regional Assessment findings in a clear, effective and efficient manner in future planning and licencing and in impact assessments for future offshore wind development activities in the Study Area, and/or through other initiatives by governments or other parties.	Sections 5, 6, 7, 8, 9
b) Recommendations for a Regional Assessment follow-up program to consider and incorporate any new or updated information that becomes available after submission of the Final Report by the Committee, in order to help ensure that the Regional Assessment remains current and useful into the future and continues to fulfill its goal and objectives as outlined in this Agreement.	Sections 5, 6, 7, 8, 9

Regional Assessment Requirements (Terms of Reference)	**Report Section(s)**
Section A 2.4, The Committee will also include the following in the Report:	
a) A generic description of the types of offshore wind development activities that may occur in the Study Area, including their construction (including expansion), operations, decommissioning, and abandonment phases as applicable. This will include fixed (i.e., pile-driven platforms) and floating technologies and associated activities.	Section 4
b) The purpose of and need for offshore wind development activities in the Study Area, including their potential environmental, health, social and economic benefits.	Sections 1, 7, 10
c) An identification and analysis of any change to offshore wind development activities in the Study Area that may be caused by the environment.	Section 9
d) A description of the public and Indigenous participation activities undertaken by the Committee during the conduct of the Regional Assessment, including a summary of any comments received and of where and how these were considered in the Regional Assessment.	Sections 3, 5, 6, 7, 8, 9, 10 Appendices A, B, C, D
e) An overview of how the Committee took into account and used any Indigenous knowledge and Community knowledge provided during the Regional Assessment. In doing so, the Committee must obtain consent to disclose any confidential Indigenous knowledge provided as per section 119 of the IAA unless otherwise required by law.	Sections 3, 7 Appendices A, B, C, D

Table Description: This table lists all the requirements from the Agreement and indicates where in this Report the reader can find information that fulfills each requirement. In many cases, the information supplied to meet one requirement can be found in several places throughout the Report.

2. Committee Conduct and Approach

This section describes Committee composition, governance, its precautionary approach, and use of the Canada Marine Planning Atlas (the Atlas).

2.1 Committee Composition

The Committee consisted of five members appointed by the federal and provincial Ministers.[20] The Committee members came from diverse backgrounds, with expertise in Indigenous engagement, law, engineering, meteorology, environmental assessment, ecology, Geographical Information Systems (GIS), commercial fisheries, marine biology, and public participation. The Committee was supported by a Secretariat, comprised of staff seconded from the IAAC. For the duration of the Regional Assessment, the Secretariat carried out technical, engagement, and administrative tasks at the direction of the Committee, not the IAAC.

2.2 Governance

2.2.1 Procedural Fairness

While the Committee was appointed by government, the Committee operates independently from government. Procedural fairness was fundamental to the Committee's governance. The Committee's priority was conducting a transparent process and remaining unbiased and free from real or perceived conflict of interest with respect to the Regional Assessment.

Following completion of administrative justice training in May 2023, the Committee developed Operational Procedures and a Confidentiality Procedure. The procedures elaborated upon the general principles and processes described in the Agreement and inform participants how the Committee functioned. The procedures described how the Committee maintained its independence, handled bias and conflict of interest, ensured information was publicly accessible in a timely manner via the Registry, and facilitated confidentiality. The procedures are available on the Registry.

2.2.2 Committee Meetings, Information Exchange, and Decision-Making

The Committee and Secretariat were afforded "deliberative privilege." Deliberative privilege ensures confidentiality in the decision-making process, which promoted open and frank discussions amongst the Committee and the Secretariat. Internal deliberations leading to a Committee decision or recommendation are protected from disclosure through the exemptions and exclusions under the *Access to Information Act* (ATIA). Throughout this Report, "Committee meeting" is used to refer to these meetings attended generally only by the Committee and the Secretariat. Though notes from Committee

[20] document reference number 75.

meetings are protected by deliberative privilege, the Committee and Secretariat maintained a high-level summary of Committee meetings on the Registry throughout the Regional Assessment process.

When planning Indigenous engagement, the Committee would sometimes invite the IAAC Indigenous Relations Advisor to a Committee meeting to discuss logistics (e.g., participants, dates, locations, materials, etc.). In these instances, the IAAC Indigenous Relations Advisor joined the Committee meeting at a pre-determined time to exclusively discuss the Indigenous engagement planning. The Committee and Secretariat would not discuss any other matters during this time. Other than the IAAC Indigenous Relations Advisor, no other person or group attended Committee meetings. The Committee meeting summary on the Registry clearly indicates where the IAAC Indigenous Relations Advisor attended to discuss only Indigenous engagement planning.

The Committee and Secretariat used Microsoft Teams (MS Teams) to meet virtually, share information, maintain records, and collaborate on presentation materials and reports. Only the Committee and Secretariat had access to this MS Teams channel.

This Report reflects the views of all Committee members. In making decisions, the Committee aimed for consensus amongst all Committee members. Any areas of non-consensus and associated dissenting viewpoints are reflected in this Report.

2.3 Precautionary Approach

The governments of Canada and Newfoundland and Labrador have no immediate plans to identify offshore wind licensing areas or hold a call for bids in the Offshore Area.[21] To date, there are no offshore wind projects in Canada. The Government of Newfoundland and Labrador has not issued a development goal or timeline. There is yet to be a pilot or demonstration offshore wind project installed in the Offshore Area. There are no studies on the effects of offshore wind development on local species, nor on the efficacy of measures to mitigate these effects in the local environment. The Committee therefore took a precautionary approach in conducting their analyses and making their recommendations.

This use of a precautionary approach means basing decisions on currently available evidence that demonstrate technical feasibility of turbine technologies, shows potential impacts to environmental, health, social,

[21] NRCan provided this update to the Committee in December 2024. In the Draft Report (October 1, 2024), the Committee's understanding was that the governments of Canada and Newfoundland and Labrador anticipated identifying Strategic Priorities for the Call for Bids in early 2025, followed by the Call for Bids for Offshore Wind Areas some time in 2025.

and economic components, and how such impacts can be avoided or mitigated before offshore wind development proceeds in a given area.

While the Committee drew upon experience with the local offshore oil and gas industry and expertise from the offshore wind energy sector in other jurisdictions, it would be imprudent to assume these effects and mitigation measures can be applied to offshore wind development activities in Newfoundland and Labrador without first having on-the-ground studies and monitoring of local projects to address current knowledge and data gaps. A key part of the Committee's mandate was to identify and evaluate such gaps, and to make recommendations to address these gaps.

The Committee believes that as gaps are filled, projects are installed, and impact assessments are conducted, local evidence and knowledge will build to further inform licencing area selections.

2.4 Use of the Canada Marine Planning Atlas

The Committee was mandated to conduct the Regional Assessment in a manner that promoted transparency and encourages public input and participation. Wherever possible, the Committee used publicly available information and data to complete its work. Since this Regional Assessment is heavily reliant on geospatial data within the marine environment, and the Committee produced their own geospatial files (i.e., Focus Area, initial offshore wind energy licencing areas), the Committee used the Atlas as a publicly available data source and as a platform for displaying its own outputs in a publicly accessible manner. While the Agreement gave the Committee the option to develop its own GIS, the Committee felt it unnecessary to expend time and resources on this when the Atlas is already available, directly relevant to the Regional Assessment, and has dedicated resourcing under a broader government mandate. Throughout this Report, the Committee has identified data gaps and limitations within some of the data curated within the Atlas and makes recommendations to help address those gaps.

3. Indigenous, Public, Fisheries, and Stakeholder Engagement

Indigenous, public, fisheries, and stakeholder participation was important to this Regional Assessment. The Committee aimed to facilitate an engagement process that:

- respected Indigenous knowledge, rights, and culture;
- valued Community knowledge;
- encouraged participants to actively participate in the Regional Assessment; and,
- established an open and constructive dialogue with participants.

From May 2023 - December 2024, the Committee engaged with Indigenous peoples, fishers,[22] other ocean users, municipal leaders, federal and provincial governmental agencies, environmental organizations, research groups, offshore wind developers and service companies, and individuals with information, knowledge, and interests relevant to the Regional Assessment. The Committee had 20 meetings with Indigenous communities and organizations, 21 meetings with government departments, 10 advisory group meetings, 13 meetings with stakeholder groups, and 33 public engagement sessions, attended by nearly 500participants overall.[23] These participants included 45 Indigenous persons representing Indigenous communities or organizations, , 141 government representatives, 37 fishers or fishing organizations, 11 environmental groups, 16 energy industry representatives, 16 academics, 96 consultants, seven other stakeholder groups, and 129 members of the public.[24]

This section provides an overview of the Committee's engagement approaches. The details of engagement activities are provided in the Committee's What We Heard Reports for Indigenous Engagement (Appendix A) and Public, Fisheries, and Stakeholder Engagement (Appendix B) (the What We Heard Reports), as well as the Indigenous and Public, Fisheries, and Stakeholder participation plans (Appendix C and D).

This Report describes how specific engagement outcomes helped inform the Regional Assessment.

[22] Throughout this Report, "fishers" includes commercial, recreational, and subsistence fishers.
[23] "Attendance of nearly 500 participants overall" refers to the number of participants throughout the engagement process, many of whom participated in numerous meetings and sessions.
[24] Where affiliation of an individual was not provided/unknown, that individual was categorized as a member of the public.

It is important to note that the engagement outcomes described throughout this Report reflect the views expressed by those who shared them with the Committee. Opinions and perspectives documented throughout this Report should not be considered representative of all Indigenous peoples, communities, and organizations, nor of all fishers, fishing organizations, stakeholders, or the public.

3.1 Consideration of Indigenous Knowledge and Aboriginal and Treaty Rights

The Agreement refers to Indigenous knowledge as the knowledge held and shared by, and based on the worldview of, Indigenous peoples. Indigenous knowledge, including the knowledge of Indigenous women, is integral to understanding the existing environment, identifying potential effects of offshore wind development, and identifying mitigation and other measures for addressing effects. The information, advice, concerns, and recommendations Indigenous peoples have shared regarding this Regional Assessment are apparent throughout this Report. Any Indigenous knowledge or data that was provided in confidence is confidential and has not been disclosed.

This Regional Assessment was not a Crown duty to consult process. However, the information provided to the Committee may inform Crown efforts to develop and implement meaningful consultation processes with Indigenous peoples in future project-specific impact assessments and other regulatory and decision-making processes for offshore wind development. As such, in addition to assisting the Committee with planning Indigenous engagement (as described in Section 2 of this Report), the IAAC Indigenous Relations Advisor would also participate in all Indigenous engagement activities, and in any public engagement activities where Indigenous peoples, groups, or organizations may be in attendance.

3.2 Indigenous Engagement

The Committee invited Indigenous groups and organizations throughout Atlantic Canada and Quebec to participate in the Regional Assessment. The Committee held 20 one-on-one meetings with Indigenous groups and two meetings with the Indigenous Knowledge Advisory Group. The Committee also invited all Indigenous groups and organizations and the Indigenous Knowledge Advisory Group to participate in document review (e.g., effects table review, literature review), as well as to attend engagement sessions open to all participants. The Committee's Indigenous Engagement - What We Heard Report (Appendix A) details the Indigenous engagement activities, including issues and concerns raised, and input provided. This Report describes how specific outcomes from Indigenous engagement helped inform the Regional Assessment.

3.2.1 Identifying Indigenous Groups and Organizations

Prior to Committee appointment, the IAAC had identified and engaged the following Indigenous groups and organizations during the planning phase of this Regional Assessment:

Newfoundland and Labrador

- Nunatsiavut Government
- Innu Nation representing Sheshatshui Innu First Nation and Mushuau Innu First Nation
- NunatuKavut Community Council (NCC)
- Qalipu First Nation (QFN)
- Miawpukek First Nation (MFN)

Ten Mi'kmaq First Nation communities in Nova Scotia represented by Kwilmu'kw Maw-klusuaqn

- Negotiation Office (KMKNO)
- Acadia First Nation
- Annapolis Valley First Nation
- Bear River First Nation
- Eskasoni First Nation
- Glooscap First Nation
- Paqtnkek Mi'kmaw Nation
- Pictou Landing First Nation
- Potlotek First Nation
- Waycobah First Nation
- Wagmatcook First Nation

Three Mi'kmaq First Nation communities in Nova Scotia not represented by KMKNO

- Membertou First Nation
- Millbrook First Nation
- Sipekne'katik First Nation

Two Mi'kmaq First Nation communities in Prince Edward Island, represented by L'nuey

- Abegweit First Nation
- Lennox Island First Nation

Eight Mi'gmaq First Nation communities in New Brunswick represented by Mi'gmawe'l Tplu'taqnn Inc. (MTI)

- Fort Folly First Nation
- Eel Ground First Nation
- Pabineau First Nation
- Esgenoôpetitj First Nation
- Buctouche First Nation

- Indian Island First Nation
- Eel River Bar First Nation
- Metepenagiag Mi'kmaq Nation

One Mi'gmaq First Nation community in New Brunswick not represented by MTI

- Elsipogtog First Nation

Six Wolastoqey First Nation communities in New Brunswick represented by Wolastoqey Nation in New Brunswick (WNNB)

- Kingsclear First Nation
- Madawaska Maliseet First Nation
- Oromocto First Nation
- Saint Mary's First Nation
- Tobique First Nation
- Woodstock First Nation

Three Mi'gmaq First Nation communities in Quebec represented by Mi'gmawei Mawiomi Secretariat (MMS)

- La Nation Micmac de Gespeg
- Listuguj Mi'gmaq Government
- Micmacs of Gesgapegiag

Seven Innu communities in Quebec

- Conseil des Innus d'Unamen Shipu
- Conseil des Innu de Ekuanitshit
- Conseil des Innus de Pakua Shipu
- Conseil des Innus de Pessamit
- Conseil de la Première Nation des Innus Essipit
- Innu Takuaikan Uashat mak Mani-Utenam
- Première Nation des Innus de Nutashkuan

Indigenous organizations

- Agence Mamu Innu Kaikusseht (AMIK)
- Atlantic Policy Congress of First Nations Chiefs Secretariat
- Newfoundland Aboriginal Women's Network (NAWN)
- Keepers of the Circle

The Committee added to this initial list as other Indigenous organizations came forward expressing interest in the Regional Assessment, or as the Committee identified additional organizations:

- Benoit First Nation Inc.
- Flat Bay Band Incorporated (Inc.)
- Port au Port Band Inc.

- Three Rivers Mi'kmaq Band Inc.
- Indian Head First Nations Inc. (IHFN)
- St. George's Indian Head Band Council Inc.

With a Regional Assessment of Offshore Wind Development occurring concurrently in Nova Scotia, competing priorities, and the Committee's eventual focus on an area west and south of the Island of Newfoundland, it is understandable that there were varying degrees of participation.

3.2.1.1 Indigenous Peoples on the Island of Newfoundland

The Committee was mandated to receive information from Indigenous peoples on the nature and scope of any Aboriginal or Treaty rights protected by section 35 of the *Constitution Act, 1982*. The Committee was not mandated or empowered to make any determination as to the existence or validity of Aboriginal or Treaty rights, the probability of adverse impacts upon any such rights, or whether any duty to consult has arisen and been discharged in any particular context. The Committee therefore engaged with all Indigenous groups and individuals, regardless of their status and not based on the Indigenous groups and individuals being section 35 rights holders. This means the Committee reached out beyond the Indigenous groups identified by the IAAC.

On the Island of Newfoundland, the Government of Canada recognizes two First Nations as bands for the purpose of the *Indian Act*. These First Nations are Qalipu First Nation and Miawpukek First Nation.

Qalipu First Nation has more than 25,000 members and is made up of 67 traditional Mi'kmaq communities. Qalipu First Nation is divided into nine electoral wards across western and central Newfoundland: Benoit's Cove, Corner Brook, Exploits, Flat Bay, Gander Bay, Glenwood, Port au Port, Stephenville, and St. George's. The central administrative office is in Corner Brook and there are satellite offices in Glenwood, Grand Falls-Windsor, St. George's, and Stephenville (Qalipu First Nation, n.d.). Additionally, there are several Indigenous organizations that are legally incorporated entities on the west coast whose members include Qalipu First Nation members. These Indigenous organizations assert land and Treaty rights independently of Qalipu First Nation. The Committee decided to engage these Indigenous organizations directly, based on requests members of these Indigenous organizations made during public engagement sessions in western Newfoundland.,

Miawpukek Mi'kamawey Mawi'omi is a First Nation Reserve. In 1987, a federal Indian Reserve was established at Conne River. The community is located at the mouth of the Conne River that empties into Baie d'Espoir on the south coast of the Island of Newfoundland. Approximately 850 members of Miawpukek First Nation live at Conne River, with an additional 2,000 members living off-Reserve (Miawpukek Mi'kamawey Mawi'om, 2023).

3.2.2 Indigenous Participation Plan

The Indigenous Participation Plan (the IPP) was intended to be developed and implemented in collaboration with Indigenous groups. The IPP outlined opportunities for engagement in the Regional Assessment and aimed to ensure that Indigenous groups were aware of planned approaches, and upcoming and completed activities. The IPP described in detail the Committee's Indigenous engagement program, including:

- Identification of potentially interested Indigenous groups and organizations;
- Indigenous Knowledge Advisory Group formation, function, and membership;
- Participant funding;
- Planned engagement activities; and
- Completed engagement activities.

The IPP is posted on the Registry and appended to this Report (Appendix C).[25] The Committee's Indigenous Engagement - What We Heard Report (Appendix A) describes all engagement activities and outcomes for the entire Regional Assessment process.

3.2.2.1 Challenges to IPP Development

The Committee had hoped the IPP would also contain community-specific engagement plans, developed in collaboration with interested Indigenous groups. However, there were challenges to co-developing the IPP in this way. On July 24, 2023, the Committee circulated a draft framework for the IPP (the draft framework) via email to all Indigenous groups and organizations. On August 11, 2023, the Committee emailed all Indigenous groups and organizations indicating the draft framework had been posted to the Registry. On both occasions, the Committee's correspondence invited all Indigenous groups and organizations to provide written feedback on the draft framework and welcomed meetings to discuss the document. The Committee reiterated this invitation for written comments and discussion when meeting with Indigenous groups throughout summer and into fall of 2023. Two communities provided feedback specifically on the draft framework.

Some Indigenous groups indicated the timing of the draft framework release was not ideal. While there was interest in the Regional Assessment and in working collaboratively with the Committee, several groups indicated being at capacity and requested the Committee re-engage them later.

The Committee also heard many concerns regarding the overall scope and timeline for this Regional Assessment, and the implications for Indigenous engagement. These concerns were central to the Committee's

[25] The last update to the IPP was for the Interim Report in March 2024.

request to the Ministers to amend the Agreement, though these concerns remained throughout the process .

With the revised scope and additional time afforded through the Agreement amendments, the Committee had hoped that co-development of at least some community-specific engagement plans for the IPP would occur. However, the Committee soon realized that with challenges Indigenous groups had identified, combined with the time remaining to engage, time and effort were best spent actively engaging rather than writing a plan for that engagement. Planning meetings and community sessions still occurred in cooperation with Indigenous groups (e.g., correspondence on ideal dates and venues for meetings and sessions) but it was administratively burdensome and taxing on already-limited time to formally write these plans for inclusion in the IPP.

3.2.3 Indigenous Knowledge Advisory Group

The Committee established an Indigenous Knowledge Advisory Group. Indigenous Knowledge Advisory Group formation and function are described in the IPP, and membership, activities, and outcomes are detailed in the Committee's Indigenous Engagement - What We Heard Report (Appendix A). Interested Indigenous persons, from within or outside of Newfoundland and Labrador, could come forward at any time during the Regional Assessment to express their interest in participating in this advisory group. Indigenous peoples were also members of the Scientific Information and Community Knowledge and Fisheries and Other Ocean Uses advisory groups. The Committee sought knowledge and perspectives from Indigenous peoples on matters relevant to the Regional Assessment. Over the course of two meetings and three document review activities, this advisory group provided information, knowledge, and perspectives on not only Indigenous peoples and their communities, activities, and other interests, but on all the same topics as the other advisory groups.

3.3 Public, Fisheries, and Stakeholder Engagement

The Committee held 33 public engagement sessions and 34 meetings attended by nearly 500 participants representing Indigenous groups and organizations, fishers and other ocean users, government agencies, environmental organizations, and members of the public. The Committee held three meetings each and provided three document review opportunities to the Fisheries and Other Ocean Users and Scientific Information and Community Knowledge advisory groups, and held one meeting with the Gender Based Analysis Plus (GBA Plus) Advisory Group. The Committee's Public, Fisheries, and Stakeholder Engagement - What We Heard Report (Appendix B) details the public, fisheries, and stakeholder engagement activities, including issues and concerns raised, and input provided. This Report describes how specific outcomes from public, fisheries, and stakeholder engagement helped inform the Regional Assessment.

3.3.1 Public, Fisheries and Stakeholder Participation Plan

In June 2023, the Committee published their Public, Fisheries and Stakeholder Participation Plan (PP) to outline its approach to provide opportunities for members of the public, fishers, fishing organizations, government agencies, environmental groups, and other stakeholders to engage in the conduct of the Regional Assessment. The PP described in detail the Committee's engagement program, including:

- Participant identification;
- Advisory group formation, function, and membership;
- Participant funding; and,
- Engagement with federal and provincial authorities.

The PP is posted on the Registry and is appended to this Report (Appendix D).[26] The Committee's Public, Fisheries, and Stakeholder Engagement - What We Heard Report (Appendix B) describes all public, fisheries, and stakeholder engagement activities and outcomes for the entire Regional Assessment process.

3.3.2 Advisory Groups

Early in the Regional Assessment process, the Committee established the three advisory groups specified in the original Agreement: Indigenous Knowledge Advisory Group, Scientific Information and Community Knowledge Advisory Group, and Fisheries and Other Ocean Uses Advisory Group. The Committee also later established a GBA Plus Advisory Group.[27]

Each of the advisory groups provided information and advice to the Committee on the following topics, as required and requested:

- Environmental, health, social and economic conditions.
- Information and knowledge gaps, and potential opportunities to address these during or following the completion of the Regional Assessment.
- Future offshore wind development activities in the Study Area, including their:
  - Need and purpose;
  - Physical activities associated with their construction, including expansion, operation, decommissioning, and abandonment;
  - Key locations of interest for future offshore wind development activities in the Study Area (to help focus the Committee's work on areas which are most likely to see future development interest, based on technical and economic factors);
  - Regulatory requirements;
  - Potential positive and adverse effects, including cumulative effects and associated sustainability considerations;
  - Mitigation, and other approaches for avoiding or reducing potential adverse effects and creating and maximizing potential positive effects; and
  - Follow-up requirements.
- Other topics relevant to the Regional Assessment, as requested by the Committee.

[26] There were no further updates to the PP following the publication of the Draft Report.
[27] Effects of offshore wind development reach beyond the Study Area, and the Committee is mandated to consider the experience of other jurisdictions with established offshore wind industries. Participation in the advisory groups was open to participants outside of Newfoundland and Labrador.

Advisory group formation and function is described in the IPP and PP, and membership, activities, and outcomes are detailed in the Committee's What We Heard Reports (Appendices A through D).

3.3.3 Federal and Provincial Authorities

The Committee strived to engage with federal and provincial authorities in a transparent manner. They were invited to participate in public engagement sessions and in advisory groups. The PP was regularly updated to indicate where federal and provincial authorities participated in these activities. While engagement activities were optional, federal and provincial authorities were required to provide information, knowledge, or advice as and when the Committee requested it.[28] The Committee did this through meetings and written requests. Throughout the Regional Assessment, meetings with federal and provincial authorities were listed in the PP. The PP also contained Registry links to the Committee's information requests and responses to those requests (except in instances where the Committee granted confidentiality in accordance with the Confidentiality Procedure).

The Committee's What We Heard Report - Public, Fisheries, and Stakeholder Engagement (Appendix B) lists all meetings with and written responses from federal and provincial authorities, as well as their participation in engagement sessions and advisory groups. This Report indicates where specific advice from federal and provincial authorities helped inform the Regional Assessment.

[28] Federal authorities are obligated by the IAA and the Agreement, provincial authorities are obligated by the Agreement.

3.4 Phased Engagement

The Committee's engagement activities unfolded in five phases, as summarized in Table 3.1.

Table 3.1. Engagement Phases

Phase	Timeframe	Focus of Committee's Engagement Efforts
Introducing the Regional Assessment	May 2023 – September 2023	• Gathering Indigenous knowledge and perspectives • Gathering Community knowledge, and input from the public, fisheries, and stakeholders • Providing an overview of the Regional Assessment objectives, scope, and timelines • Inviting feedback on the IPP and PP • Promoting advisory groups
Defining the Focus Area	August 2023 – October 2023	• Gathering Indigenous knowledge and perspectives • Gathering Community knowledge, and input from the public, fisheries, and stakeholders • Inviting feedback on the Proposed and Final Focus Area based on technical and economic constraints • Engaging advisory groups

Phase	Timeframe	Focus of Committee's Engagement Efforts
Identifying Preliminary Offshore Wind Energy Licencing Areas	November 2023 – March 2024	• Gathering Indigenous knowledge and perspectives • Gathering Community knowledge, and input from the public, fisheries, and stakeholders • Inviting feedback on the proposed constraints analysis • Inviting feedback on the final constraints analysis and resulting preliminary offshore wind energy licencing areas for the Interim Report (Refer to Appendix B for summary of comments received in February and March 2024) • Engaging advisory groups
Preparing the Draft Report	March 2024 – September 2024	• Gathering Indigenous knowledge and perspectives • Gathering Community knowledge, and input from the public, fisheries, and stakeholders • Adjusting constraints analysis and offshore wind energy licencing areas based on feedback (Refer to Appendix B for submissions received on the Interim Report) • Inviting input on existing conditions, effects, mitigation, follow-up, and monitoring • Engaging advisory groups
Finalizing the Report	October 2024 – December 2024	• Gathering Indigenous knowledge and perspectives • Gathering Community knowledge, and input from the public, fisheries, and stakeholders • Gathering feedback on Draft Report via the public review and comment period (October 1-November 29, 2024)* • Engaging the GBA+ Advisory Group

Table Description: The Committee's engagement program consisted of five phases: 1) Introducing the Regional Assessment; 2) Defining the Focus Area; 3) Identifying Preliminary Offshore Wind Energy Licencing Areas; 4) Preparing the Draft Report; 5) Finalizing the Report. Engagement occurred from May 2023 to December 2024.
Notes:* The Committee has prepared a summary of the comments received on the Draft Report and will post this summary to the Registry.

3.5 Engagement Challenges

The Committee acknowledges the engagement challenges encountered during this Regional Assessment, that limited the ability of some participants to meaningfully engage, including:

- Engagement fatigue –There are numerous overlapping initiatives all requesting time from the same participants (e.g.., marine spatial planning, onshore wind development, other natural resource development projects). Communities and organizations have a limited capacity to engage.
- Advertising engagement sessions – The Committee leveraged their email distribution list, social media, and local and print media to advertise engagement sessions. However, for in-person sessions in rural communities, the Committee heard that additional advertising (e.g., mailed notices, placing posters in community gathering spaces) is needed.
- Access to technology – While technology enables engagement (e.g., holding virtual engagement sessions, sharing information on the Registry, communicating with participants via email, advertising meetings on social media), it also excludes anyone without internet access or anyone less familiar with technology.
- Seasonality / timing – The timeline for the Regional Assessment, even with the four-month extension, limited the ability of the Committee to meet with participants at a time that worked best for the participants. The Committee's engagement efforts overlapped with hunting and fishing seasons, cultural celebrations, and engagement programs for other local projects.

4. Description of Offshore Wind Development and Associated Activities

This section provides a generic description of offshore wind development activities throughout the construction (including expansion), operations, and decommissioning and abandonment phases.

4.1 Overview of Power Generation

Figure 4.1 provides an overview of one example of how electricity generated from offshore wind turbines can reach land. Offshore wind turbines (1) capture wind energy and generate electricity. Array cables (2) transmit electricity to an offshore substation. (3) Electricity then moves through export cables (4), reaches land (5), and transfers to the onshore grid (6).

Figure 4.1. Offshore Wind Power Generation System

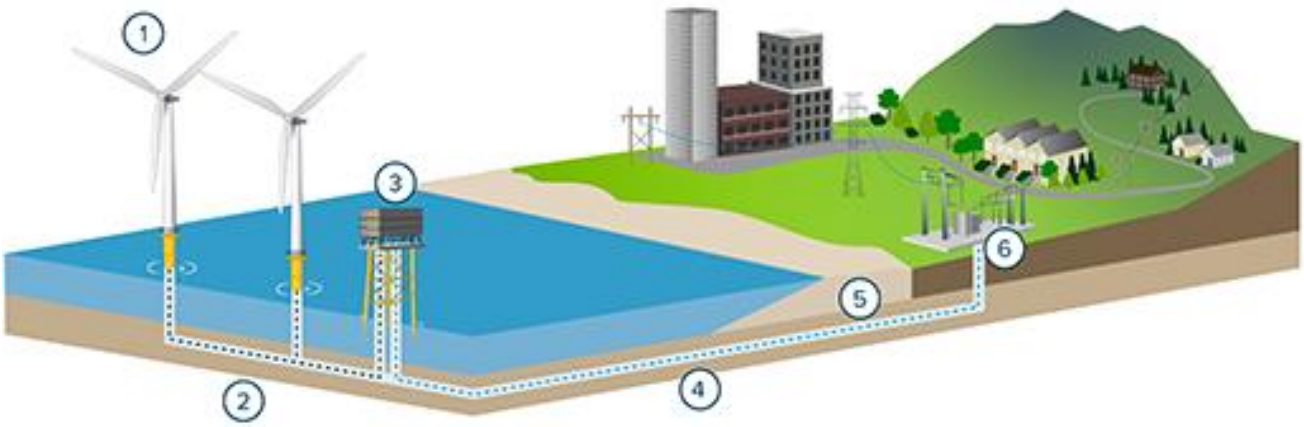


Figure Description: Image showing offshore and onshore landscape with respect to offshore wind energy generation and transmission. Two offshore wind turbines are depicted. Electricity from the turbines moves towards an offshore substation through undersea cables. From there, the electricity moves to the onshore substation through a buried cable where it is then transferred to the existing transmission network.
Source: NYSERDA, 2024.

4.2 Offshore Wind Development Components

Offshore wind farms include various components, the specifics of which would be determined by the project design. A typical offshore wind project includes turbines, array and export cables, and offshore substations. Each of these components is described in more detail below.

4.2.1 Turbines

4.2.1.1 Turbine Components

Offshore wind turbine design varies based on several factors (e.g., water depth, wind speeds, desired energy production, sea floor geology, etc.). Generally, turbines consist of the following components (Figure 4.2):

- The hub (1) is connected to the nacelle. It supports the blades of the turbine and houses the pitch system. This system helps to optimize the blade angle and rotation speed of the blades, based on wind conditions.
- The blades (2) extend out from the hub. They rotate to capture wind energy and convert it into mechanical energy. There are typically three blades, made primarily of fiberglass, carbon fiber material, and balsa wood. Blades are curved to create an air pressure difference across the two sides of the blades that make the blades spin.
- The nacelle (3) houses the internal infrastructure of the turbine, which converts the mechanical energy from the blades into electrical energy.
- The tower (4) is the structure that extends from the foundation; supports the nacelle, hub, and turbine blades; and holds the cables that transport the electrical energy to the array cables. The tower must be tall enough to keep the turbine blades at a safe distance above the water, usually 22 - 30 m above sea level (asl).
- The foundation (5) secures the turbine tower; and the nacelle, hub, and blades attached to the tower. Foundations are classified as either fixed or floating.

Figure 4.2. Offshore Wind Turbine Components

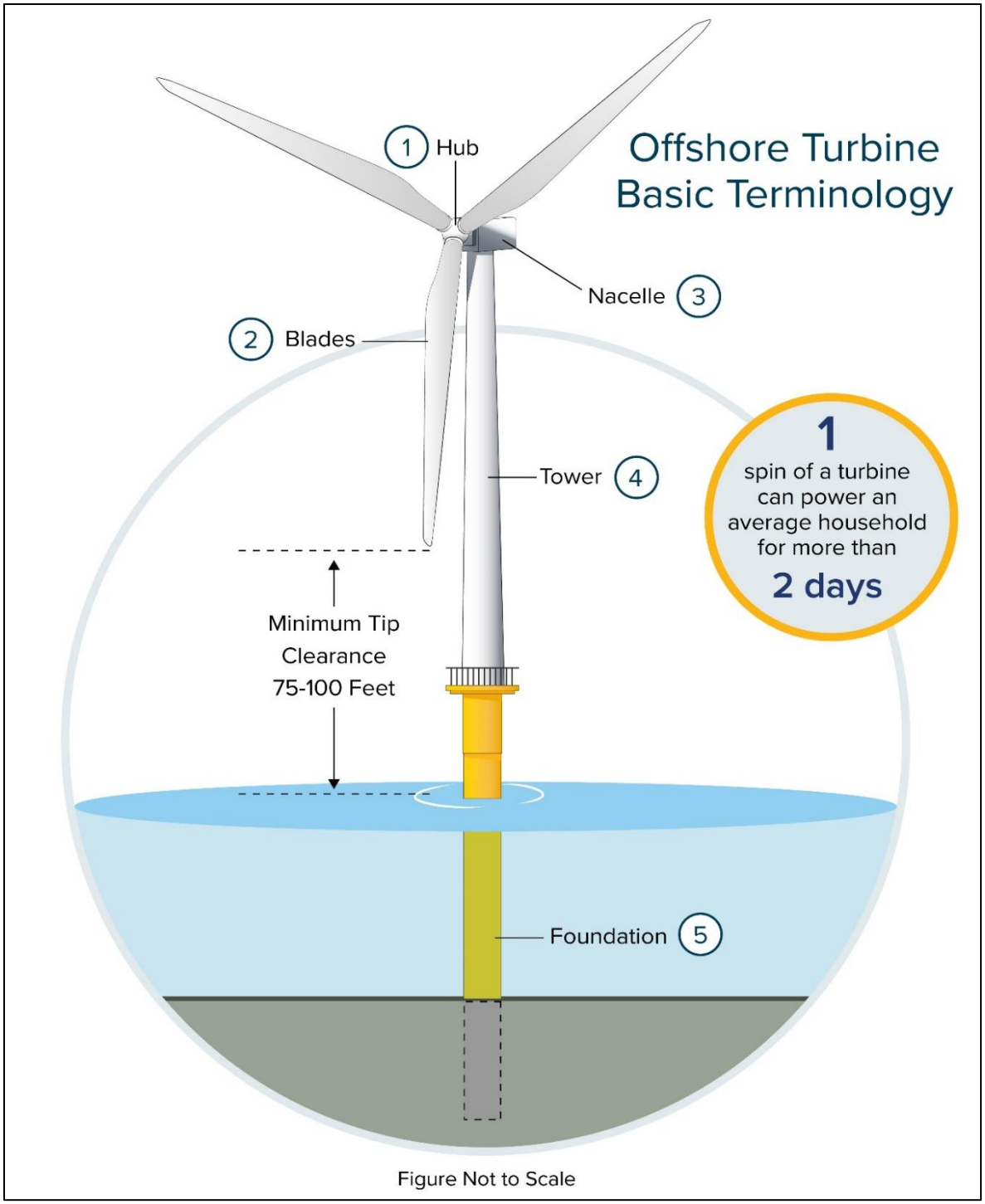


Figure Description: The image depicts a single offshore wind turbine. It is labelled to indicate the following components: (1) hub, (2) blades, (3) nacelle, (4) tower, and (5) foundation. For clarity, 75 - 100 feet (as denoted in the diagram) is 22.86 - 30.48 m.
Source: NYSERDA, 2024.

Anglais	Français

Offshore Turbine Basic Terminology	
1. Hub 2. Blades 3. Nacelle 4. Tower 5. Foundation	
1 spin of a turbine can power an average household for more than 2 days	
Minimum Tip Clearance 75-100 Feet	
Figure Not to Scale	

4.2.1.2 Turbine Heights and Rotor Blade Diameters

Dimensions of offshore wind turbines can vary greatly, based on design of the overall wind farm and other factors such as environmental conditions and technical and economic considerations. Wind turbines have tended to increase in size (both in vertical height and blade length) as technology has evolved. Larger turbines generate more power than smaller ones resulting in the need for fewer turbines to generate the desired power output. However, in some cases, this could involve a larger overall spatial footprint. For example, anchors and cables for floating turbines may need to be spaced farther out to secure and stabilize a larger structure.

Figure 4.3 demonstrates the increases in power generation and corresponding increases in turbine sizes for offshore wind turbines since 2010. As an example, a 3-megawatt (MW) turbine, a typical size in 2010, has a hub height of approximately 75 m and a blade rotor diameter of approximately 90 m. By 2021, turbines were installed in several locations with 12 MW generation capacity, hub heights of approximately 150 m, and blade rotor diameters of approximately 220 m.. At the time of posting the Draft Report, additional examples of increasingly larger turbines were announced by Chinese and Norwegian companies.

Specific examples of the enlarging wind turbines include (Buljan, 2024; Memija, 2024; Sanderson, 2024):

- the 2015 Block Island Wind Farm in offshore State of New York which has turbines that are 100 m in hub height, with rotor blade diameters of 150 m and generate 6 MW of electricity;
- recent offshore wind developments in the Netherlands (utilizing Siemens Gamesa turbines) that are 150 m in hub height with rotor blade diameters of 200 m and generate 11 MW of electricity;
- the General Electric's Haliade X offshore turbine (12 MW) which is 138 m in hub height, with a rotor blade diameter of 220 m, making it one of the largest turbines in the industry and is indicative of the current trend globally
- China's state-owned CRRC announced in September 2024 a booking of its first order for a 20 MW offshore floating wind turbine with a hub height of 190 m and a rotor blade diameter of 260 m,
- China's state-owned Dongfang Electric Corporation has also announced in October 2024 the unveiling of a 26 MW offshore wind turbine with a hub height of 185 m and a rotor blade diameter exceeding 310 m, and

- A U.S. patent was issued in October 2024 to Entrion Wind (Norwegian company) for its Fully Restrained Platform (FRP) monopile which can extend water depths for monopile foundations to up to 100 meters. The company conducted a proof-of-concept study for the FRP monopile in 2020 and reports its is planning for commercial production in 2027. Maximum depths for fixed monopiles have been 60-80 metres to date.

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Figure 4.3. Trends in the Development of Offshore Wind Turbines

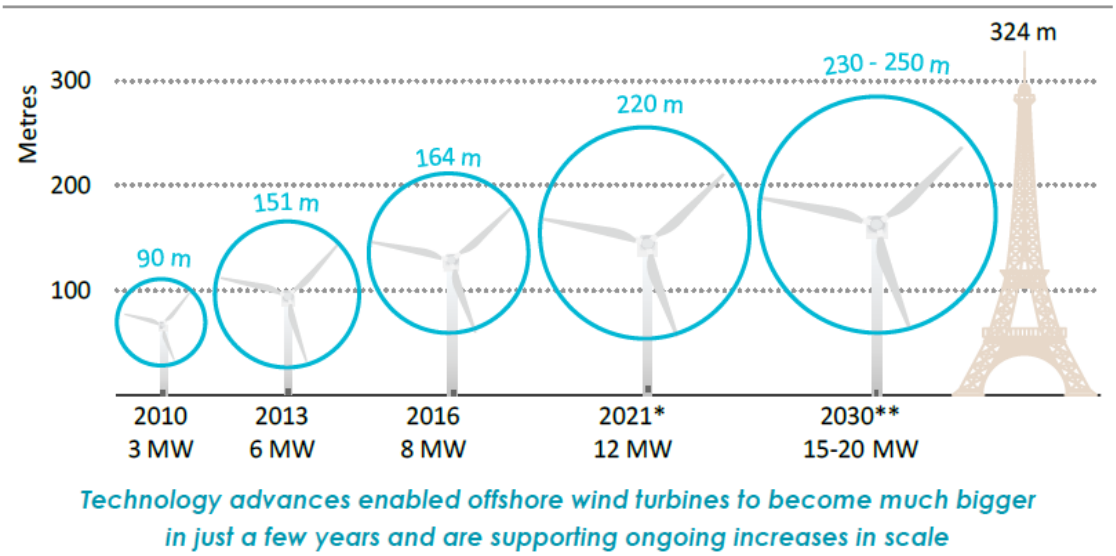


Figure Description: The figure above demonstrates how turbine technologies have increased in size since 2010 and are projected to continue increasing in size into the future. The turbine sizes range from 90 m in height in 2010 for a 3 MW turbine, to 230 - 250 m in height in 2030 for a 15 - 20 MW turbine. The Eiffel Tower (324 m in height) is provided for comparison. The reported sizes of turbines by Chinese companies in these examples above suggest the 2030 forecast is feasible.
Source: IEA, 2019.

Anglais	Français
Metres	
Technology advances enabled offshore wind turbines to become much bigger in just a few years and are supporting ongoing increased in scale	

Table 4.1 provides examples of offshore wind farms developed between 2015 – 2024 and illustrates a range of sizes of capacities, numbers of turbines, and footprints. The spacing between turbines is roughly proportionate to the size of turbines (the examples range in turbine capacities of 3.6 - 8 MW).

Table 4.1. Offshore Wind Energy Project Specifications

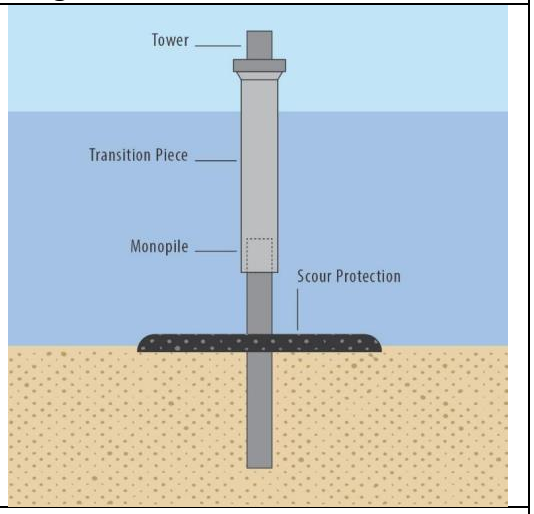
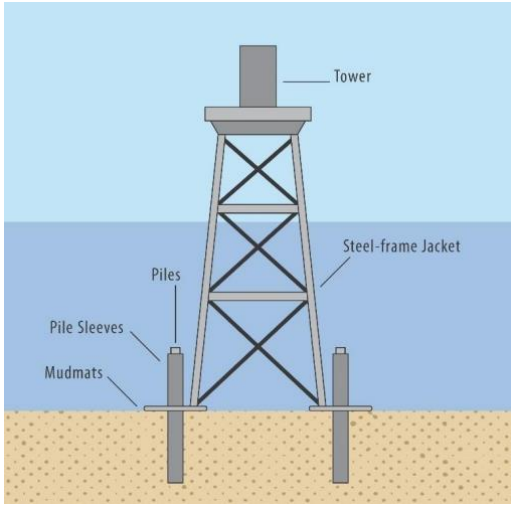
Project	Area (km^2)	No. of Turbines	Spacing (nm)	Capacity (MW)	Capacity Density (MW/km^2)	Commercial Operation Date
Gwynt y Môr (U.K.)	79	160	0.6 x 0.6	576	7.2	2015
Block Island Wind Farm (U.S.)	15	5	0.5 x 0.5	30	2	2016
Hornsea One (U.K.)	407	174	0.75 x 0.75	1,200	2.95	2020
Changhua 1 (Taiwan)	109	75	1.5 x 1.5	605	4.35	2024

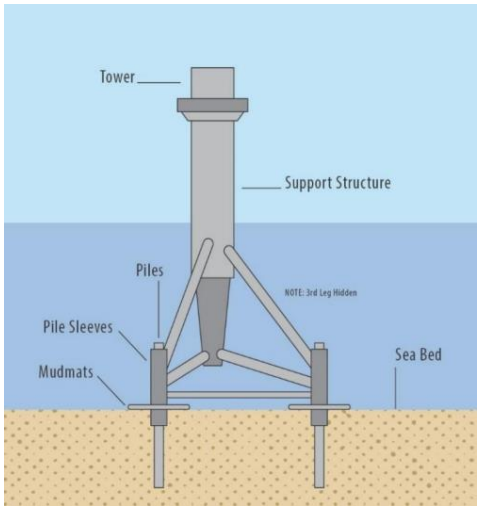
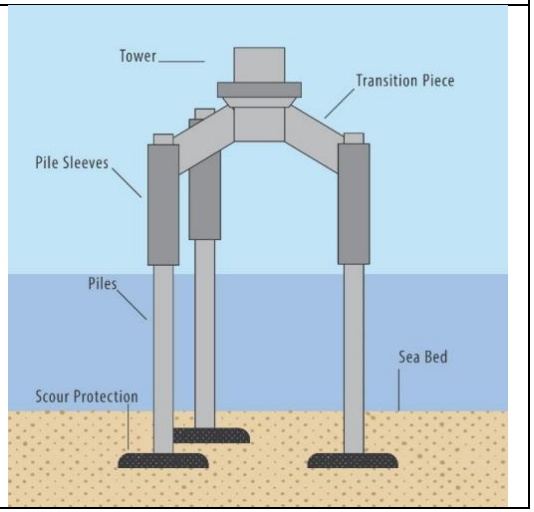
Table Description: This table describes the area, total turbine number and spacing, capacity, capacity density, and commercial operation date for four operating offshore wind projects in various jurisdictions.
Source: Block Island Wind Farm, 2024; Greater Changhua Offshore Wind Farms, Taiwan, 2024; Gwynt y Môr, 2024; Gwynt y Môr Offshore Wind Farm: Non-Technical Summary, 2005; Hornsea 1 Windfarm, 2024; Hornsea Project One Environmental Impact Assessment Scoping Report, 2010; Landscape Architecture Foundation, 2019.

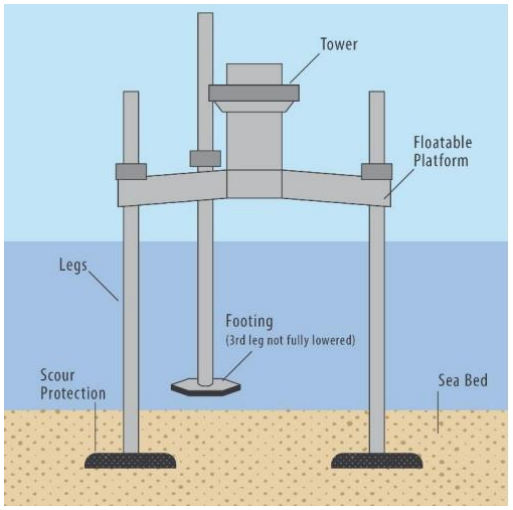
4.2.1.3 Turbine Foundations

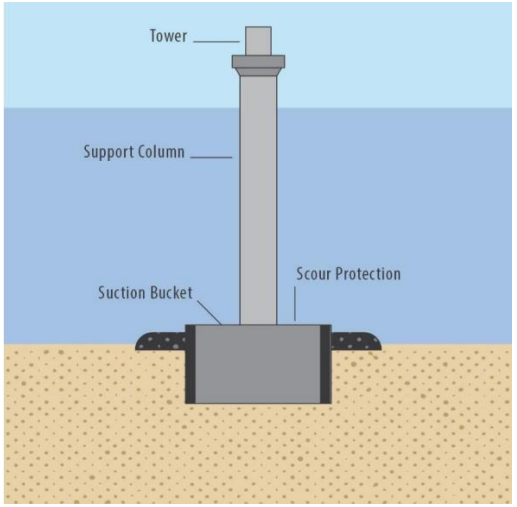
Fixed foundations form part of a solid continuous structure extending from on or below the seabed to the nacelle. Fixed foundation designs include monopile, jacketed, tripod, suction bucket, and gravity-based systems (GBS). Most fixed foundations penetrate the seafloor. An exception is the gravity-based foundation which rests on the seafloor. Table 4.2 describes and provides examples of fixed foundation types.

Table 4.2. Fixed Foundation Types

Type	Description	Image
Monopile Foundation	• Most commonly used foundation in offshore wind developments. • Consists of a single pile, driven into the seabed, providing vertical and lateral support. • Size of monopile depends on water depth, strength of seabed sediment, size and weight of the turbine, area covered by the turbine blades, and the expected forces acting on the structure (wind, waves and currents). • Have been used or proposed for use in water up to 50 m, and designers expect technology will advance to work in waters up to 60 m.	
Jacket Foundation	• Similar to offshore oil platform design, these consist of lattice-truss structures. • Usually consists of four legs, with tubular legs at the corners, with smaller diameter horizontal cross pieces and diagonal struts for rigidity. • The design above the waterline allows for vertical loads to be transferred to the seabed, while horizontal loads are counteracted through compression and tension of the piles. The weight of the foundation and turbine also aid in resisting these forces. • Jackets have been used in waters less than 5m (for pilot projects), but are most often used in waters from 50 - 60 m. • Oil and gas platforms have used similar structures in waters over 400 m.	

Tripod Foundation	• Hybrid platform of the jacket foundation and monopile. It has piles or suction caissons at the corners of the triangular base, similar to a jacket structure, while braces connect each leg into a central column similar to a monopile (column does not enter the seabed). • It transfers vertical loads to the seabed, similar to the jacket foundation, through the piles or suction caissons. Horizontal forces are resisted by compression and tension forces from the piles or caissons, transferred to the seabed. • The central column is usually smaller in diameter than those used in monopiles. • These foundations have been typically used in waters from 20 - 41 m.	
Tri-pile Foundation	• As per the name, there are three cylindrical legs, that then connect above the waterline, forming a frame to support a turbine above the water. • Consists of smaller diameter piles than those used in monopiles, but the three legs distribute the load over a larger footprint. • The piles transfer the vertical loads into the seabed, while horizontal forces are resisted by the compression and tension carried by the piles into the seabed, and by the stiffness of the piles. • These foundations have been used in waters from 25 - 40 m.	

Jack-up Foundation	• Originated from their use in the oil and gas industry. • Has a floatable platform with either three or four legs that can be raised or lowered relative to the platform. • As the legs lower, the weight of the structure and additional ballast water allows the legs to pierce the seabed. • Footings or spud cans can help distribute the loads from the legs to the seabed. • Once legs are set, the ballast water is drained so that the hull can be jacked up above the water surface to the operational height for the turbine. • These foundations have been proposed to be used in waters up to 100 m.	

Suction Bucket Foundation	• Also called mono bucket foundations or monopods.
	• Acts as a single base for the foundation, using a large diameter suction caisson.
	• Foundations are forced below the seabed by pumping water out to reduce the pressure of external forces to force the bucket into the seabed.
	• More prone to scour around the foundation, due to the solid obstruction to current flow, compared to other foundations (especially in sandy bottoms or in areas where winds are high)
	  ○ Scour can shorten the effective length of the flow path for the bucket, which weakens its ability to develop suction.
	  ○ Designs can account for scour potential and mitigate these issues by using scour protection.
	• As of 2020, no commercial facilities use this type of foundation.
		

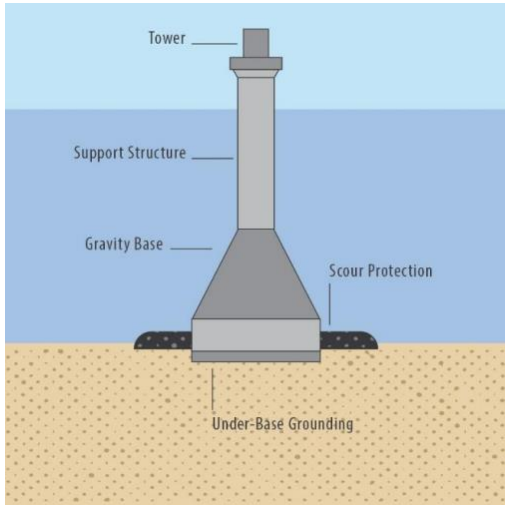
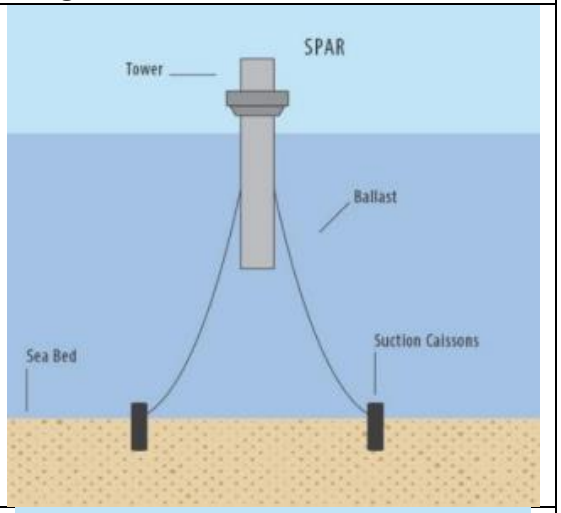
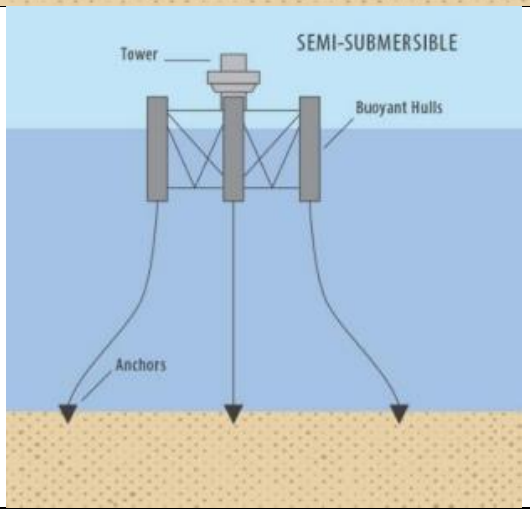
Gravity Foundation	• Includes a wide, heavy base that sits on the seabed, that supports the central column that rises above the water. • The base is usually made of reinforced concrete, but steel has also been used in some cases. • Supports the vertical loads through direct contact pressure with the seabed, while horizontal loads are counteracted by the weight of the base and turbine structure, ○ Dimensions of the gravity base will be based on water depths and expected forces from the wind, waves and currents. • Due to overturning forces and moments increasing as the rotor diameter, turbine hubs and water depths also increase, gravity foundations are usually limited to smaller turbines in water less than 20 m, but have been used in waters up to 30 m.	

Table Description: Different types of fixed foundations with descriptions and images of each.
Source: ICF, 2020.

A floating foundation is a buoyant structure that is connected to the seabed via anchors (gravity, embedded or pile driven) and cables (mooring lines), or other mechanisms that will keep the floating base tied to the seabed. Some common floating foundation designs include spar buoy, tension leg platform and semi-submersible. The design must have enough stability to support the turbine's weight, pitch, heave, and roll motions in a variety of sea state conditions. Floating foundations are generally meant for deeper waters (> 60 m) and/or where fixed technologies are considered not feasible. Floating foundations are a newer technology but are becoming more common globally as offshore wind farms move into deeper water. Table 4.3 outlines the three floating foundation options.

Table 4.3. Floating Foundation Types

Type	Description	Image
Spar	• Have a single cylinder that is ballasted, which supports the tower to remain upright as it extends under the water. • Main function of the anchors is station keeping. • Utilizes catenary mooring systems (most commonly used in shallow water) with mooring lines at low tension to keep the turbine in place. ○ Mooring lines are connected to dead weight anchors, drag anchors, dynamically embedded anchors, driven piles or suction caissons. • Has been used in projects in waters up to 220 m.	
Semi-Submersible	• Has multiple submerged columns (hulls) that are all connected with braces. The columns (hulls) are buoyant to allow the structure to float without flipping over. • Main function of the anchors is station keeping. • Utilizes catenary mooring systems (most commonly used in shallow water) with mooring lines at low tension to keep the turbine in place. ○ Mooring lines are connected to dead weight anchors, drag anchors, dynamically embedded anchors, driven piles or suction caissons. • Has been used in projects in waters up to 120 m.	

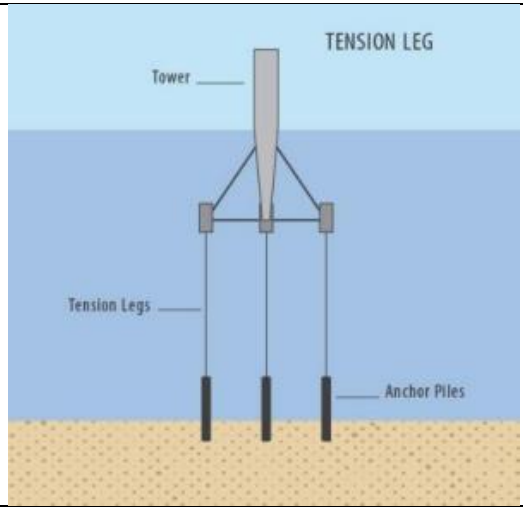
Tension Leg	• A buoyant multihull steel floating platform, that is moored to the seabed, which minimizes the movement of the structure. • Adds additional downward, stabilizing forces through the tension developed in the tendons. • Tension in anchors provide both station keeping and stability. • Utilize piles or suction caissons, which are precisely placed during installation. • Has been used in projects in waters up to 113 m.	

Table Description: Different types of floating foundations with descriptions and images of each.
Source: ICF, 2020.

The foundation type chosen for a given project is dependent on several factors – water depth, penetration or embedment depth into the seabed, suitable substrate, and other considerations. Table 4.4 provides an overview of this information (Eamer, 2021).

Table 4.4. Key Variables to Consider for Selection of Offshore Wind Turbine Foundation Type

Foundation Type	Water depth (m)	Embedment depth (m)	Ideal substrate	Suitable substrate	Major considerations
Gravity	<20	<5	Bedrock (low relief) Stiff clay/till (over-consolidated)	Sands and gravels	Scour Flat surface required
Monopile	<30	30 - 50	Sands and gravels	Glaciomarine/postglacial mud (underlain by competent sediments) Till (sandy or less consolidated)	Cobble to boulder sized clasts could cause refusal
Jacket/tripod	30 - 60	30 - 70	Sands and gravels	Glaciomarine/postglacial mud (underlain by competent sediments) Till (sandy or less consolidated)	Cobble to boulder sized clasts could cause refusal
Suction caisson	30 - 60	15 - 30*	Sand Glaciomarine/postglacial mud	N/A	Any sized hard bedrock could cause refusal
Floating	>60	<10	Sands and gravels Bedrock Glaciomarine/postglacial mud	Till (boulders may be ideal for anchors)	Range of embedment types

Table Description: This table summarizes water depth, embedment depth, ideal substrate, suitable substrate, and major considerations for five foundation types (gravity, monopile, jacket/tripod, suction caisson, and floating).
*Note that recently deployed caissons at a demonstration site appeared to require as little as 5.25 m of embedment (Patel, 2018).
Sources: Fugro Marine GeoServices Inc., 2012; Taylor, 2011.

4.2.2 Array and Export Cables

Array cables are the cables that connect individual turbines to an offshore substation. Array cables can connect multiple turbines into one feed-in cable to the substation.

Export cables are higher voltage cables that move electricity from an offshore substation to onshore infrastructure for future use (e.g., supply the local grid, export, storage, etc.). For projects far from shore or that generate larger amounts of power, electricity from a substation can travel through alternating current (AC) export cables to an offshore converter station, where the AC is converted into direct current (DC) prior to being sent to onshore infrastructure. DC cables are generally used for longer distances to shore. The technical specifications of cables, such as voltage capacity, length, location, etc., would be designed using specific project parameters.

4.2.3 Offshore Substations

Offshore substations collect the power generated by the turbines and transmit it to shore. A substation includes a topsides frame that holds the substation components and provides storage areas for maintenance equipment. Basic substations are designed to be unmanned and serviced on a regular schedule. More complex substations can include helicopter decks, boat landings, and living accommodations. Substations to date typically have fixed foundations, using jacket or monopile systems to securely anchor them to the seabed. They are designed to withstand harsher marine environmental conditions than onshore substations.

In some cases, projects may also require the installation of an additional converter station to convert high voltage AC power to DC before being transmitted to shore. These stations would also use similar jacket or monopile systems to secure them to the seabed. With technology advances, options for floating substations are now contemplated for projects located in areas farther offshore.

4.3 Offshore Wind Development Phases and Activities

Offshore wind development occurs in several phases: site selection and planning, design and fabrication, construction, operations and maintenance, and decommissioning and abandonment.[29] However, as described in Section 1.5.1 of this Report, the scope of this Regional Assessment is specific to construction (including expansion), operations (which includes maintenance activities), and decommissioning and abandonment. Section 4.3.1 summarizes the site selection and planning, and design and fabrication phases. The rest of Section 4 describes in detail the activities that take place in the phases within scope that are important to understand when identifying the potential effects of offshore wind development (Section 7 of this Report). The lifetime of an offshore wind project can be 30 years from project installation to decommissioning. The duration of each phase and

[29] Development phase terminology varies across jurisdictions. This Report categorizes phases based on NRCan's Discussion Paper: Canada's Approach to Offshore Renewable Energy Regulations, 2020.

activity associated with offshore wind development is also a key consideration when identifying potential effects.

4.3.1 Site Selection and Planning, and Design and Fabrication Phases

The project lifecycle starts with selecting and planning the project site. This initial phase can extend over several years and includes choosing the site, investigating it, and obtaining permits to determine the exact location for the facilities. Site selection considers various factors beyond just favorable wind conditions, such as visibility, distance from shore, proximity to power demand areas and local electricity infrastructure, impacts on shipping routes, existing underground infrastructure, and bird migration paths.

Key activities in this phase involve conducting surveys and reviews of physical, environmental, and socio-economic factors, performing technical studies, and identifying, characterizing, and selecting the site. Meteorological studies are carried out using weather buoys or towers to assess wind, waves, and current patterns and velocities. These activities generally involve lower direct safety and environmental risks compared to other phases of the project lifecycle (NRCan, 2020).

The Design and Fabrication phase takes the information and decisions from the site selection and planning phase and uses them to design the project's facilities and equipment. After finalizing the design, the necessary facilities and equipment are chosen and manufactured in preparation for construction (NRCan, 2020).

4.3.2 Construction

The construction phase is typically 2 - 3 years in duration and includes the installation of foundations, turbine towers and components, cables, and sub- and converter stations. Activities associated with expansion (e.g., adding additional turbines and installing additional cables) to an existing project are the same as those for construction.

4.3.2.1 Turbine Installation

Once site identification and project design has been approved, the physical site preparation and installation of foundations and turbines can begin Site preparation activities vary at each individual turbine location. These activities can include, for example, dredging or excavating areas of the seabed to provide a level surface for foundation installation.

Once the turbine sites have been prepared, the installation phase of the turbines can begin. For fixed foundation turbines, the installation of the appropriate foundations is conducted. This starts with loading the foundations from an onshore supply base (laydown yard) onto an installation vessel and transporting them to the project site. Using dynamic positioning, the vessel lowers the foundation (using a crane or similar mechanism) onto the seabed and inserts the foundation into the seabed. For GBS foundations, the foundation is lowered to and rests on the seabed (i.e., it is not inserted) (see Section 4.2.1.3 Foundation Types). For monopile foundations, hydraulic hammers pile-drive the foundation to the design depth. While monopile foundations have been used throughout

the world for approximately 80% of turbine installations, there are other fixed foundation types which could be used for more shallow water installations (see Section 4.2.1.3 Foundation Types) (ICF, 2020).

Once the foundations are securely in place, the remaining components are lifted and secured onto the foundation. Lift vessels are used to lift the turbine components (towers, nacelles, hubs, and blades) onto the foundations, and to hold them in place while they are secured.

Floating platform installations can vary greatly, depending on project design. The mooring infrastructures and array cables are typically installed at the project site before foundations are brought to the site. The floating foundations are towed to site and connected to the array cables and mooring infrastructures to secure them in place. Once the foundations are stable, the installation vessels lift the remaining components onto the foundations and secure them.

4.3.2.2 Array and Export Cables Installation

A variety of techniques may be used to lay and protect array and export cables (Figures 4.4 and 4.5). Methods include (Tang & Kilpatrick, 2021):

- Burying cables (i.e., disturbing the seabed floor and inserting the cable in a trench of approximately 1.5 – 2 m depth);
- Riprap (i.e., using rock and other material to cover the cable on the top of the seabed floor to protect it);
- Mattresses (i.e., placing long rectangular concrete blocks over top of the cable for protection); and
- Frond mats (i.e., installing frond mats over top of the cable for protection).).

In some instances, horizontal directional drilling may also take place to create a route for the cable back to the converter station and the shore.

Figure 4.4. Methods for Burying and Protecting Cables

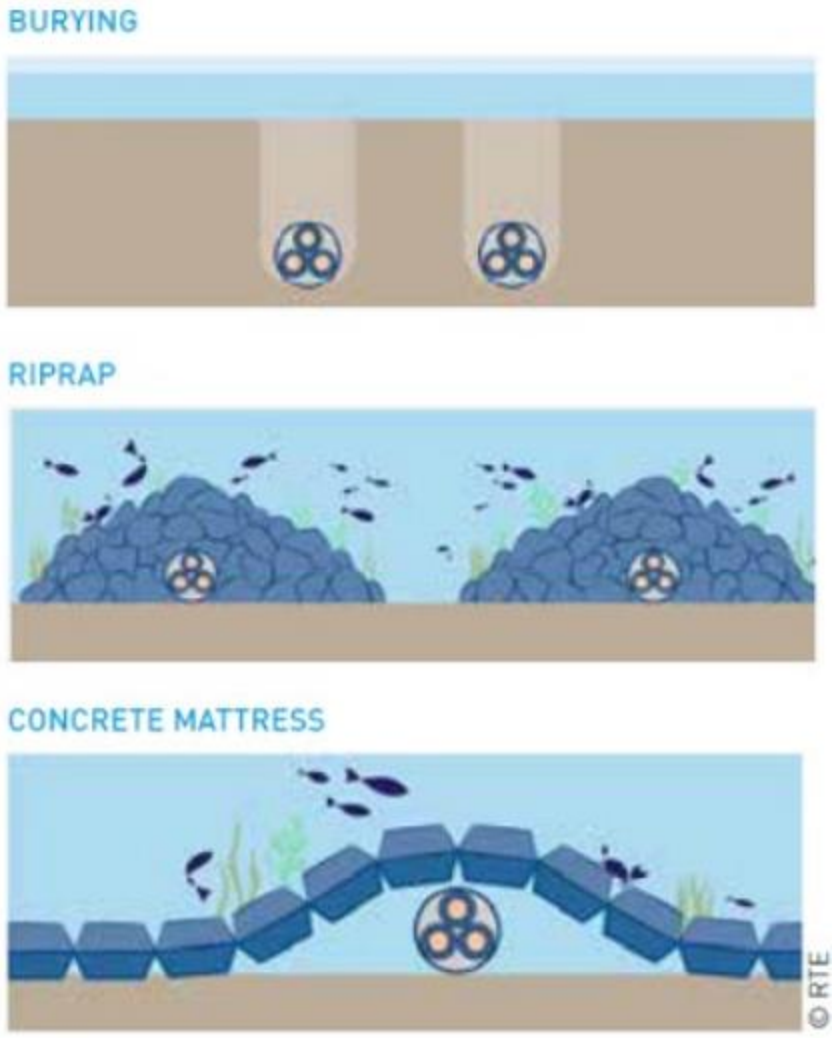


Figure Description: Three methods for burying and protecting cables are burying cables in the sea floor, installing riprap around the cables, or placing a concrete mattress over the cables.
Source: Taormina et al., 2020.

Figure 4.5. Frond Mat for Protecting Cables



Figure Description: This image shows the Seabed Scour Control Systems: Frond System. The Frond System includes a polyester webbing mesh base, that secures continuous lines of overlapping buoyant polypropylene Fronds. Fronds create a viscous drag barrier and help protect cables against scouring. Frond mats can also provide artificial habitat for marine species. Frond mats are secured to the seabed by a weighted perimeter or anchors that are driven into the seabed by divers (Seabed Scour Control Systems, n.d.-b).
Source: Seabed Scour Control Systems, n.d. -a.

Cable installation and burial equipment includes burial plows, tracked burial machines, vertical injectors, Remotely Operated Vehicles (ROVs) with attached burial equipment, jet plows, trenching machines, and burial sleds. Cables can be laid and buried simultaneously by a single vessel or utilize two vessels – one for laying and the second for burial.

The method chosen to lay and bury the cable (i.e., burying, riprap, mattresses or frond mats and specific equipment used) is based on the desired protection of the cable and geological and physical oceanographic properties at the project site (NYSERDA, 2017c). The surrounding benthic ecosystem is also an important consideration when selecting a burial and protection method for cables. Some of the described methods can create artificial habitat for benthic ecosystems (see Section 7.4.2.1.3), and these have been used in numerous projects globally.

4.3.2.3 Substation and Converter Station Installation

Offshore substations and, when necessary, co-located converter stations (which convert AC to DC before transmission), are installed on foundations similar to those used for turbines (fixed monopiles or jackets) and face the same selection constraints. Substations are intended to stabilize and enhance the voltage generated offshore, minimize potential issues like electrical losses, and safely transmit electricity to the shore (NREL, 2024).

The main components of a substation consist of grid transformers, switchgear, and auxiliary power units, along with storage areas for maintenance equipment. Typically, a substation is designed to operate unmanned and is maintained on a regular basis. Complex substation designs may also feature facilities like helicopter decks, boat landings and living quarters for maintenance personnel (NREL, 2024; BOEM, 2015).

4.3.3 Operations

Following facility installation, testing, and commissioning, the wind farm becomes operational (i.e., the installation is generating electricity). Activities during this phase include routine and unscheduled maintenance throughout the project's operational life. These activities involve transporting equipment and personnel to and from the project site by supply vessel or helicopter. Maintenance tasks can include:

- Maintenance of wind turbine generators (e.g., wear and tear on blades, gearboxes, safety equipment, etc.);
- Inspection of external platforms and required maintenance to provide upgrades and maintain integrity;
- Inspection of scour protection around foundations and cables;
- Inspection of foundation structures, cables, etc.;
- Inspection of fire protection systems;
- Inspection and maintenance of substation and converter equipment;
- Response to reports of oil sheens potentially caused by lubrication oil leaks or other environmental emergencies; and
- Response to occupational health and safety emergencies.

The operations phase can last 20 years or longer. While the operations phase is the longest phase of an offshore wind development project, activities during this phase are less intense and less frequent when compared to the construction phase.

4.3.4 Repowering, Decommissioning and Abandonment

When offshore wind farms reach the end of their operational life, initiatives are taken to either extend their operation through "repowering" or dismantle them through "decommissioning." Repowering involves replacing numerous components simultaneously to upgrade to more efficient technologies, whereas decommissioning involves dismantling and disposing of the infrastructure (Hall et al., 2020; Jadali et al., 2021; Spielmann et al., 2021; Topham and McMillan, 2017).

Repowering is different from regular maintenance, which involves periodic replacement of infrastructure. It allows operators to update to newer technologies without replacing longer-lasting components, such as electrical cables, which have an estimated lifespan of 40 years — longer than many turbine parts. However, repowering is not a permanent solution (Berry et al., 2024; Topham and McMillan, 2017).

Few offshore wind development projects have been decommissioned globally. Decommissioning of the Vindeby project in Denmark was completed in 2017. The facility was removed after 25 years in operation. Other wind farms in the North Sea region have also been decommissioned – 3 projects in the UK, 1 in Germany, and 2 in Sweden (Kruse, 2019).

Decommissioning likely involves similar activities to those in the construction phase (but reversed), with similar duration (two to three years) and costs. Vessels are needed to disassemble and remove the above water wind turbine structures from the foundations, and to return those structures to shore based facilities for further handling and processing (recycling or disposal). Subsea infrastructure can be removed completely, partially removed, or left fully in place at the project site. Planning and permitting is required to determine how subsea infrastructure is decommissioned. After project equipment has been removed, operators may need to restore damaged marine environments and monitor the recovery process. In situations where components could serve new purposes, like providing habitats for fish, or where removal could harm the marine environment, partial decommissioning may be considered (Hall et al., 2022; Hernandez et al., 2021).

During the project approval process in many jurisdictions, operators are often required to provide financial security to ensure their decommissioning commitments are met, as specified by regulations (Jensen, 2020). This is a common regulatory practice in the offshore oil and gas and mining industries in Newfoundland and Labrador. Current versions of the Accord Acts mandate decommissioning requirements for the oil and gas industry. Similarly, amendments in Bill C-49 introduce financial requirements for the Offshore Renewable Energy industry to cover the duration of the work, including decommissioning and abandonment (see Bill C-49 clause 183.2).

4.3.5 Activities and Vessel Support for All Phases of Development

Vessels and other equipment are used to support activities during all phases of an offshore wind development project. Supply vessels and helicopters are used to transport personnel, equipment, and materials to and from an offshore wind farm location. The number of trips vary depending on the phase of development, workforce numbers, distance, weather conditions, and other factors. For example, the operation of aviation equipment is regulated by Transport Canada (TC), including various applicable regulations and operational requirements for helicopter flight traffic.

Regarding development phases, the highest number, frequency, and duration of vessels and equipment is used during the construction phase. The operation phase uses vessels and equipment for routine and emergency maintenance activities. The decommissioning phase is likely comparable to the construction phase. Table 4.5 provides an overview of the

types of vessels and equipment that would likely be required during the lifecycle of an offshore wind farm. Figure 4.6 provides a general schematic of what these vessels could look like.

Table 4.5. Vessels/Equipment and Associated Activities during Construction, Operation, and Decommissioning/ Abandonment

Vessel/Equipment	Phase*			Purpose
	C	O	D	
Anchor Handling Tug Supply Vessels	X			Installs underwater noise mitigation devices (e.g., bubble curtains) and supports offshore export cable installation in shallow water.
Cable Installation Vessels	X			Lays and buries subsea array and export cables in the seafloor.
Crew Transfer Vessels and Helicopters	X	X	X	Transports construction and O&M crew and marine mammal observers to and from the site.
Dredging Vessels	X			Used in specific areas for foundation site preparation and cable laying to remove upper portions of sand waves.
Emergency Generators		X		Installed on turbine and substation platforms generators.
Heavy Lift Crane Vessels	X		X	Lifts, holds, and positions parts of each wind turbine generator and substation platform during installation. Used for foundation installation and decommissioning.
Jack-up Vessels	X	X		Extends legs to the ocean floor to provide a secure work platform for offshore crew and transports wind turbine generator components to site.
Multipurpose Offshore Support Vessels	X			Clears the seabed floor of any obstructions prior to laying subsea cables.
Ocean-Going Heavy Transport Vessels	X		X	Ocean-going vessels that may transport components (e.g., monopiles and blades) to and from the site.

Vessel/Equipment	Phase*			Purpose
	C	O	D	
Pile-driving Hammer Engines	X			Drives the wind turbine monopile foundation into the ocean floor.
Scour Protection Vessels	X	X		Places a layer of stone on the seafloor around the foundations of the wind turbine and substation platform to stop sediment from being removed. It is also used to cover parts of offshore cable.
Service Operation Vessels	X	X	X	Transports crew to the site and provides offshore living accommodation and workspace.
Survey Vessels	X	X		Performs geotechnical or geophysical surveys.
Tugboats	X	X	X	Transports equipment and barges to and from the site.
Drones	X	X	X	Site inspections and light equipment supply.
Remote Operated Vehicles	X	X	X	Underwater inspections and site surveys. Also, free swimming ROVs have capabilities for cable burial.

Table Description: The table provides an overview of the types of vessels and equipment that are typically required during the lifecycle of an offshore wind farm.

*C: Construction phase, O: Operations phase, D: Decommissioning phase.

Sources: Corio, 2022; NYSERDA, 2017a; c; d.

Figure 4.6. Overview of Potential Vessels Used in Offshore Wind Development

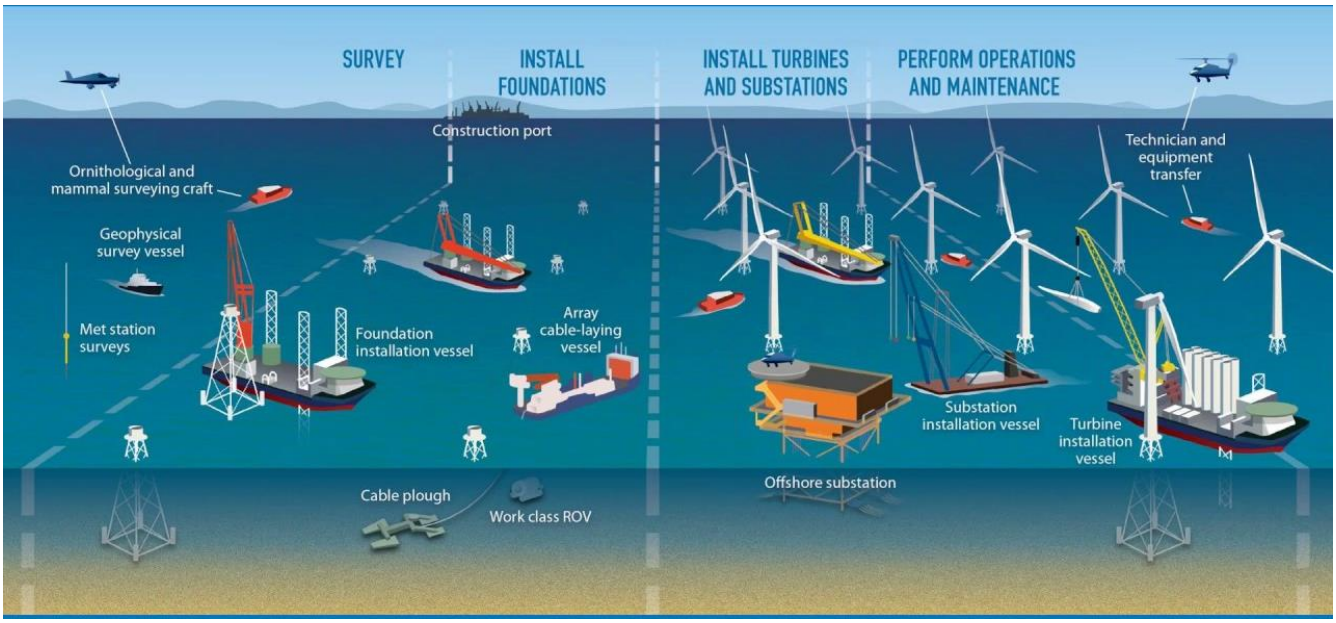


Figure Description: The image provides a visual representation of the types of vessels and equipment that would likely be required during the lifecycle of an offshore wind farm.
Source: Clean Energy Group (Webinar: An Offshore Wind Vessel and Other O&G Sector Opportunities (6.6.2017) - YouTube).

Other infrastructure is also needed to support an offshore wind development project but is not within the scope of this Regional Assessment (see Section 1.5.1 of this Report). For example, onshore supply bases (laydown yards) and ports provide re-fueling, temporary storage, staging, and loading of materials and supplies in support of offshore wind activities.

5. Defining the Regional Assessment Focus Area

As outlined in Section 1.5.2.2 of this Report, the Committee identified a Focus Area and centered its information gathering and analysis within this area.[30] The Committee announced a Proposed Focus Area for public feedback on August 17, 2023, then published a final decision about the Focus Area on November 7, 2023.[31] On March 12, 2024, the Minister of Environment and Climate Change Canada wrote to the Committee indicating acceptance of the Focus Area.[32]

This section describes the Committee's approach, considerations, and decision to identify the Focus Area.[33] It describes the Committee's findings at the time of its evaluation (up to November 7, 2023).

Although the Committee selected a Focus Area, much of its assessment of environmental, health, social, and economic effects draws on information from other jurisdictions and is therefore applicable on a regional scale.

5.1 Constraints Used to Define the Focus Area

The Committee identified a Focus Area as the portion of the Study Area more likely to see offshore wind development (of 10 turbines or more) in the foreseeable future. The Committee reviewed several considerations that could influence offshore wind development interest and found icebergs and water depth are among some of the most limiting physical constraints for offshore wind development in Newfoundland and Labrador.

5.1.1 Considering Icebergs

Newfoundland and Labrador is known for its significant iceberg presence due to its proximity to the Labrador current and Greenland icesheet (Reid, 2005). Iceberg movement on the Labrador Shelf is well documented (Peterson & Prinsenberg, 2014; Perez-Gruszkiewicz & Peterson, 2018). The southerly migration of icebergs through the northwest Atlantic and along and into the bays of the northeast coast of Newfoundland is an annual

[30] The Exclusive Economic Zone (EEZ) for St. Pierre et Miquelon was not considered within the Focus Area, as its boundaries are outside of Canadian jurisdiction.
[31] The Proposed Focus Area and the Committee's Decision Regarding the Focus Area are available on the Regional Assessment Registry Page under document reference number 107 and document reference number 191. The Committee's Decision Regarding the Focus Area is also appended to this Report (Appendix E).
[32] The Minister's letter to the Committee is available on the Regional Assessment Registry Page under document reference number 228.
[33] Appendix F, GIS Methods outlines technical steps and data used to identify the Focus Area.

occurrence throughout the late winter to mid-summer months. Most of the icebergs originate from tidewater glaciers on the west coast of Greenland (Reid, 2005) as seen in Figure 5.1.

Figure 5.1. Iceberg Movement in the North-West Atlantic

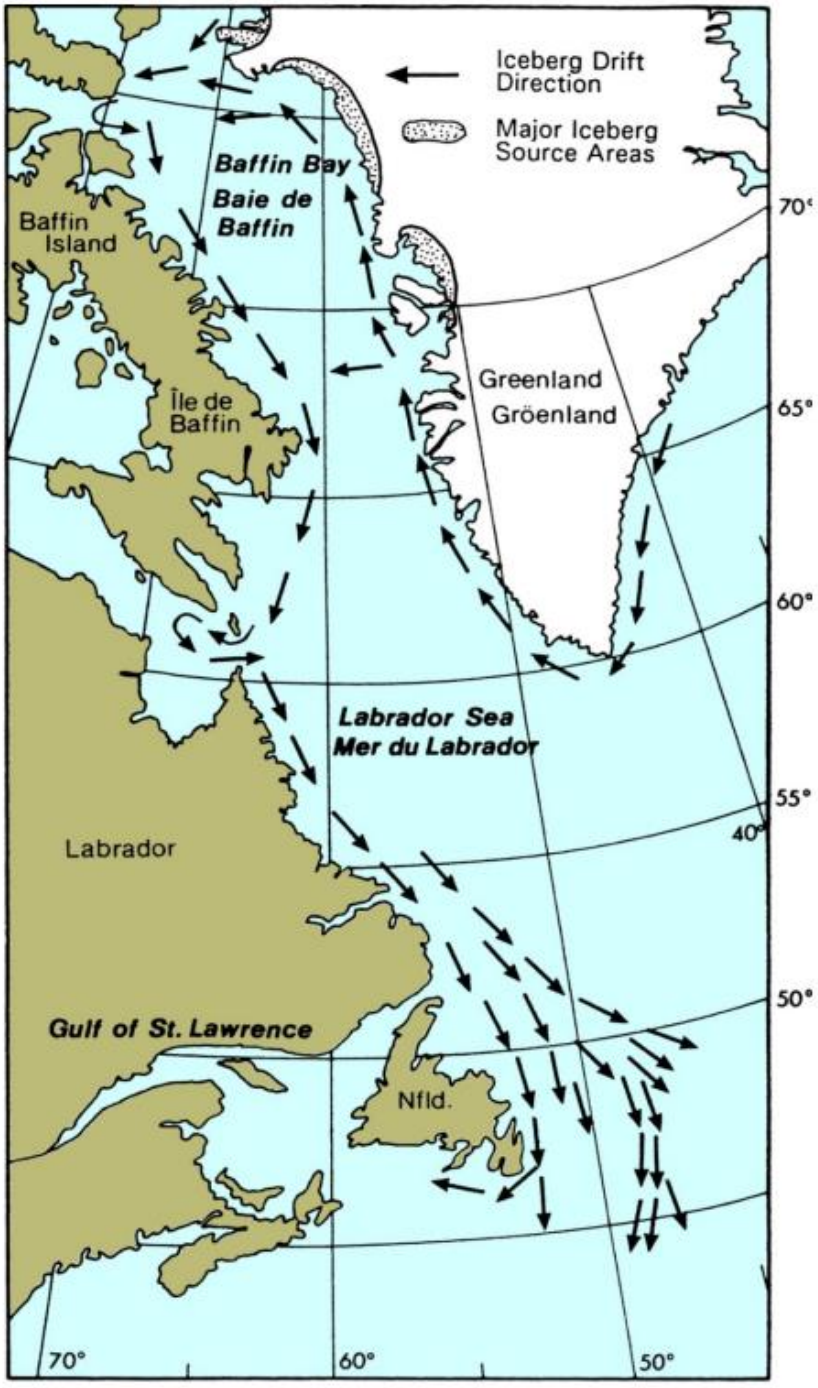
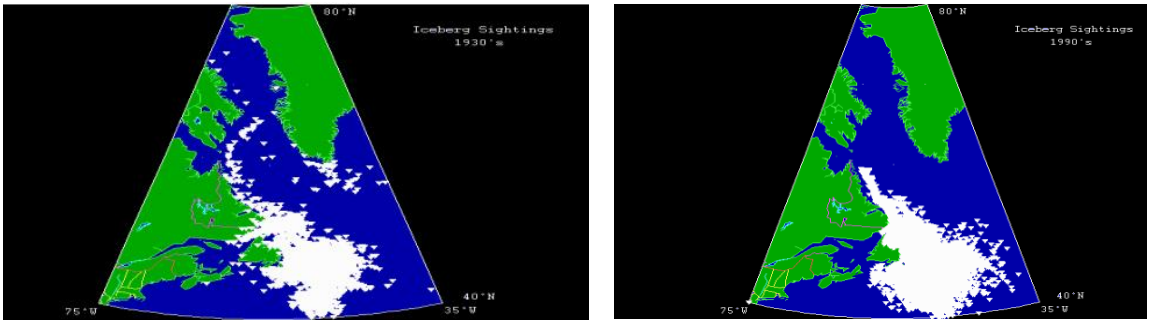


Figure Description: This figure shows major iceberg sources and drift direction along the eastern coast of Labrador and the Island of Newfoundland.

Source: Image from Canadian Coast Guard, 2012.

While as many as 15,000 icebergs are calved each year, the International Ice Patrol's (IIP) data records, which extend to 1900, show that nearly 500 icebergs enter the shipping lanes (south of 48N) in an average year. There is a wide year-to-year variation in the number of icebergs. In 1984, the busiest iceberg year in IIP's history, 2,202 icebergs entered the shipping lanes. During 1966 and 2006 no icebergs were determined to reach the shipping lanes. The annual variability in numbers of bergs reaching the shipping lanes is not well understood but is influenced by the oceanographic and meteorological conditions that icebergs encounter during their journey. The variable conditions seem to be linked to the North Atlantic Oscillation (NAO), the dominant pattern of winter atmospheric variability in the North Atlantic which fluctuates between negative and positive phases. The characteristic features of the negative phase include persistent onshore winds along the Labrador coast bringing relatively warm maritime air to Labrador. The resulting lack of sea ice exposes icebergs to wave-induced deterioration, and the onshore wind moves them toward the shallower waters near the coast, where they can run aground or become trapped in bays. The positive NAO phase, on the other hand, is characterized by strong and persistent northwest winds along the Labrador coast during the winter. These winds bring cold air and extensive sea ice cover, which protects icebergs from wave erosion, providing a longer lifespan for the icebergs during the last part of their journey south, a journey aided by the long-shore wind phase (Reid, 2005). Figure 5.2 shows iceberg distribution off Newfoundland and Labrador in the 1930's and 1990's. Observations from both decades show icebergs in a large portion of the Regional Assessment Study Area.

Figure 5.2. Grand Banks International Ice Patrol Iceberg Sightings



A) 1930'S **B) 1990'S**

Figure Description: This figure compares iceberg sightings throughout the Grand Banks of Newfoundland and Labrador in the 1930's and 1990's. During the 1930's, the total number of icebergs observed by the IIP was 19,946. The most extreme southeasterly sighting for this decade was at 42.24°N and 34.22°W. During the 1990's a total of 30,406 icebergs were observed by the IIP. The extreme southeasterly sightings for this decade were 39.90°N & 43.33°W and 44.17°N & 36.48°W. Researchers concluded differences in iceberg distribution in the 1930's and 1990's are due to different climates and different observation techniques for each decade (Reid, 2005).

Source: Image from Reid, 2005.

Icebergs can pose risks to offshore structures, including wind turbines, subsea cables, and other infrastructure. Furthermore, no offshore wind farms currently operate or have been demonstrated to safely operate in areas with icebergs. Some work has been completed to understand the dynamics of ice loads (including pack ice and icebergs) on offshore wind turbines (Aker Arctic, n.d.; Eranti et al., 2011; Hammer et al., 2023; Fuglem et al., 2022; King et al., 2022; Wang et al., 2022). Regarding these technologies, few projects with foundations built for sea ice (not icebergs) are in operation or planned, including the Tahkoluoto wind farm and expansion in the Sea of Bothnia near Finland. The initial project was piloted in 2010 and completed in 2017 as the world's first offshore wind farm to encounter frozen sea conditions. A demonstration project for a different foundation type, built for deeper waters, is to be implemented in the same area between 2023-2026 followed by the construction of the wind farm extension (The Maritime Executive, 2023).

Research on turbine-iceberg interaction is also advancing but work to date is theoretical and based on modelling (Fuglem et al., 2022; King et al., 2022).

The Committee is therefore of the view that a precautionary approach should be taken whereby commercial offshore wind development should not be allowed in regions where icebergs could be present, until demonstration projects provide proof of concept.

The Committee has not taken the same stance on areas subject to sea ice at this time, given this technology is further developed.

5.1.1.1 Removing Portions of the Study Area Based on Iceberg Presence

The Committee reviewed data on iceberg presence in the Study Area using a subset of the IIP Iceberg Sightings Database, Version 1 (Figure 5.3). This database contains records of iceberg locations for the period of 1960 - 2021. The Committee used data from 2002 - 2021. For this analysis, only icebergs classified as medium to very large were included (Table 5.1). This is not to suggest offshore wind development should be sited in areas with smaller icebergs. Any iceberg presence should be considered when siting projects.

Table 5.1. Iceberg Size Classification

Classification	Height above sea surface (m)	Length (m)	Weight (megatons)
Growler	< 1	< 5	0.001
Bergy Bit	1 - < 5	5 - < 15	0.01
Small Berg	5 - 15	15 - 60	0.1
Medium Berg	16 - 45	61 - 120	2.0
Large Berg	46 - 75	121 - 200	10.0
Very Large Berg	> 75	> 200	> 10.0

Table Description: This table outlines iceberg size classification as per the Canadian Ice Service (2005) manual. The Committee included medium or larger icebergs in its analysis.

Source: Table adapted from Canadian Ice Service, 2005.

Figure 5.3. Iceberg Presence in the Study Area 2002 - 2021

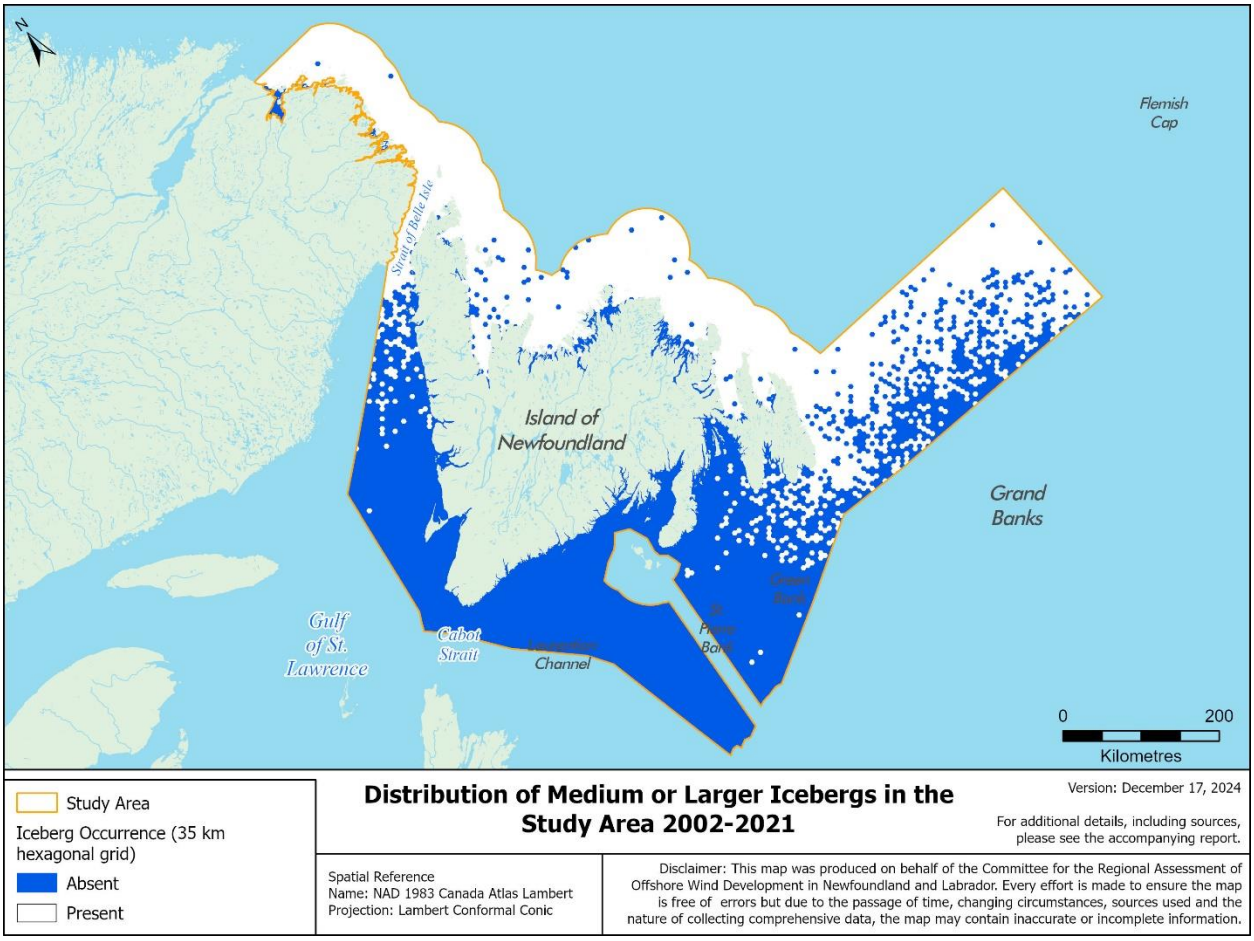


Figure Description: This figure shows portions of the Study Area where at least one medium to very large iceberg was present over the 20-year period 2002 - 2021.

Data Sources: IAAC, 2023b; International Ice Patrol, 1995.

The Committee removed portions of the Study Area where medium or larger iceberg sightings were recorded between 2002 - 2021(Figure 5.4).

Figure 5.4. Removing Portions of the Study Area with Iceberg Sightings between 2002 - 2021

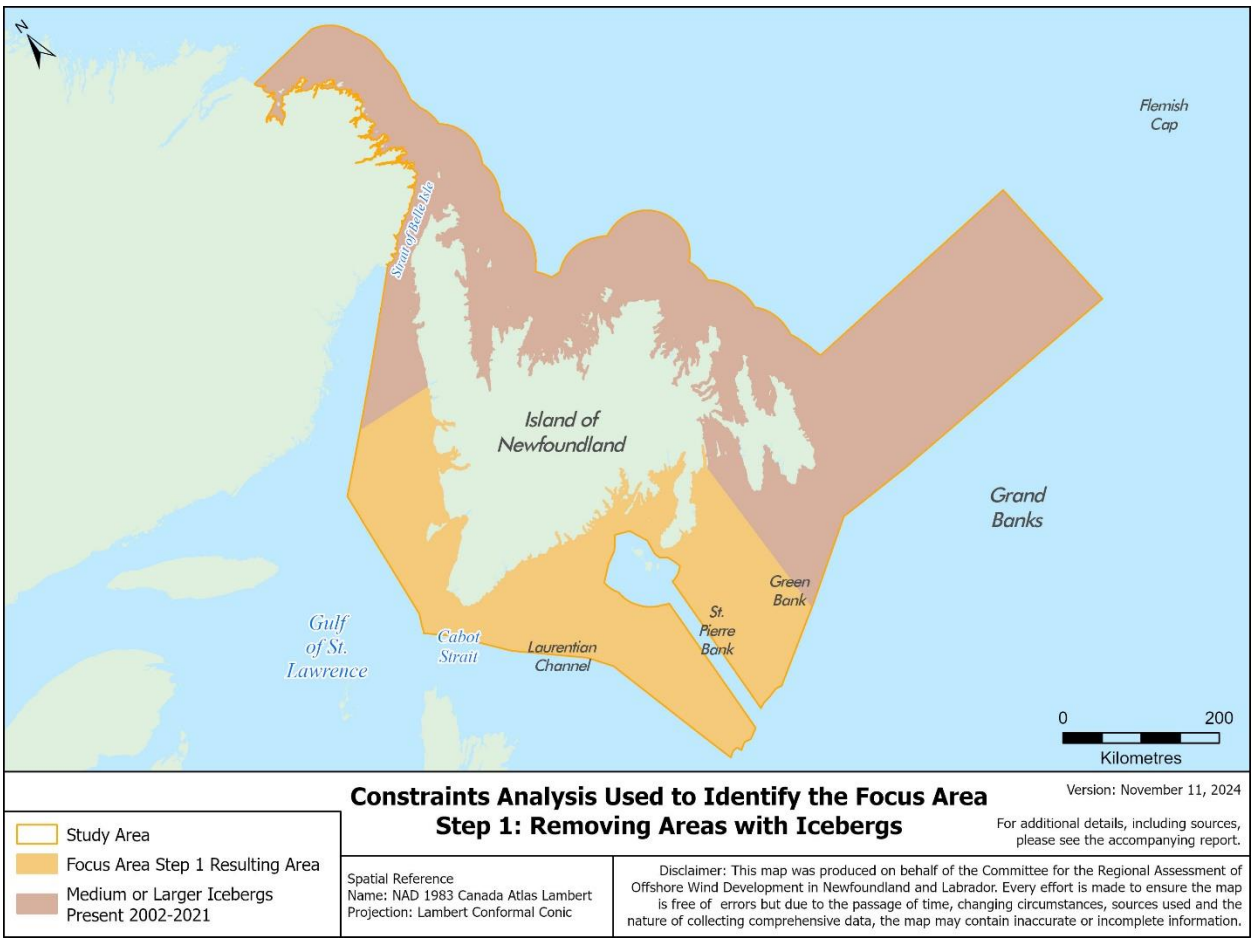


Figure Description: This figure shows one of the steps used to identify the Focus Area. The Committee removed portions of the Study Area where medium or larger iceberg sightings were recorded between 2002 - 2021.

Data Sources: IAAC, 2023b; International Ice Patrol, 1995.

Some sections around the south-east and north-west portions of the Study Area were not excluded despite recorded iceberg presence. The decision to include these areas was based on the low number of icebergs recorded there and projections of future iceberg densities provided by Perez-Gruszkiewicz and Peterson (2018). Perez-Gruszkiewicz and Peterson (2018) predict, by 2100, a 50% reduction in icebergs reaching the southern sections of the Study Area. Icebergs deteriorate as they drift due to calving and melting, and water temperature significantly influences the rate of these processes such that warmer waters increase rate of deterioration (Kubat et al., 2007). Status and trend information for oceanographic variables in the Focus Area are in Section 7.4 of this Report

(Table 7.4.1). On average seasonal sea-surface temperature is warming on a similar scale to air temperatures, which is at around a 1°C increase since the 1870's. The year 2021 represented the warmest temperatures measured for the Newfoundland and Labrador Shelves (NLS) and the third-warmest year for the Atlantic. Deeper waters are also warming or remaining stable (Bernier et al., 2023; DFO, 2024c).

During October 2023 engagement sessions (see Section 5.2 below) ECCC indicated to the Committee that they do not have the science to support trends of more or fewer icebergs in these areas in the future. In their response to the Committee's request for advice regarding the potential impacts of climate change on offshore wind development, ECCC also indicated that the processes of thick multi-year ice being transported from the higher latitudes in response to warming temperatures has been noted in the literature and is expected to increase further with more warming (e.g. Howell et al., 2013; Kwok et al., 2010). Barber et al. (2018), recently showed that this process can happen and with more warming it is expected to happen more frequently.[34]

Potential iceberg and drift ice presence in these areas should be considered during project impact assessments.

5.1.2 Considering Water Depth

Regarding water depths, the deepest operating turbine to date is the Hywind Tampen project, located about 140 km off the Norwegian coast, in full operations since summer 2023 at depths up to 300 m (Equinor, 2023). Prior to this project, the deepest floating turbines include the Tetraspar Demonstration Project, located 10km off Karmøy, Norway, at a 200 m test site, and other pre-commercial or demonstration projects at depths no greater than 125 m (ABSG Consulting, 2021; Stiesdal, n.d.).

Though technically possible, Committee discussions with offshore wind developers to date suggest floating options may not be commercially feasible at this time and sites suitable for fixed turbines or concrete gravity-based structures (tested to withstand pack ice), which are more economical, are preferred in Newfoundland and Labrador. Fixed turbines are currently suitable for depths up to 60 m (ICF, 2020; Tang & Kilpatrick, 2021).

The Committee decided to include areas with water depths ≤ 300 m in the Focus Area. Although the Committee expects offshore wind development may be more likely in shallower waters early on, the Committee used 300 m as a cutoff because demonstration projects show floating turbines are technically feasible at these depths. This approach is consistent with the Committee's considerations regarding icebergs.

[34] See the submission containing this reference on the Registry under document reference number 183.

5.1.2.1 Removing Portions of the Study Area where Depth Exceeds 300 m

Figure 5.5 shows portions of the Study Area removed because of water depth. This step was completed after removing areas based on iceberg sightings.

Figure 5.5. Removing Portions of the Study Area where Water Depth Exceeds 300 m

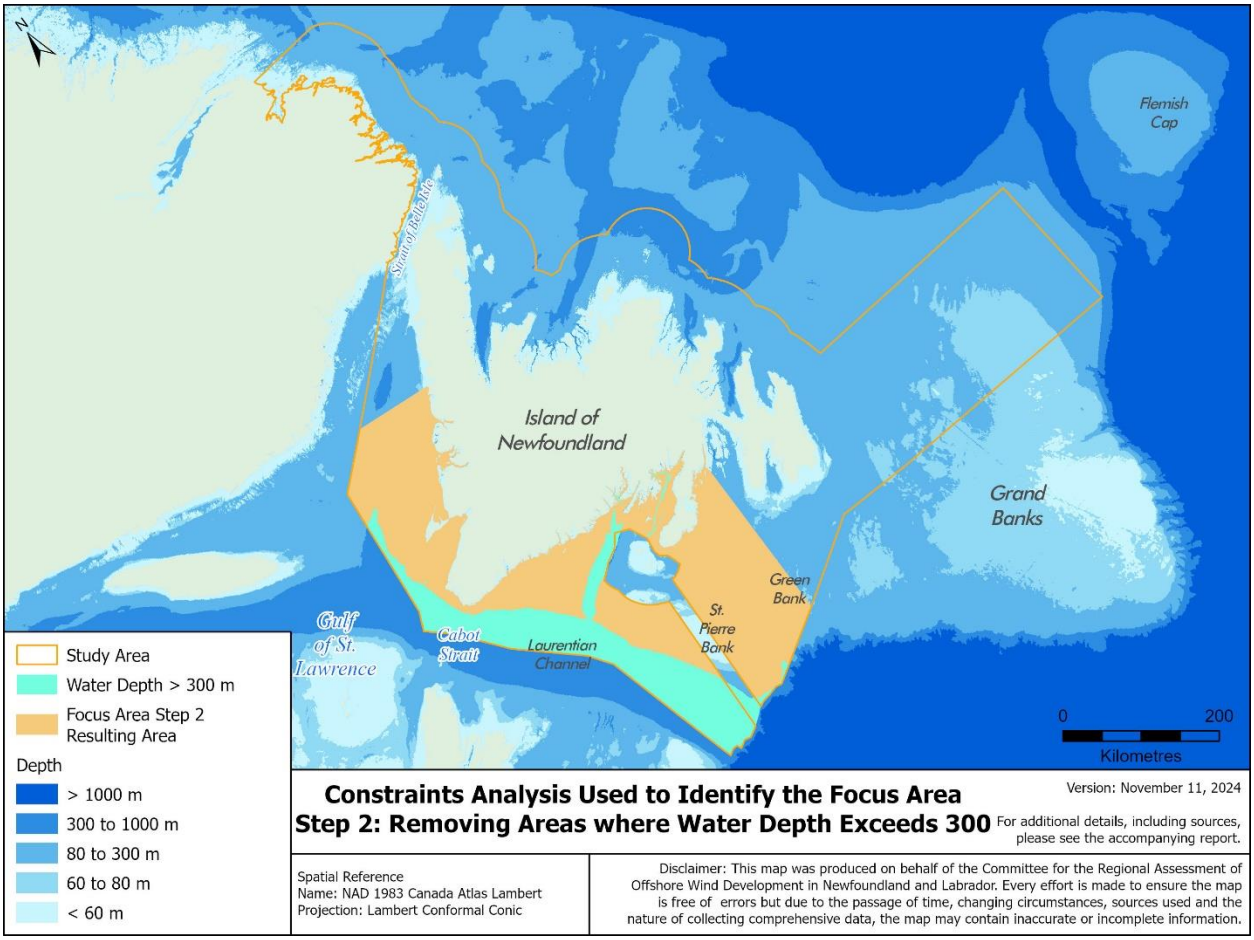


Figure Description: This figure shows one of the steps used to identify the Focus Area. After removing portions of the Study Area where medium or larger iceberg sightings were recorded between 2002 - 2021, the Committee removed areas where water depth exceeds 300 m.

Data Sources: GEBCO, 2023.

5.1.3 Other Physical Constraints

It is understood that there are other physical constraints for offshore wind development. For example, pack ice, wave height, wind resource, subsea geology, and distance to shore are all important physical considerations, both for selecting offshore wind areas and for project development.

The Committee started with considering icebergs and water depth, then moved on to considering areas from the perspective of impacts to environmental and socioeconomic

components, the true focus of this Regional Assessment. The decision to stop at icebergs and water depths is not to discount the importance of other physical constraints. The decision was in part made because of the allotted time to carry out the Regional Assessment and because the Committee is aware of separate, ongoing work that will inform the consideration of physical constraints. As the Committee understands it, NRCan will collect (or facilitate the collection of) more detailed geoscience and geophysical data, meteorological and oceanographic data, and marine wildlife and habitat data off the coasts of Newfoundland and Labrador under the Offshore Wind Predevelopment Program.[35] Other physical constraints on the initial offshore wind energy licencing areas should be revisited as this information becomes available.

A brief discussion on substrate throughout the Focus Area follows, as this was repeatedly raised in engagement and during the public comment period for the Draft Report.

5.1.3.1 Substrate

Geological characteristics and processes are important determinants of where and what type of offshore wind foundations could be installed (see Section 4 of this Report).

Substrate throughout the Focus Area includes bedrock dominated, till (commonly includes imbedded boulders and cobbles), postglacial mud (silt and clay with lesser amounts of fine sand), and thin veneers of postglacial sand and gravel with isolated pockets of deeper sedimentation. The following bullets provide a general overview of where these occur (Shaw et al. 1997; Eamer et al. 2020; 2021):

- Bedrock dominated: most of the shallow seabed from south of St. George's Bay, along the south coast, along the west coast and head of Placentia Bay, the northeast coast and eastern side of the Great Northern Peninsula is bedrock.
- Till: shallow coastal areas near Bonne Bay, Bay of Islands, within St. George's Bay, and small pockets along western side of Placentia Bay.
- Postglacial mud: small pockets in shallow waters within Port au Port and St. George's Bays.
- Postglacial sand and gravel: along the west coast as far south as St. George's Bay, coastal pockets near the Connaigre Peninsula and the eastern shore of Fortune Bay, along the south coast of the Burin Peninsula, along the eastern shore of Placentia Bay and eastward to southeast corner of the Avalon Peninsula, and along the straight shore between the Bonavista and Notre Dame Bays.

Cameron et al., (2010), Josenhans (2007), Shaw & Potter (2015) and Shaw et al., (2023) also provide important sources of existing information on the seabed in and near the Regional Assessment Focus Area.

As above substrate should be considered as more data becomes available. However, based on water depth and currently available geological information, it is expected that the

[35] Natural Resources Canada presented the Committee an overview of the Offshore Wind Development Program. The presentation is available on the Registry under document reference number 258.

Focus Area will only be compatible with fixed-bottom foundation types which penetrate the ocean floor, such as monopiles and jacketed foundations.

5.2 Feedback and Committee Decision Regarding the Focus Area

After announcing the Proposed Focus Area, the Committee held virtual public and advisory group sessions and accepted written comments until September 22, 2023. Throughout October 2023, the Committee also engaged subject-matter experts to validate its work. The Committee's engagement reports (Appendices A through D) provide details of these activities. This Report describes how specific outcomes from that engagement informed the Committee's decision regarding the Focus Area. Some key themes from engagement included:

- Support for the Focus Area and/or focus area approach.
- Raising potential consequences of prioritizing a Focus Area (e.g., limiting the scope of the cumulative effects assessment undertaken). For example, Innu Nation did not agree with the Focus Area because it reduced the scope of the Regional Assessment.
- Suggesting the Committee consider the Minister's legal discretion to exclude offshore wind projects in the Study Area from future impact assessments following completion of the Regional Assessment, and that the Committee recommend any offshore wind projects proposed within or outside the Focus Area would not be excluded from future impact assessments.
- Varied agreement/disagreement with criteria used to select the Focus Area, and recommendations for additional or alternative criteria (e.g., the Committee should consider: grid integration, minimum distance from shore, and potential for eventual use; pack ice; future technologies and conditions); important ecosystem areas including but not limited to Marine Protected Areas and critical habitats; and important fishing areas, displacement of fishers, and related economic impacts).
- Support for applying a precautionary approach. Recommendations to include or exclude specific areas in the Focus Area, and to identify additional Focus Areas.
- Recommended information sources, experts to contact, additional information and data and analysis, including a recommendation to consider different sources of iceberg data.
- Dissatisfaction with engagement to date.
- Concerns and information about potential impacts of offshore wind development on environmental, social, health and economic components within the Focus Area.

5.2.1 Other Key Areas Recommended

Feedback on the Proposed Focus Area included recommendations to include or exclude specific areas. For example, participants raised concerns about key fishing areas and protected areas. The Committee did not adjust the Focus Area based on these concerns, and instead applied them as constraints in selecting initial offshore wind energy licencing areas (see Section 6 of this Report).

Feedback provided on the Proposed Focus Area also suggested inclusion of sites around offshore oil and gas platforms. Work completed by Growler Energy (2022) and Paulin et al. (2022), evaluate options for electrifying offshore oil and gas platforms in Newfoundland and Labrador and show offshore wind energy is being considered. However, both reports also present conclusions regarding challenges with icebergs and deep waters. Growler Energy notes:

> "While floating wind technology has improved, wind location sites for the current project are in very deep waters with high sea states and ice infestation. In general terms, these are conditions that push the current design envelope for offshore wind." (p. 94).

Paulin et al. (2022), similarly states:

> "To develop an economical ice resistant floating wind turbine foundation, additional research, engineering, and proof of concept work would need to be carried out." (p. 10).

5.3 Committee Conclusions and Recommendations

Following engagement on the Proposed Focus Area, the Committee revisited information on offshore wind development in other jurisdictions, and information and views provided by the public and expert parties.

Committee deliberations on the Focus Area included in-depth discussions about:

- The appropriateness of defining a Focus Area, in the context of the Agreement.
- Whether presence of icebergs and water depth exceeding 300 m are reasonable constraints to define the Focus Area.
- The specific iceberg datasets that should be used.
- Whether additional focus areas should be defined to include specific locations, such as existing and planned offshore oil and gas platforms, despite the presence of icebergs and deep waters.

The Committee concluded the following:

> **Conclusion 1:** Defining a Focus Area is justifiable given the requirements and allowances in the Agreement, and that focusing its work where offshore wind development is most likely in the foreseeable future is prudent.
>
> **Conclusion 2**: While offshore wind technology is rapidly advancing to accommodate deeper waters and research and development for turbines in the presence of icebergs is a local priority, this remains a challenge for current technologies. A precautionary approach should be exercised as work in these areas has not progressed to a degree where the Committee can confidently recommend full-scale offshore wind development in areas where these constraints are present.
>
> **Conclusion 3:** The IIP Iceberg Sighting Database with data from 2002 - 2021 provides a sufficient picture of icebergs in the region for the purpose of defining a Focus Area.

The Committee did not reach a consensus on Conclusion 2. One of the five Committee members concluded that the Focus Area should include areas in proximity to the four oil producing platforms located in the Jeanne D'Arc basin in water depths of approximately 80 -120 m. The Committee member also concluded that any offshore wind development within this area would be subject to detailed project-level assessments. The project-level assessment would provide a risk assessment of ice encounters within the area and

information on ice management planning. This would include a history of ice management by oil producing operators and information on how ice management would include the offshore wind development operations.

The Committee recommends:

- Potential iceberg and drift ice presence in the Focus Area should be considered further during project impact assessments.
- Physical constraints to initial offshore wind energy licencing areas should be revisited as more data becomes available, for example through the Offshore Wind Predevelopment Program led by NRCan.

Maps of the Study Area and Focus Area are provided in Section 1.5.2 of this Report.

6. Identifying Initial Offshore Wind Energy Licencing Areas for Consideration

This section includes an overview of offshore wind development licencing and project siting practices in other jurisdictions. It also describes work undertaken by the Committee to identify areas it recommends the Ministers consider using as a starting point to delineate offshore wind energy licencing areas.

As some important background for reviewing this section, readers should note that NRCan has completed work to support the identification of candidate regions for future offshore wind energy areas. NRCan's work was published in February 2024 as an initial analysis of spatial consideration for potential future offshore wind areas in Atlantic Canada.[36,37] Aside from the Committee's work, this is the only publicly available study identifying potential offshore wind areas in Newfoundland and Labrador.

More broadly, DFO has been advancing MSP in Canada. On January 13, 2025, DFO published the Marine Spatial Planning Framework for the Newfoundland and Labrador region. The framework serves as a first-generation marine spatial plan for the Newfoundland-Labrador Shelves Bioregion. It outlines a methodology for advancing MSP in the area, including support for the development and implementation of area-specific plans, activities, and initiatives. It can be applied throughout the entire Newfoundland and Labrador region (DFO, 2025).[38,39]

The Committee undertook this Regional Assessment independently of government. The Committee followed a different approach than NRCan and concluded with the identification of a larger potential area than illustrated in the NRCan study.

6.1 Licencing and Project Siting in Other Jurisdictions

The Committee reviewed offshore wind energy licencing processes in the United Kingdom of Great Britain and Northern Ireland (U.K.), New England (United States of America (U.S.)),

[36] NRCan's report is publicly available on the NRCan Open Science and Technology Repository. The full report citation is: Kilpatrick, R. J., Wakim, C., & Caesar, G. (2023). Preliminary considerations analysis of offshore wind energy in Atlantic Canada. Natural Resources Canada. https://doi.org/10.4095/331855

[37] At the time of completing this Report (January 2025), the Committee understands the governments of Canada and Newfoundland and Labrador have no immediate plans to identify Wind Energy Areas or begin a process towards a Call for Bids.

[38] This first-generation marine spatial plan is a first step towards MSP in the Newfoundland and Labrador region and does not lay out a specific plan for how different areas would be used and why. Furthermore, the Framework notes 'sunsetting' throughout this publication, and so the Committee is unclear regarding future funding and next steps related to MSP in the Newfoundland and Labrador region. The Committee identified recommendations related to MSP (see Section 6.4.1 of this Report).

[39] The Marine Spatial Planning Framework for the Newfoundland and Labrador Region is publicly available on DFO's Publications webpage.

Belgium, the Netherlands, France, Denmark, Germany, and Albania. In these jurisdictions, potential impacts of offshore wind development are considered at various stages from area identification, to licencing and project approval processes (BOEM, 2023a; c; Danish Energy Agency, 2022; Mahdi, 2022; Ministère de la transition écologique, 2019; 2021; The Crown Estate, 2019; 2021; Wind and Water Works Netherlands, 2022).

It is important to note that several jurisdictions, particularly in the European Union, use MSP as a proactive, early planning process to identify broader "offshore renewable energy areas" before designating licencing areas specifically for offshore wind development (Department for Environment, Food and Rural Affairs, 2023; European Commission, 2024a; b; c; d; The Crown Estate, 2023a).

At the licencing stage, a central body within each jurisdiction typically selects a designated area within which licenses would be issued. Bidders are required to submit some or all of the following as a part of their application: a site plan, evidence of financial capacity and cost plan, construction plan, decommissioning plan, and an environmental impact assessment if not conducted by a governing body (BOEM, 2023b; c; Danish Energy Agency, 2015; 2020; 2022; Government of Netherlands, 2021; The Crown Estate, 2022; 2023a; b; Ministère de la transition écologique, 2021). In some jurisdictions (e.g., France and Denmark), developers have additionally been allowed to bring forward proposals for locations through a 'non-tender' or 'open-door' process, though this approach has not been successful to date (Barthelemy & Rubio, 2017; Danish Energy Agency, 2023; Nielsen & Hemmer, 2017).

In their letter to the Committee dated April 10, 2024, East Coast Environmental Law shared some key findings from their report: Comparative Jurisdictional Research Report on the Assessment and Regulation of Offshore Wind Development (Kofahl & Northrup 2023).[40] This report explores the assessment and regulation of offshore wind development in Germany, the U.K., and the U.S. It ultimately showed that coordinated planning and assessment processes that are conducted from the highest to the lowest levels of planning, assessment, and decision-making benefit the overall assessment and regulation of offshore wind development. They identified best practices that could be considered in

[40] This report is publicly available at the East Coast Environmental Law Resource Library under title Comparative Jurisdictional Research Report on the Assessment and Regulation of Offshore Wind Development.

the Canadian context. These include:

- Development of marine spatial plans that identify and seek to reconcile competing human uses and ecosystem needs in marine areas of interest;
- Centralized site identification by government (or government-appointed regulators) to ensure that marine spaces opened to development accord with marine spatial plans and, where necessary, reflect appropriate prioritization of competing ocean uses and ecosystem needs; and,
- Tiered planning and assessment processes that include, at minimum:
  - Strategic environmental assessments of government programs, plans, and policies (including marine policies and marine spatial plans);
  - Regional or sectoral assessments that identify competing human uses (past, present, and future) and ecosystem needs in areas of interest, including cumulative effects assessments to determine if the combined or synergistic effects of proposed new activities will be sustainable; and,
  - Project-specific assessments that review project-specific information in light of the cumulative effects assessments and marine spatial planning conducted for the area in question.

East Coast Environmental Law also expressed support for, or requested inclusion of, the following recommendations in the Final Report

- Recommendation 1: The federal Minister of Environment and Climate Change should not exercise their authority under the IAA to exclude offshore wind developments proposed within the Regional Assessment Study Area from Impact Assessments.
  - Related to this recommendation, they discussed cumulative effects and indicate that higher level processes are ideal for identifying competing human uses, but that, especially where a project type is new to an area, data and analysis that could assist in predicting how competing uses and ecological needs within an area could interact or come into conflicts is limited. When marine wind energy proponents are ready to propose specific projects for marine sites, they will be in the best position to provide data and analysis that assess how the specific technologies they propose to use will interact with the existing environmental and human interests of the sites they wish to develop. Therefore, both Regional Assessments and project-level Impact Assessments need to occur and be coordinated.
- Recommendation 2: The federal and provincial ministers of Environment and Climate Change should not approve calls for bids in areas that were excluded from focused and detailed assessment under the Regional Assessment of Offshore Wind Development in Newfoundland and Labrador (or otherwise open such areas to offshore renewable energy development) without subsequent high-level assessment through a strategic environmental assessment or regional assessment.
  - Related to this recommendation they indicate support for the Committee's approach to define a Focus Area given the short timeline the Committee has been given to conduct its work; however, they express concerns that areas outside the Focus Area may eventually be opened to development without having had the full benefit of a complete high-level assessment.
- Recommendation 3: The Offshore Energy Regulator should conduct project-specific environmental assessments for all proposed offshore renewable energy projects that do not trigger impact assessments (whether due to exclusion from the impact assessment process altogether or due to falling outside the descriptions of offshore renewable energy activities that have been designated for assessment under the IAA).
  - Related to this recommendation, they indicate regional assessments are best-suited to provide a "big-picture" view of an area and the importance of project-specific impact assessment to determine localized conditions, setbacks, and buffers needs to be recognized.

The Committee views the broader planning phases used in other jurisdictions (e.g., area identification) as having the most relevance to the Regional Assessment. Some factors considered during broader planning phases in other jurisdictions include public opinion; stakeholder and international interests; existing uses or defined areas in the marine space (e.g., transportation infrastructure, cultural heritage sites, protected areas, commercial fishing, aquaculture, military use, and recreational spaces) and potential impacts to the environment (BOEM, 2023a; c; European Commission, 2024a; b; c; d; The Crown Estate, 2019; 2021).

As described in the following sections, the Committee considered these and other factors when identifying initial offshore energy licencing areas.

6.2 Approach for Identifying Initial Offshore Wind Energy Licencing Areas for Consideration

The Committee identified initial offshore wind energy licencing areas using a stepwise approach (Figure 6.1). Beginning with the Study Area outlined in the Agreement, the Committee defined a more precise Focus Area where the remainder of the assessment would be concentrated (see Section 5 of this Report). The Committee proceeded to identify preliminary offshore wind energy licencing areas, followed by an updated draft and final version of the initial offshore wind energy licencing areas.

The Committee used a constraints analysis to identify the Focus Area and, subsequently, to identify initial offshore wind energy licencing areas. The process to identify initial offshore wind energy licencing areas involved successively removing constraints from the Focus Area.

The Committee defined 'constraints' as distinct areas where offshore wind licences should not be considered at this time because of potential impacts to environmental, health, social, and economic components.

The remaining areas at the end of the process were brought forward in the Interim Report as preliminary offshore wind energy licencing areas.

Following completion of the Interim Report, the Committee continued to accept participant feedback on the preliminary offshore wind energy licencing areas in consideration of whether to refine those areas. The refined areas are presented in this Report and have remained unchanged since the Draft Report (released on October 1, 2024, for a 60-day public comment period).

Figure 6.1. Approach for Identifying Initial Offshore Wind Energy Licencing Areas

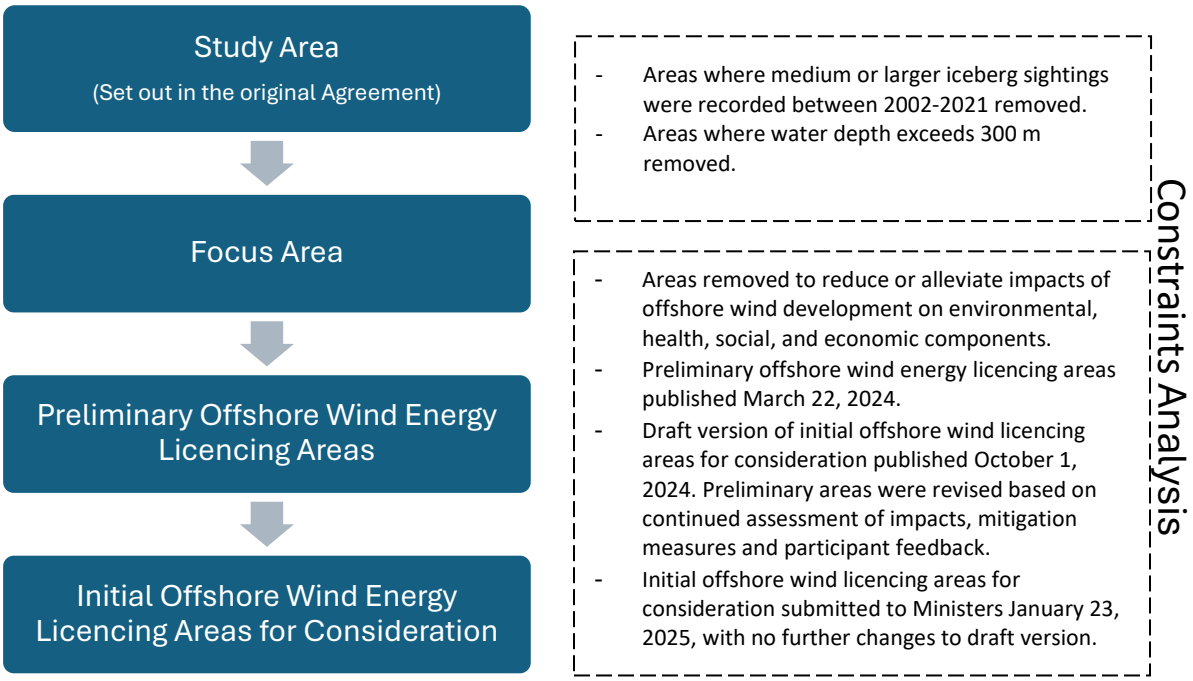


Figure Description: This figure summarizes the Committee's approach for identifying initial offshore wind energy licencing areas for consideration. Beginning with the Study Area set out in the Agreement, a constraints analysis was used to identify the Focus Area. The Committee sought public feedback on the Focus Area before finalizing it in November 2023. The Committee continued the constraints analysis (from the Focus Area) to identify preliminary offshore wind licencing areas. The Committee published these areas in March 2024, and the areas have since been updated. The Committee's final initial offshore wind energy licencing areas for consideration are presented in this Report. A draft version of this Report was subject to a 60-day public comment period. The areas were not changed since the Draft Report.

A key assumption informing the Committee's approach for identifying initial offshore wind energy licencing areas for consideration is that project-level impact assessments would occur following the Regional Assessment.

The Committee is not implying offshore wind projects may or should occur everywhere within the initial offshore wind energy licencing areas. Firstly, the areas should be refined with more practical boundaries.[41] Secondly, and more importantly, the Committee strongly recommends additional work be carried out in advance of offshore wind projects to

[41] The Committee identified initial offshore wind energy licencing areas using a constraints analysis with very little modification to results. More practical boundaries should be set for actual offshore wind licencing areas.

identify more specific buffers around various constraints, informed by scientific study and Indigenous, fisheries, and stakeholder engagement. These buffers should inform considerations during project-level impact assessments.

Overall, the Committee advocates for the use of a precautionary approach when siting offshore wind development projects. Taking a precautionary approach means evidence needs to show that potential adverse impacts to environmental, health, social, and economic components can be avoided or mitigated before offshore wind development can proceed in each area.

6.2.1 Use of Publicly Available Data

The Committee was mandated to conduct the Regional Assessment in a manner that promotes transparency and encourages public input and participation.

Wherever possible, the Committee used publicly available information and data to complete their work. Most geospatial data used to identify the initial offshore wind energy licencing areas can be found on the Open Government Portal and/or the Atlas. NRCan has also curated a publicly available content collection of Resources to Understand Potential Effects from Future Offshore Wind Development in Atlantic Canada.

The Study Area, the Focus Area and the Preliminary Offshore Wind Energy Licencing Areas recommended by the Committee in the Interim Report are also publicly available on Open Government and the Atlas. Participants can access geospatial representations of these areas and view them in relation to other data curated on the Atlas.[42,43]

To find the Study Area, the Focus Area and the Preliminary Offshore Wind Energy Licencing Areas on the Atlas:

- go to the “Add Data” tool;
- select either “Content”, “MSP Data” or “Human Use Data Categories”;
- type “offshore wind” in the Search bar;
- select “Add” to add it to the map.

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[42] The draft version of initial offshore wind energy licencing areas for consideration will be made available on these platforms. Ministers may also choose to make the final versions of these areas available following the Regional Assessment. However, no changes have been made to the geospatial data representing the draft areas.
[43] Please note the Committee updated the term “Initial Offshore Wind Energy Licencing Areas for Consideration” in this Report to better communicate the areas it identified are not licencing areas, but a starting point to help inform the selection of licencing areas. Previous iterations of these areas in the Interim Report, Draft Report, and corresponding open government publications use the term “Offshore Wind Licencing Areas”.

The Committee has agreed to keep select information provided by NRCan, ECCC, and an offshore wind developer confidential, as per the Committee's Confidentiality Procedure.[44]

6.3 Constraints Analysis

The Committee selected constraints for identifying initial offshore wind energy licencing areas based on:

- processes used in other jurisdictions for identifying offshore wind development areas;
- information and recommendations provided to the Committee by federal government departments and agencies with specialist or expert information or knowledge;
- publicly available spatial data;
- components the Committee is required to assess under the Agreement;
- information, knowledge, and feedback shared by Indigenous groups; and
- information, knowledge and feedback received during engagement activities, including from advisory groups.

Table 6.1 below summarizes the Committee's analysis used to identify the initial offshore wind energy licencing areas for consideration. The considerations outlined in the table primarily recount information and engagement outcomes up to March 22, 2024 (when preliminary offshore wind licencing areas were published in the Interim Report) or considerations that informed changes to the areas. Additional information and engagement outcomes related to each of the components assessed under the Regional Assessment are under Section 7 of this Report.

Appendix F: GIS Methods outlines the steps undertaken in GIS to identify initial offshore wind energy licencing areas.

6.3.1 Changes to the Preliminary Offshore Wind Energy Licencing Areas

Constraints marked with an asterisk (*) in Table 6.1 were not previously applied, or were applied in a different way, when compared to the preliminary offshore wind energy licencing areas published in the Interim Report. Changes were mostly made in response to engagement outcomes. They include five key updates.

Firstly, the Committee removed more areas where there could be spatial conflict with commercial fisheries. When selecting the preliminary offshore wind energy licencing areas, the Committee removed any areas above the 50th percentile of commercial fishing density in the 2023 DFO, Eastern Canada Commercial Fishing dataset (DFO, 2023g).

[44] Please refer to Registry, document reference numbers 137 (NRCan), 179 (NRCan), 222 (ECCC), and 190 (Simply Blue Group).

The initial offshore wind energy licencing areas for consideration avoid 90% of commercial fishing density in the Focus Area.[45]

A lower threshold was used for the initial offshore wind energy licencing areas for consideration given the importance of commercial fisheries to the province and to local harvesters. This was consistently raised throughout the Regional Assessment engagement program (see Engagement Outcomes under Section 7.7 of this Report).

Secondly, the Committee also removed areas identified in DFO's publicly available Community-based Coastal Resource Inventory (CCRI) and groundfish data from the currently unpublished CCRI update. Participants regularly raised concerns that the Committee's initial approach for avoiding commercial fisheries did not necessarily reduce impacts to local harvesters, whose interest may not be reflected in the larger commercial fisheries dataset. The Atlantic Groundfish Council (AGC) and Fish, Food & Allied Workers (FFAW) also advised the Committee to consider historical groundfish fisheries, as these could become active again over time. The CCRI dataset was compiled by DFO, in conjunction with several Federal and Provincial agencies based on decades of traditional knowledge, both Indigenous and Community based, from local residents. Avoiding areas identified in the CCRI dataset is intended to help address these gaps and better consider local ocean users. Two Committee members disagreed with using the unpublished update to the CCRI data in the constraints analysis. These two Committee members believe the CCRI is best used to provide local knowledge during project level impact assessments.

Thirdly, and as another update to preliminary offshore wind energy licensing areas, the Committee removed areas with high vessel traffic density for 2012-2021 available on Open Government and in the Atlas. In the Interim Report the Committee identified known gaps in the Canadian Hydrographic Service's (2024) Vessel Traffic Routes dataset. DFO recommended the Committee utilize the above noted vessel density data in the constraints analysis. The Committee removed areas with greater than 0.3 vessels per day.

Fourthly, the Committee removed a 65 km buffer around Cape St. Mary's bird colony to reduce potential impacts to Northern Gannet (*Morus bassanunotr*).[46] Concerns regarding Northern Gannet were raised by participants during June 2024 public engagement sessions and by ECCC (see Engagement Outcomes below).

Other differences between the preliminary offshore wind energy licencing areas and initial offshore wind energy licencing areas in this Report are the result of updated datasets or

[45] 90 % of commercial fishing density was removed after clipping the dataset to the Focus Area. More details are available in Appendix F: GIS Methods.
[46] ECCC advised the Committee to apply guidelines from the American Ornithological Society when referring to common bird names in the Regional Assessment. The Committee applied the same conventions when referring to all species (not just birds) for consistency throughout the Report.

improved GIS workflow. For example, the publicly available DFO Critical Habitat dataset was updated in 2024 and has an additional Northern Wolffish (*Anarhichas denticulatus*) area in the Focus Area that was not included/removed in the Interim Report. This area was removed from the initial offshore wind energy licencing areas in this Report.

6.3.2 Changes to the Draft Offshore Wind Licencing Areas

No changes were made to the initial offshore wind energy licencing areas since publishing the Draft Report.

6.3.3 Engagement Outcomes

Feedback about specific constraints is included under Report sections related to each component. This section provides an overview of engagement and submitted feedback specifically regarding the initial offshore wind energy licencing areas (or the preliminary version of these areas).

In May 2024, the Committee met with the AGC, FFAW, ECCC, and Marine Renewables Canada (MRC) to discuss feedback on the Interim Report. These meetings were held at the request of the participants, followed the Committee operational and confidentiality procedures, and were documented in the PP. The Committee also received written feedback related to licencing areas from ECCC, DFO, MRC, Energy NL, East Coast Environmental Law, Port au Port Indian Band, MFN, Innu Nation, and Flat Bay Band Inc. which is posted on the Registry.

AGC flagged historical groundfish data as a gap in the Committee's approach. They indicated that several fisheries are under moratorium and are, therefore, not reflected in the 2012-2021 dataset used. Some of these fisheries are being considered for reopening. AGC stressed that another key gap is that the current fishing footprint may not be an accurate depiction of what it could be in years to come. This underscores the importance of transparency as the offshore wind industry develops and of continued engagement on offshore wind development after the Regional Assessment concludes. Finally, AGC indicated that some of the preliminary offshore wind energy licencing areas outlined in the Interim Report overlap important halibut fixed gear fishing areas. AGC pointed out the timing (i.e., preparing for fishing season) made it challenging for members to fully engage on this topic at this time and identify other potential conflicts.

FFAW raised concerns about gaps in the DFO dataset used by the Committee to consider commercial fisheries. For FFAW, the dataset does not reflect submitted logbook data, especially in most recent years. FFAW indicated this is important because fisheries are dynamic and changing quickly. They discussed plans to compile and submit feedback from their membership on areas that should be avoided but stressed that the Regional Assessment timeline presented a challenge for FFAW to complete this work in time for inclusion in the Committee's Final Report.

MRC found the approach to identifying offshore wind energy licencing areas overly restrictive and recommended an approach to identifying wind energy areas that recognizes the use of mitigation measures to reduce conflict and impacts, allowing broader areas to

be identified. MRC also stressed the importance of using scientific evidence to inform any buffers or setback distances recommended in the Regional Assessment or during project-level impact assessments.

Energy NL is of the view that the Committee's preliminary recommendations for offshore wind licencing areas were not informed by evidence-based research on the potential effects of offshore wind development projects. They indicated the constraints analysis did not consider offshore wind development compatibility with other marine and offshore activities and did not reference evidence or proof of the actual effects of offshore wind development on such other activities. They referred to previous feedback they provided on the Focus Area.[47] They indicated the selected "Focus Area", coupled with the application of the constraints analysis, is leading to an end result that is not reflective of Newfoundland and Labrador's true offshore wind industry potential, or the already proven ability of the offshore energy sector to co-exist with other sectors and is limiting the possibility of advancing an offshore wind industry.

DFO commented on specific constraints and recommendations. Some of their feedback included reiterating (from their response to the Committee's August 2023 request for advice) that non-georeferenced, small vessel fishing activity and privacy screened data in the commercial fishing data should not be overlooked. They also noted that the removal of high-density fishing areas based on the All-Species data layer (i.e., the Committee's approach) could bias removals to fisheries with higher overall catch weights. They recommended that, in addition to the Committee's constraints analysis work, areas of high commercial fishing density should be considered at the project-level. DFO recommends that project-level assessments should assess commercial fishing density on a species and/or gear type level to ensure smaller scale fisheries are captured.

ECCC recommended including larger and biologically relevant buffers around bird colonies. They noted that this is particularly important for Northern Gannets. The closest preliminary offshore wind licencing area was around 30 km from Cape St. Mary's, an important bird colony for Norther Gannets, and well within the foraging range of the species during breeding season. ECCC indicated that Northern Gannet populations had been increasing substantially since the 1970's, but Highly Pathogenic Avian Influenza killed 11-30% of the North American population in 2022 and knocked them back to the levels they were at in the 1990s. They also indicated that while compensation measures are typically an option to mitigate impacts, several activities are already planned or underway to restore Northern Gannet populations in Eastern Canada. (i.e., Northern Gannet Nesting

[47] Energy NL did not agree with the constraints used to identify the Focus Area. They indicated the study area should not have been reduced because of iceberg presence given Newfoundland and Labrador's proven track record in cold-ocean and harsh environment activities, and the near-to-medium term prospect for offshore wind projects which may be associated with powering offshore oil and gas facilities. Regarding water depth, they indicated a comparison to the deepest operating turbine to date is not substantial evidence that depth should be a constraint. Feedback about the Regional Assessment Focus Area and the Committee's consideration of these factors is under Section 5: Defining the Regional Assessment Focus Area.

Colony Restoration in Eastern Canada). Therefore, there would be limited opportunity for project proponents to compensate impacts of offshore wind development on Northern Gannet. Additional information regarding the importance of the Northern Gannet can be found in Section 7.3 of this Report.

In their August 2024 letter, MFN, indicated that they support the Focus Area and applying constraints to identify preliminary offshore wind development areas. They consider a 10 km coastal buffer and removal of the South Coast Fjords Study Area the most important constraints. The coastal buffer significantly reduces potential impact on areas of concern like Food, Social, Ceremonial (FSC) fisheries, cultural and traditional use areas, environmentally sensitive ecosystems, and culturally relevant species (salmon, eel). Regarding the South Coast Fjords Study Area, MFN is a party to the South Coast Fjords Agreement, National Marine Conservation Area (NMCA), and strongly supports the designation and conservation efforts of the steering committee. Finally, MFN made the following recommendations about future licencing processes:

- That any licencing and permitting process for offshore wind development put in place following this Regional Assessment should also take into account Indigenous knowledge and involve engagement of officially recognized First Nations that are adjacent to any proposed development.
- That the C-NLOPB (to be rebranded as Canada-Newfoundland and Labrador Offshore Energy Regulator, or C-NLOER) Board of Directors has Indigenous representation on it such that knowledge and sensitivity with respect to Indigenous knowledge and Indigenous issues be present at the board level.
- That no development of an offshore wind area should be permitted or licensed until after the area has been thoroughly studied from an environmental and ecological point of view. Further, coastal communities and Indigenous First Nations should be engaged to assist with any studies related to this recommendation. This should include the collection of Indigenous knowledge as well as pertinent scientific data and analyses, decision-making and any construction and post-development environmental monitoring.
- That offshore wind development projects under no circumstance should be excluded from the IAA requirements.

Innu Nation raised concerns about how the Committee's work on licencing areas relates to, and does not sufficiently inform, policy direction. They noted that the Committee's approach often suggests additional work be undertaken during project-level impact assessments and indicate an over-reliance on project-level impact assessments will result in key policy matters best informed by the Committee and/or regulators during regulation- or policy-specific consultations playing out during project-level impact assessments. They recommend the Committee clearly state the costs and benefits associated with this approach, and that if the Committee believes that this approach is necessitated by the time and resource limitations imposed on the Committee, then this should be clearly stated in the Final Report. Innu Nation also recommended the Committee clearly define "setback" and "buffer", and any modifier they use in relation to these terms (e.g., "precautionary buffer", "conservative buffer", "specific setback" and "standard setback". They indicate a "setback" is a prescribed distance from a facility, project, emissions source, etc. in which typically no development can occur while a "buffer" is an area adjacent to an environmental resource such as a habitat, species, park, or protected area

and that exists to protect or preserve that resource. Buffers and setbacks should not overlap. Finally, to assist regulators in reviewing the state of the knowledge, Innu Nation recommends that the Final Report include a table (or tables) summarizing the state of the knowledge in relation to each proposed setback and buffer, including relevant policy or regulations, regulatory responsibility, and the Committee's findings.

Port au Port Band Inc. requested removal of Port au Port Peninsula and Bay St. George region from consideration for offshore wind development until free, prior and informed consent is obtained. Port au Port Indian Band also submitted a compilation of key concerns of band members (described under applicable sections of this Report). Specific points related to the Focus Area or Offshore Wind Licencing Areas included:

- The defined Focus Area is unceded territory and this was recently affirmed by the Governor General.

- In the Focus Area, the Committee has not accounted for shipping routes in the Bay of Islands or Bay St. George. The Committee must also account for "future" project plans, for example, the Marine Port Aguathuna for movement of materials onshore. This will transfer from Stephenville to Aguathuna.

Table 6.1. Constraints Analysis Used to Identify Initial Offshore Wind Energy Licencing Areas

Constraint	Avoided	Approach (Removed from the Focus Area)	Key Considerations	Report Sections for Relevant Components
Critical Habitat	X	10 km buffers around the islands of Newfoundland and Ramea Critical habitat as delineated in DFO's (2024g) Critical Habitat of Species at Risk dataset	• Critical habitats on federal lands are protected under the *Species at Risk Act* (SARA) (2002), which makes it illegal to destroy any part of critical habitat and may impose restrictions on development and construction. • Critical habitats are important to protect. Potential impacts of projects pose a greater risk to species at risk (relative to other species) because the loss of a few individuals can have detrimental effects at the population level. • Critical Habitats for Bank Swallow (*Riparia riparia*), Bobolink (*Dolichonyx oryzivorus*), and Piping Plover (*Charadrius melodus melodus*), and Northern Wolffish and Spotted Wolffish (*Anarhichas minor*) occur within or adjacent to the Focus Area. • ECCC recommended to the Committee that offshore wind development avoid shoreline with critical habitat or important areas for aerofauna species at risk by 10 km at a minimum and cautioned that foraging distances around critical habitats likely exceed this buffer (ECCC, 2023l). • In November 2023 meetings with the Committee, MFN, and QFN supported avoiding critical habitat, specifically referencing that for seabirds. • At the time of this analysis, several aerofauna species were being considered for listing under SARA (2002) (e.g., Lesser Yellow Legs (*Tringa flavipes*), Eastern Red Bat (*Lasiurus borealis*), Hoary Bat (*Lasiurus cinereus)*, Leach's Storm-petrel (*Oceanodroma leucorhoa)*, and Silver-haired Bat (*Lasionycteris noctivagans*)). Critical habitat for these species is not yet defined. • Habitat use (e.g., foraging distance) and movement behaviour around aerofauna critical habitats are not well understood.	7.1, 7.3, 7.4, 7.6

Constraint	Avoided	Approach (Removed from the Focus Area)	Key Considerations	Report Sections for Relevant Components
Marine Protected Areas	X	Laurentian Channel, as delineated in the DFO (2023x) Marine Protected Areas dataset	• Marine Protected Areas (MPA) are designated under the federal *Oceans Act* (1996) and provide legal protections for marine ecosystems and associated resources. • The Laurentian Channel MPA is located partially within the Focus Area and protects a variety of species from human activities. • Prohibited activities currently do not include offshore wind development, but do include any activities that disturb, damage, destroy, or remove (or is likely to do so) any living marine organism or its habitat (DFO, 2023o). • DFO Newfoundland Region recommended that offshore wind development licencing areas avoid the MPA (DFO, 2023p). • A study looking at the edge effects of MPAs (the degradation of the effective size of protected areas caused by human related stressors in the surrounding areas), suggests that all MPAs should be surrounded by, at a minimum, 1 km precautionary buffer to reduce these effects (Ohayon et al., 2021). DFO recommended during the Public Comment period that due to sedimentation effects on sensitive species (eg., sea pens), that there should be a minimum of a 2 km buffer applied to the Laurentian Channel MPA (DFO, 2024q). • Expert authorities did not provide the Committee with advice or information surrounding buffers to minimize edge effects. • In their November 2023 meeting with the Committee, MFN supported the avoidance of MPAs. • In their February 2024 engagement with the public, a participant suggested the Committee consider applying a buffer around MPAs.	7.1, 7.5, 7.6, 7.7
National Marine Conservation Areas	X	South Coast Fjords Study Area, as delineated by Parks Canada (2024)	• NMCAs are established under the *National Marine Conservation Areas Act* with the primary goal of achieving ecological sustainability while creating enjoyable experiences for visitors, promoting awareness and understanding of conservation, and providing benefits for Indigenous peoples and coastal communities (Parks Canada, 2023b).	7.1, 7.5, 7.6, 7.7, 7.8, 7.13

Constraint	Avoided	Approach (Removed from the Focus Area)	Key Considerations	Report Sections for Relevant Components
			• Prohibited activities within designated NMCAs include the exploration and extraction of hydrocarbons, minerals, aggregates, and other inorganic matter. • South Coast Fjords is the only NMCA (proposed) occurring in the Focus Area. It is currently being assessed for feasibility to be designated as a formal NMCA. It would help protect significant coastal and marine systems, including the fragile sand dunes ecosystem and the habitats and key migration routes of endangered species. • Parks Canada recommended that offshore wind licencing areas avoid the South Coast Fjords Study Area to ensure no overlap of significant areas that may be in the final NMCA area. • In their November 2023 meeting with the Committee, MFN supported the avoidance of the NMCA Study Area at this time. • In their February 2024 engagement with the public, a participant suggested the Committee consider applying a buffer around the NMCA Study Area.	
Key Biodiversity Areas	X	10 km buffers around the islands of Newfoundland and Ramea 5 km buffer around islands with bird colonies	• Key Biodiversity Areas (KBAs) are geographic areas that contribute to the persistence of biodiversity nationally and globally. KBA protection can support rare and threatened species and ecosystems, as well as natural processes. • KBAs are information tools. Designation does not change access/ownership or prescribe any use or regulatory recommendations or requirements. • All existing and proposed KBAs within the Focus Area occur along the coast of Newfoundland or within the St. Pierre-Miquelon Exclusive Economic Zone. • KBAs are currently being identified and assessed for designation in Canada, including the reassessment and designation of Important Bird and Biodiversity Areas (IBAs). Boundaries for KBAs the Committee considered to date could change and new information about KBAs could become available as they are reassessed.	7.1, 7.3, 7.6

Constraint	Avoided	Approach (Removed from the Focus Area)	Key Considerations	Report Sections for Relevant Components
Ecologically and Biologically Significant Areas		Not removed due to lack of legal protection, the broad extent of considerations within these vast areas, and data and information gaps.	• Ecologically and Biologically Significant Areas (EBSAs) are marine areas identified by DFO that have high ecological and/or biological significance and that may be considered important for several marine species or ecological processes. • EBSAs have no legal protection, but this does not undermine these areas importance to be considered. The identification of EBSAs is intended to "facilitate provision of a greater-than-usual degree of risk aversion in management of activities in areas of especially high ecological and biological significance" (DFO, 2004a). • 5 EBSAs occur within (or partially within) the Focus Area: West Coast of Newfoundland, South Coast, Laurentian Channel, Placentia Bay, Southwest Slope. They were identified for a variety of reasons including but not limited to: o providing habitat for the Blue Whale and other marine mammals; o supporting high concentrations of groundfish and being a significant area for pelagic fish; o including sea pen and sponge sensitive benthic areas; and o including salmon rivers and spawning areas for a variety of species etc.	7.4, 7.5, 7.6

Constraint	Avoided	Approach (Removed from the Focus Area)	Key Considerations	Report Sections for Relevant Components
Significant Benthic Areas		Not removed due to lack of legal protection, and no advice provided by expert authorities or engagement outcomes indicating they should be removed.	• Significant Benthic Areas (SBAs) are areas that may contain large densities or aggregations of corals and sponges. Corals and sponges play an important ecological role in marine ecosystems and are key components of healthy, productive marine environments. • SBAs are not legally protected and there are no regulated prohibitions or restrictions of activities within them, but this does not undermine these areas importance to be considered. • SBAs within the Focus Area are primarily situated within the Laurentian Channel, South Coast and West Coast of Newfoundland EBSAs and include areas associated with sea pens, sponges, and large and small gorgonian corals. • Expert authorities did not provide the Committee advice on avoiding SBAs when identifying initial offshore wind energy licencing areas. • Engagement did not result in any feedback specific to avoiding SBAs when identifying initial offshore wind energy licencing areas.	7.4, 7.6
Marine Refuge and Fisheries Closure Areas	X	10 km buffers around the islands of Newfoundland and Ramea.	• Marine Refuge or Fisheries Closures are considered Other Effective Area-Based Conservation Measures (OEABCMs), which are complimentary to MPAs and can provide some legal protection. • The Bay of Islands Salmon Migration Closure as well as three Lobster Area Closures (Trout River, Shoal Point, & Penguin Islands) occur within the Focus Area. These prohibit all pelagic fixed gear fisheries and all lobster fishing, respectively. • In their response to the Interim Report, DFO recommended that the Committee consider fisheries closures that are not designated Marine Refuges, including those where fisheries are restricted due to spawning areas of valuable commercial species. • Indigenous groups and Indigenous Knowledge Advisory Group members expressed the importance of protecting Atlantic Salmon (*Salmo salar*) and American Eel (*Anguilla rostrata*), including avoiding migratory routes of these species.	7.1, 7.6, 7.7

Constraint	Avoided	Approach (Removed from the Focus Area)	Key Considerations	Report Sections for Relevant Components
			• Public stakeholders suggested the exclusion of the Bay of Islands to protect the Atlantic Salmon and other fish migratory routes within the preliminary offshore wind energy licencing areas.	
Lobster and Nearshore Fisheries	X	3 km buffer around coastal islands not already avoided by a minimum of 3 km after applying other coastal buffers	• All fisheries in Newfoundland and Labrador contribute significant value to the economy, culture, and livelihood of the population. The lobster fishery accounts for 80% of landed value for small non-georeferenced fisheries within the Focus Area. • Expert authorities did not provide the Committee advice on avoiding lobster or other nearshore fisheries when identifying initial offshore wind energy licencing areas. • MFN and QFN indicated that the entire Focus Area is important for Indigenous commercial, ceremonial, and communal fisheries. • In their February 2024 engagement with the Fisheries and Other Ocean Uses Advisory Group, a participant suggested a coastal buffer of 12 miles (~19 km) would be more suitable as the Committee's 10 km coastal buffer does not encompass the fishing activities in 3Pn and parts of 4R.	7.1, 7.7, 7.13
Areas with High Commercial Fisheries Density*	X	Areas with the highest 90% fishing density based on the Eastern Canada Commercial Fishing, 2012-2021, dataset	• Fisheries in Newfoundland and Labrador are highly significant to the population's livelihood, and to the province's economy and culture. • Other jurisdictions have implemented marine spatial plans where the co-location of fisheries is planned and explained for different marine industries, including offshore wind energy. Setback distances from specific fisheries or from turbines are based on these plans and are decided on a project-by-project basis. • Expert authorities emphasized the importance of commercial fisheries to the province.	7.1, 7.7, 7.13

Constraint	Avoided	Approach (Removed from the Focus Area)	Key Considerations	Report Sections for Relevant Components
			• In response to the Committee's August 2023 Request for advice, DFO noted that non-georeferenced vessels should not be overlooked. They reiterate this in their response to the Interim Report. They also noted that privacy screened data does not indicate the absence of fisheries and limitations associated with using 'All Species' data when identifying areas with high commercial fisheries density. • During the Committee's engagement with an offshore wind developer in October 2023, a participant suggested the avoidance of high-density fishing areas to prevent conflict i.e. avoidance of high-density fishing areas. • During the February 2024 engagement with the public, and the Fisheries and Other Ocean Uses and the Scientific and Community Knowledge advisory groups, participants suggested the consideration of fisheries data in logbooks as many vessels under 35 ft do not carry Automatic Identification Systems (AIS) and, therefore, not rely solely on data from the Atlas. • Fishing density data that is publicly available only captures most geo-referenced fisheries and has incorporated logbook data as best as possible. Small vessel fisheries (vessels smaller than 35 ft) and certain species are not captured in this dataset. More engagement than was possible during the Regional Assessment is needed to fill these gaps. Fishing density may not accurately represent importance (e.g., density is not directly related to economic value, areas with lower density may be significant to specific communities/fishers etc.).	
Community – Based Coastal Resources*	X	Features identified in the DFO CCRI, 1996-2007 dataset, and groundfish data from the unpublished CCRI update	• Regional Assessment participants consistently identified gaps in the Committee's approach to remove areas important to fishers based on only the 'Eastern Canada Commercial Fishing' dataset and a coastal buffer. • During June 2024 engagement, the Committee heard areas important for local harvesters do not necessarily coincide with areas of high commercial fisheries density. Impacting areas important to local harvesters can affect individuals' sole source of income.	7.1, 7.7, 7.13

Constraint	Avoided	Approach (Removed from the Focus Area)	Key Considerations	Report Sections for Relevant Components
			• Public participants and the AGC have also recommended the Committee avoid historical ground fisheries, as these could become active again in the future. • From 1996 - 2007, DFO in conjunction with several federal and provincial agencies managed a program set out to develop a coastal resource inventory based on the traditional knowledge of local residents and assembled a database containing several decades' worth of local knowledge. Information was gathered through interviews with individuals who had extensive knowledge of the immediate geography and resources, having lived, worked, and harvested the regions over a lifetime. In 2022, DFO and partners set out to conduct further interviews and update the 1996 - 2007 CCRI. The 1996 - 2007 dataset is publicly available and contains data on local use and observations for fisheries, marine mammals, marine birds, aquatic plants, culturally significant areas, infrastructure, and aquaculture. The dataset also includes publicly available details such as specific use and number of sources validating the importance of the area. • An updated dataset, including additional interviews conducted more recently is forthcoming. DFO provided the Committee with geospatial groundfish data associated with this unpublished dataset, for the Committee's use in the Regional Assessment. Most CCRI areas overlapping the Focus Area and not removed due to other constraints are from the unpublished dataset. Details including gear type, period fished, and other comments that may communicate importance of the area will be available once the update is published on the Open Government Portal by DFO. Some details are summarized in Section 7.7 of this Report. • Avoiding areas identified in the CCRI dataset helps to reduce impacts to local ocean users, based on Indigenous group input. It also incorporates consideration of historical groundfish.	

Constraint	Avoided	Approach (Removed from the Focus Area)	Key Considerations	Report Sections for Relevant Components
			• Once the updated dataset is published, attribute details should be reviewed to better understand specific use of areas and data validity for the areas identified in the CCRI dataset and overlapping the Focus Area. Licencing areas could be reconsidered, if for example, co-location with the existing use of offshore wind development could be feasible. Other data in the dataset (i.e., in addition to groundfish data) should also be considered.	
Aquaculture Sites and Licences	X	10 km buffers around the islands of Newfoundland and Ramea	• Aquaculture sites for a variety of species occur within the Focus Area along the coastline within Placentia Bay, Fortune Bay, and St. George's Bay. • Expert authorities did not provide the Committee advice on avoiding aquaculture sites and licenses when identifying initial offshore wind energy licencing areas. • Engagement did not result in any feedback specific to avoiding aquaculture sites and licenses when identifying initial offshore wind energy licencing areas.	7.1, 7.7, 7.13
Viewscapes – Gros Morne National Park and World Heritage Site	X	80 km buffer perpendicular to Gros Morne National Park's coastal boundaries	• Gros Morne is a National Park and World Heritage Site (WHS) with important visual resources. It contributes greatly to Newfoundland and Labrador's tourism sector. • The United Nations Educational, Scientific and Cultural Organization (UNESCO) published Guidance for Wind Energy Projects in a World Heritage Context. This guidance recommends offshore wind development impacts need to be measured in relation to a site's Outstanding Universal Values (OUVs) and that any potential, irreversible negative impacts on OUVs should be avoided (UNESCO, 2023). Gros Morne's OUVs relate to exceptional natural beauty and internationally significant illustrations of geological evolution (IUCN & UNEPWCMC, 2011).	7.1, 7.6, 7.8, 7.9, 7.13

Constraint	Avoided	Approach (Removed from the Focus Area)	Key Considerations	Report Sections for Relevant Components
			• Parks Canada (2023b) recommends Gros Morne is highly sensitive to visual intrusions and any impacts to viewscapes should be avoided. Parks Canada recommends a precautionary buffer of 80 km be used to avoid impacts to viewscapes. This buffer could be adjusted if viewshed analyses provide evidence of no impacts to viewscapes. • Areas off the coast of Gros Morne National Park and WHS could be more technically suitable for development than other areas in the Focus Area. • The Committee heard about the importance of viewscapes for tourism operators while conducting public engagement sessions in Corner Brook, June 2024. • No viewshed analyses were completed by Parks Canada or the Committee to inform the Committee's recommendations. The Committee assumed offshore wind turbines up to 80 km from coastal park boundaries could be visible from any elevated viewpoints at Gros Morne National Park.	
Viewscapes – Sandbanks Provincial Park	X	South Coast Fjords NMCA Study Area	• Sandbanks Provincial Park is being considered for redesignation as a national park. • Parks Canada (2023b) recommended excluding the South Coast Fjords NMCA Study Area from offshore wind development licencing areas would avoid visual intrusions within Sandbanks Provincial Park. • Provincial authorities did not provide the Committee with advice on avoiding viewscapes from Sandbanks Provincial Park when identifying initial offshore wind energy licencing areas. • There are no overarching policy, guidance, or regulations regarding protection of visual resources at nationally or provincially protected areas. • No viewshed analyses were completed by the Committee to inform their recommendations. • The South Coast Fjords NMCA and Sandbanks Provincial Park (proposed redesignation to national park) boundaries are not finalized.	7.1, 7.6, 7.8, 7.9, 7.13

Constraint	Avoided	Approach (Removed from the Focus Area)	Key Considerations	Report Sections for Relevant Components
Viewscapes – Provincially Protected Areas	X	10 km buffers around the islands of Newfoundland and Ramea	• Several provincially protected areas are adjacent to the Focus Area. • Section 4 of the *Wilderness and Ecological Reserve Act* includes the experience and appreciation of natural environment as a possible reason for establishing a wilderness reserve and the province lists recreation and ecotourism as some of the many reasons parks and reserves are maintained (DOECC, 2020). Furthermore, the province recognizes benefits of provincially protected areas include providing for the enjoyment and appreciation of outstanding scenery, landscape, and wildlife (DOECC, 2020). Visibility distances and impacts on viewscapes are highly dependent on project- site- and viewer- specific factors. • Expert authorities did not provide the Committee with advice on avoiding viewscapes from provincially protected areas when identifying initial offshore wind energy licencing areas. The Government of Newfoundland and Labrador provided the Committee with a list of tourism operators in the Focus Area. • During February 2024 engagement with the Indigenous Knowledge Advisory Group, a participant noted that a coastal buffer for offshore wind development is generally larger than 10 km in most jurisdictions, with the goal of protecting viewscapes. However, if the coast is not largely inhabited, and protection of the viewscape is not of significant concern, then the 10 km coastal buffer may be sufficient. The participant suggested a coastal buffer of 20 km or more, depending on the size of the turbines and significance of the viewscape.	7.1, 7.6, 7.8, 7.9, 7.13
Viewscapes and Noise - Communities and Cottages	X	10 km buffers around the islands of Newfoundland and Ramea	• Visibility distances and impacts on viewscapes are highly dependent on project- site- and viewer- specific factors. • Expert authorities did not provide the Committee with advice on avoiding viewscapes or noise from communities and cottages when identifying initial offshore wind energy licencing areas.	7.1, 7.9, 7.13

Constraint	Avoided	Approach (Removed from the Focus Area)	Key Considerations	Report Sections for Relevant Components
			• During February 2024 engagement with the Indigenous Knowledge Advisory Group, a participant noted that a coastal buffer for offshore wind development is generally larger than 10 km in most jurisdictions, with the goal of protecting viewscapes. However, if the coast is not largely inhabited, and protection of the viewscape is not of significant concern, then the 10 km coastal buffer may be sufficient. The participant suggested a coastal buffer of 20 km or more, depending on the size of the turbines and significance of the viewscape.	
Bird Colonies and Foraging Areas	X	10 km coastal buffer around the islands of Newfoundland and Ramea 5 km buffer around coastal islands with bird colonies 65 km buffer around Cape St. Mary's Bird Colony	• Several bird colonies occur near the Focus Area and support high densities of birds during sensitive life periods. • Birds primarily use areas around the colonies; however, distribution varies. Ronconi et al. (2022) used tracking data for seabird species in Atlantic Canada to develop prediction models for foraging distribution around breeding sites. Results show large variation between species and colonies. • ECCC advised offshore wind licencing areas should avoid bird colonies and foraging areas. However, a catch-all buffer around bird colonies is not appropriate. Distribution around colonies and risk to potential impacts of offshore wind development vary across colonies, species, individual traits, years, and project factors. ECCC should be contacted by proponents to provide advice on appropriate colony or species-specific metrics based on best available data and subject-matter expert opinion. In response to the preliminary offshore wind energy licencing areas, ECCC also advised the Committee to consider larger buffers around at least some bird colonies. During the Public Engagement period, ECCC further recommended expanding the bird colony buffer from 5 km to 10 - 15 km, as it would capture the highest density and largest increase in total foraging birds found within (ECCC, 2024h).	7.1, 7.3

Constraint	Avoided	Approach (Removed from the Focus Area)	Key Considerations	Report Sections for Relevant Components
			• During engagement with an offshore wind developer in January 2024, the Committee heard they do not tend to use a standard setback distance around bird colonies when siting offshore wind projects in other jurisdictions. Instead, proponents tend to track, model, and predict the distribution of birds and aim to avoid areas where a high distribution of birds is expected. Standard setback distances around colonies are not used because of high variation in foraging distances around colonies. • During June 2024 engagement sessions, participants raised concerns about Northern Gannet populations in Newfoundland, due to the recent avian flu outbreak. ECCC and recent studies (Avery-Gomm et al., 2024) have also suggested their vulnerability (see Section 7.3.5 of this Report under Aerofauna, for more information). Cape St. Mary's is the only Northern Gannet colony in proximity to the Focus Area. It is also a provincially designated ecological reserve. Additional information detailing the Northern Gannet can be found in Section 7.3.2.2.1 – Northen Gannet.	
Sea Duck Key Habitat Sites	X	10 km coastal buffer around the islands of Newfoundland and Ramea 5 km buffer around coastal islands with bird colonies	• Sea Duck Key Habitat Sites are designated to heighten awareness of valuable sea duck habitats and aid in prioritizing habitat conservation and protection efforts. • Most sites occur outside of the Focus Area or along the coast of Newfoundland. A small part of the St. Pierre-Miquelon to Cape St. Mary's Sea Duck Key Habitat Site occurs within the Focus Area, mostly along the coast of Newfoundland. • Expert authorities did not provide the Committee with advice on setback distances for avoiding Sea Duck Key Habitat Sites when identifying initial offshore wind energy licencing areas. • Engagement did not result in any feedback specific to avoiding Sea Duck Key Habitat Sites when identifying initial offshore wind energy licencing areas.	7.1, 7.3

Constraint	Avoided	Approach (Removed from the Focus Area)	Key Considerations	Report Sections for Relevant Components
			• During the Public Engagement period, ECCC further recommended expanding the bird colony buffer from 5 km to 10 - 15 km, as it would capture the highest density and largest increase in total foraging birds found within (ECCC, 2024h).	
Red Knot Important Stopover Areas	X	10 km coastal buffer around the islands of Newfoundland and Ramea 5 km buffer around coastal islands with bird colonies	• ECCC provided the Committee with a confidential map showing locations of shoreline identified as Red Knot (*Calidris canutus*) priority stopover sites with an additional 10 km buffer. They indicated this buffer is a conservative estimate of the distance required for Red Knot to reach flight altitudes higher than anticipated heights of turbine rotor swept zones (20 - 300 m). • Engagement did not result in any feedback specific to avoiding Red Knot important stopover sites when identifying initial offshore wind energy licencing areas. • During the Public Engagement period, ECCC further recommended expanding the bird colony buffer from 5 km to 10 - 15 km, as it would capture the highest density and largest increase in total foraging birds found within (ECCC, 2024h).	7.1., 7.3
Important Shorebird Sites	X	10 km coastal buffer around the islands of Newfoundland and Ramea 5 km buffer around coastal islands with bird colonies	• Important shorebird sites are regionally important sites for shorebirds. • ECCC identified these as potentially important to consider in the Regional Assessment and indicated that shorebird sites are assumed to be connected and could imply movements between sites. • Expert authorities did not provide the Committee with advice on setback distances for avoiding these sites. • Engagement did not result in any feedback specific to avoiding important shorebird sites when identifying offshore wind energy licencing areas. • During the Public Engagement period, ECCC further recommended expanding the bird colony buffer from 5 km to 10 - 15 km, as it would capture the highest density and largest increase in total foraging birds found within (ECCC, 2024h).	7.1, 7.3

Constraint	Avoided	Approach (Removed from the Focus Area)	Key Considerations	Report Sections for Relevant Components
Lawn Island Archipelago	X	10 km coastal buffer around the islands of Newfoundland and Ramea 5 km buffer around coastal islands with bird colonies	• Provincial ecological reserve that ECCC advised the Committee to consider as an important area for birds. • No recommendations or information was provided by the Government of Newfoundland and Labrador on this topic. • During the Public Engagement period, ECCC further recommended expanding the bird colony buffer from 5 km to 10 - 15 km, as it would capture the highest density and largest increase in total foraging birds found within (ECCC, 2024h).	7.1., 7.3, 7.5, 7.6
Aerofauna Movement Patterns		Not avoided due to information and data gaps. Project-level impact assessment consideration recommended.	• Avoiding known flyways and migration routes when siting offshore wind projects can reduce collision risk (Hüppop et al., 2006). • ECCC provided the Committee with confidential maps showing available information on movement patterns for various species including, for example, GPS locations and interpolated movement tracks for individuals. • During engagement with an offshore wind developer in January 2024, the Committee heard they do not tend to use a standard setback distance around bird colonies when siting offshore wind project in other jurisdictions. Instead, proponents tend to track, model, and predict the distribution of birds. • In the February 2024 Indigenous Knowledge Advisory Group session, a participant noted that it is important to consider bird migratory routes when identifying areas for offshore wind development. The Committee's coastal buffer attempts to address this somewhat, but the Committee acknowledged bird migratory routes are data gaps at this time.	7.3

Constraint	Avoided	Approach (Removed from the Focus Area)	Key Considerations	Report Sections for Relevant Components
			• During February 2024 engagement with the Fisheries and Other Ocean Uses Advisory Group, a member suggested the exclusion of bird migratory routes and foraging areas. A similar suggestion was made during a February 2024 public engagement session to exclude the Atlantic migratory flyway at the west coast of the Island of Newfoundland. Note: see the "Bird Colonies and Foraging Areas" section of this table for information on foraging.	
Areas with High Bird Density		Not avoided. Project-level impact assessment consideration recommended.	• Eastern Canada Seabirds at Sea data provides some indication of areas with higher bird density; however, this information is based on opportunistic surveys and has survey effort gaps in the Focus Area. • ECCC is in the process of developing predictive density models.	7.3
Airports and Inland and Marine Aerodromes	X	10 km buffers around the islands of Newfoundland and Ramea	• Two airports are near the Focus Area. • Turbines can impact aircraft navigation systems, radar, and communications equipment. • Setback distances in other jurisdictions vary depending on the size of the specific wind farm. • Engagement did not result in any feedback specific to avoiding airports and inland and marine aerodromes when identifying initial offshore wind energy licencing areas. • Data only includes airports served by NAV Canada control towers or flight service stations. • Safeguard distance between airports and windfarms is unclear. The distance varies across jurisdictions and is dependent on project-specific factors.	7.13

Constraint	Avoided	Approach (Removed from the Focus Area)	Key Considerations	Report Sections for Relevant Components
Marine Traffic*	X	Vessel traffic routes identified in the Canadian Hydrographic Service's (2024) Vessel Traffic Routes dataset Additional 500 m buffer around ferry routes between ports on the Island of Newfoundland (Argentia and Port aux Basques) and Nova Scotia (North Sydney) because ferry routes were represented linearly in the dataset. Areas with greater than 0.3 vessels per day based on the DFO (2012-2021) Vessel Density Mapping dataset (all AIS carrying vessels)	• There is extensive marine vessel traffic throughout the Focus Area during all seasons, especially in the Cabot Strait and Placentia Bay. Vessels can include and are not limited to fisheries and research vessels, cargo vessels, passenger vessels, and cruise vessels, and can include both domestic and international traffic. Setback distances for offshore wind projects from marine traffic routes vary across jurisdictions. The Committee has found examples where buffers ranging from 3.7 - 9.3 km are used around marine traffic routes (Gahramanov & Beji, 2023). The Committee has also found examples where a standard risk matrix is used to select setback distances at a project-specific level (Maritime & Coastguard Agency, n.d.). • The Committee asked TC for any recommendations on buffers to apply to marine traffic routes either in general or related specifically to offshore wind development activities or other marine activities. TC indicated they do not have legislative authority to impose exclusion or safety zones or buffers. • The Canadian Hydrographic Service (2024) vessel traffic route dataset does not include known vessel routes into Stephenville and Corner Brook. DFO recommended using 2012 - 2021 annual summaries available on the Marine Atlas.	7.1, 7.7, 7.8, 7.13

Constraint	Avoided	Approach (Removed from the Focus Area)	Key Considerations	Report Sections for Relevant Components
Submarine Cables		Not avoided due to lack of publicly available data.	• Within the Focus Area there are both active and inactive submarine cables present. There are telecommunications cables that extend between Nova Scotia and Newfoundland and Labrador, as well as international cables between Europe and North America that may run through portions of the Focus Area (i.e., between the Island of Newfoundland and St. Pierre et Miquelon). • TeleGeography maintains an interactive map showing locations of global submarine cables. The Committee does not have access to nor verified datasets used to develop this resource. • Expert authorities did not provide the Committee advice on avoiding submarine cables when identifying initial offshore wind energy licencing areas. The Committee notes a pre-development survey would identify submarine cables to be avoided when siting a project. • During the Committee's engagement with public stakeholders in February 2024, participants suggested the consideration and removal of existing structures (e.g., pipelines and cables), military dumping grounds, and shipwrecks.	7.8
Military Use Sites and Unexploded Ordinances		Not avoided due to data and information gaps.	• The Royal Canadian Navy (RCN) and Air Force (RCAF) both conduct practice exercises and undertake planned military activities along Canada's coasts, including within the Focus Area. Activities may involve ships, submarines, aircraft, or other components. • Canada's Department of National Defence (DND) has designated areas in the Focus Area for exercises that involve both surface and sub-surface activities. There is potential for live firing and exercises may result in the deposition of unexploded ordinance (UXO) (i.e., bombs, grenades, artillery shells, flares, mortars, and hazardous residues resulting from partial or failed detonation) in various locations) (DND, 2021). • There are currently no known historic UXO sites located in or around the Focus Area.	7.8

Constraint	Avoided	Approach (Removed from the Focus Area)	Key Considerations	Report Sections for Relevant Components
			• Expert authorities did not provide the Committee with advice on avoiding military use sites or UXO sites when identifying initial offshore wind energy licencing areas. [48] • Engagement did not result in any feedback specific to avoiding military use sites or historic UXO sites when identifying initial offshore wind energy licencing areas. • While the Committee is aware of the broad areas determined for DND firing practice and exercise areas, there is currently no public dataset of georeferenced UXO sites.	
Physical and Cultural Heritage Sites		Not avoided due to information and data gaps. Some could be captured under the CCRI dataset applied (see Coastal-based Community Resources above)	• A cultural heritage resource is considered a human piece of work or place that has historic value, spiritual or cultural meaning, or provides evidence of past human activity. • Due to Newfoundland and Labrador's rich maritime history, there are many coastal features that are symbols of the province's past, holding great value to both residents, tourists, and researchers alike. • Expert authorities did not provide the Committee advice on avoiding physical and cultural heritage components when identifying initial offshore wind energy licencing areas. • In their November 2023 meeting with the Committee, MFN indicated support for further consideration of historical and culturally significant areas, noting that islands off the south coast of the Island of Newfoundland are archaeologically significant. • In their February 2024 engagement with public stakeholders, a participant suggested the consideration of culturally or historically significant Indigenous submerged areas.	7.1, 7.11

[48] The Committee did not confirm with the DND UXO and Legacy Sites Program but note in their recommendations that proponents should contact the department for specific information.

Constraint	Avoided	Approach (Removed from the Focus Area)	Key Considerations	Report Sections for Relevant Components
			• The Committee, to date, has not found any publicly available geospatial data on components related to physical and cultural heritage.	
Areas Important for Indigenous Use		MFN has indicated they intend to provide the Committee with advice on MAMKA/Natural Resources, including traditional harvesting and food fisheries. This was not received in time for inclusion in the Draft Report. The Committee will consider such information if received.	• The entire Focus Area and all offshore wind licencing areas are within the traditional lands and waters of MFN and QFN. These areas are also important for Indigenous commercial, ceremonial, and communal fisheries. • The Committee considered input from Indigenous peoples related to constraints applied and discussed above. • The CCRI dataset may include some areas important for Indigenous use.	7.1

Table Description: This table summarizes the Committee's analysis used to identify the initial offshore wind energy licensing areas for consideration. Considerations outlined in the table primarily recount information and engagement outcomes up to March 22, 2024 (when the preliminary offshore wind energy licencing areas were published in the Interim Report) or considerations that informed changes to the preliminary offshore wind energy licencing areas. Additional information and engagement outcomes related to each of the components assessed under the Regional Assessment are under various report sections. These are identified under the column 'Report Sections for Relevant Components'.

*New or updated constraint application since the Interim Report.

Sources: Birds Canada, 2024; DFO, 2004a; 2017g; c; d; 2019l; ; 2023ff; gg; o; p; x; 2024g; DND, 2021; ECCC, 2015a; 2016a; 2023g; l; 2024a; h; DOECC 2022; 2023; FFA, 2020; Gahrmanov & Beji, 2023; Hüppop et al., 2006; IUCN & UNEPWCMC, 2011; Jago & Tailor, 2002; Kenchington et al., 2016; Key Biodiversity Areas, n.d.; Maritime & Coastguard Agency, n.d.; NRCan, 2022a; Nielson & Hemmer, 2017; Ohayon et al, 2021; Parks

Canada, 2023a; b; d; 2024; Robinson Willmott et al. 2013; Ronconi et al., 2022; Sea Duck Joint Venture, n.d.a; SEANSE Project Partners, 2019; *SARA,* 2002; TC, 2021; Templeman, 2007; UNESCO World Heritage Centre, 2023; Wieduwilt & Wirth, 2018; *WER Act*, 1980.

Overall, the Committee applied a coastal buffer, and removed marine critical habitats, marine protected areas, marine traffic routes and areas with high vessel density, national marine conservation areas, areas surrounding national parks and world heritage sites, high-density commercial fishing areas, and areas identified in the CCRI (1996 - 2007 dataset, and the unpublished CCRI update) from the Focus Area to identify initial offshore wind energy licencing areas. Applying a coastal buffer means the Committee would recommend offshore wind development not occur within a certain distance of the coast. The coastal buffer included a 10 km buffer around the Island of Newfoundland, a 10 km buffer around the Island of Ramea, a 5 km buffer around each island with bird colonies, a 65 km buffer around Cape St. Mary's, and a 3 km buffer around any coastal islands not already avoided by a minimum of 3 km after applying other coastal buffers.[49]

6.3.4 Using a Coastal Buffer

The Committee applied a buffer around the Island of Newfoundland and other coastal islands within the Focus Area to reduce or avoid several potential impacts of offshore wind development (Figure 6.2). The Committee has seen several examples of coastal buffers used at the licencing or project assessment stage to reduce impacts of offshore wind projects in other jurisdictions. These include buffers ranging from 1-20 km and some recommendations suggesting larger buffers (e.g., 30 – 40 km) could be preferred around the coast (Musial & Ram, 2010; Spyridonidou & Vagiona, 2020; USAID, 2022; Zuckerman et al., 2023). Coastal buffers are typically used to limit the impact of offshore wind projects to viewscapes but have also been based on jurisdictional zoning in some jurisdictions.

For offshore Newfoundland and Labrador, the Committee is of the view that a coastal buffer should be used as a starting point when identifying licencing areas to alleviate various impacts of offshore wind development.

The Committee used a coastal buffer to address the following constraints:

- Important areas for birds including Aerofauna Critical Habitat, Bird Colonies, Sea Duck Key Habitat Sites, Important Shorebird Sites, Red Knot Important Stopover Sites, and Lawn Island Archipelago;
- KBAs;
- Coastal ferry routes;
- Marine Refuge or Fisheries Closures;
- Coastal fisheries, such as lobster fisheries;

[49] ECCC provided additional information on extending bird colony buffers to at least 10 - 15 km during the Public Comment Period. The Committee recommends when the regulator determines licencing areas, that this information be considered.

- Recreational and subsistence harvesting of marine resources;
- Aquaculture Sites and Licenses;
- Airports and Marine Aerodromes;
- Provincially protected areas;
- Community and Cottage Viewscapes & Soundscapes; and
- Tourism.

Figure 6.2. Using a Coastal Buffer to Reduce Offshore Wind Development Impacts on Coastal Species and Activities

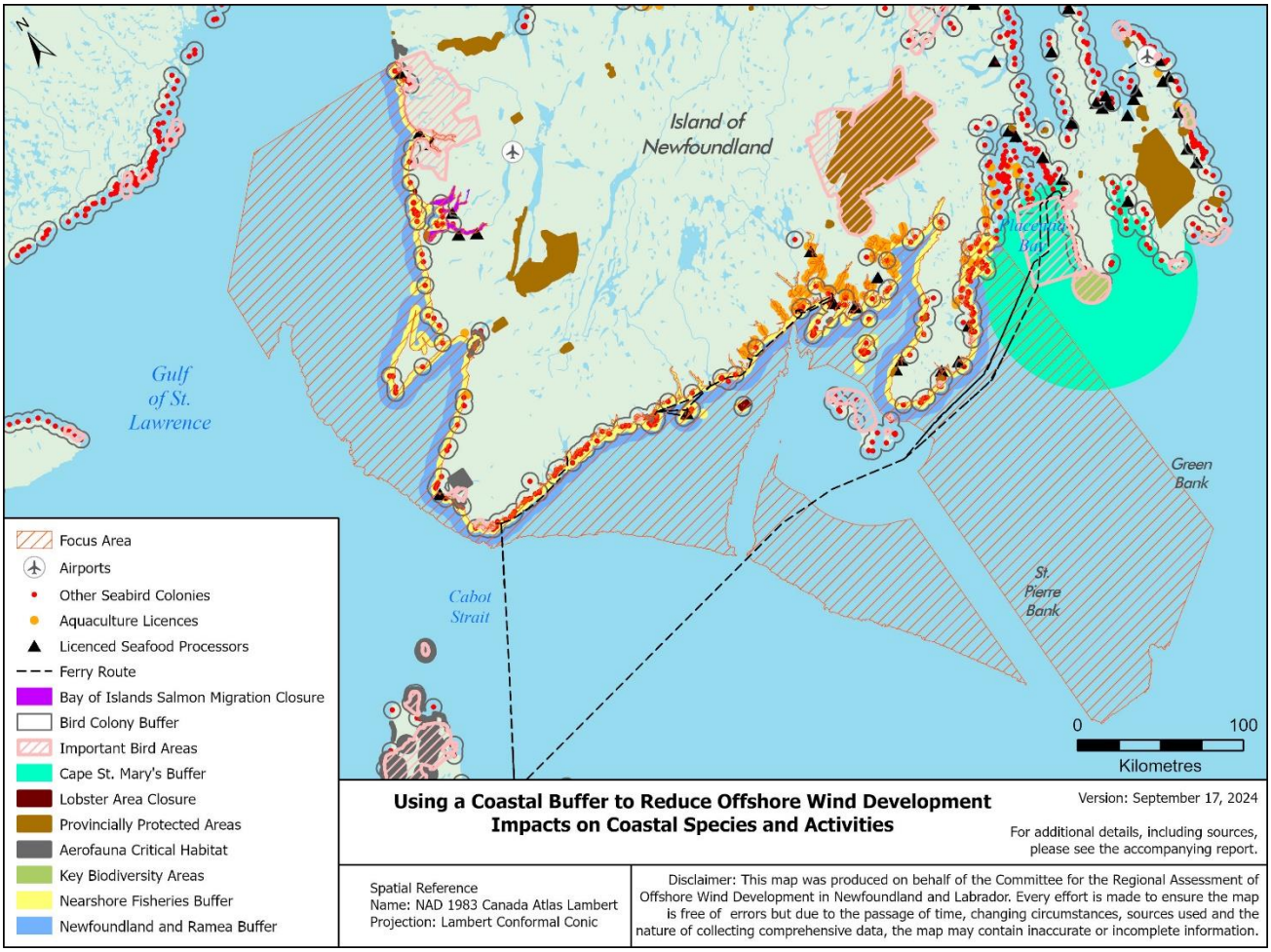


Figure Description: This map depicts the coastal buffer applied by the Committee in the constraints analysis in relation to various components for which a coastal buffer could reduce or avoid impacts of offshore wind development. Applying a coastal buffer means the Committee would recommend offshore wind development not occur within a certain distance of the coast. The coastal buffer applied by the Committee in the constraints analysis includes a 10 km buffer around the islands of Newfoundland and Ramea, a 5 km buffer around each coastal island with bird colonies, a 65 km buffer around Cape St. Mary's Bird Colony and Ecological Reserve, and a 3 km buffer around any other coastal island in consideration of nearshore fisheries.

Data Sources: Canadian Hydrographic Service, 2024; ECCC, 2015a; 2016a; ECCC, 2023g; FFA, 2020; n.d.; IAAC, 2023a; KBAs Canada, 2024; NRCan, 2023; Regional Assessment Committee, 2024a; b; d; e; TC, 2021.

6.3.5 Constraints Analysis Steps

The following map series shows each step in the constraints analysis. Appendix F: GIS Methods includes detailed descriptions of technical steps taken during analysis.

Figure 6.3. Step 1: Removing a Coastal Buffer

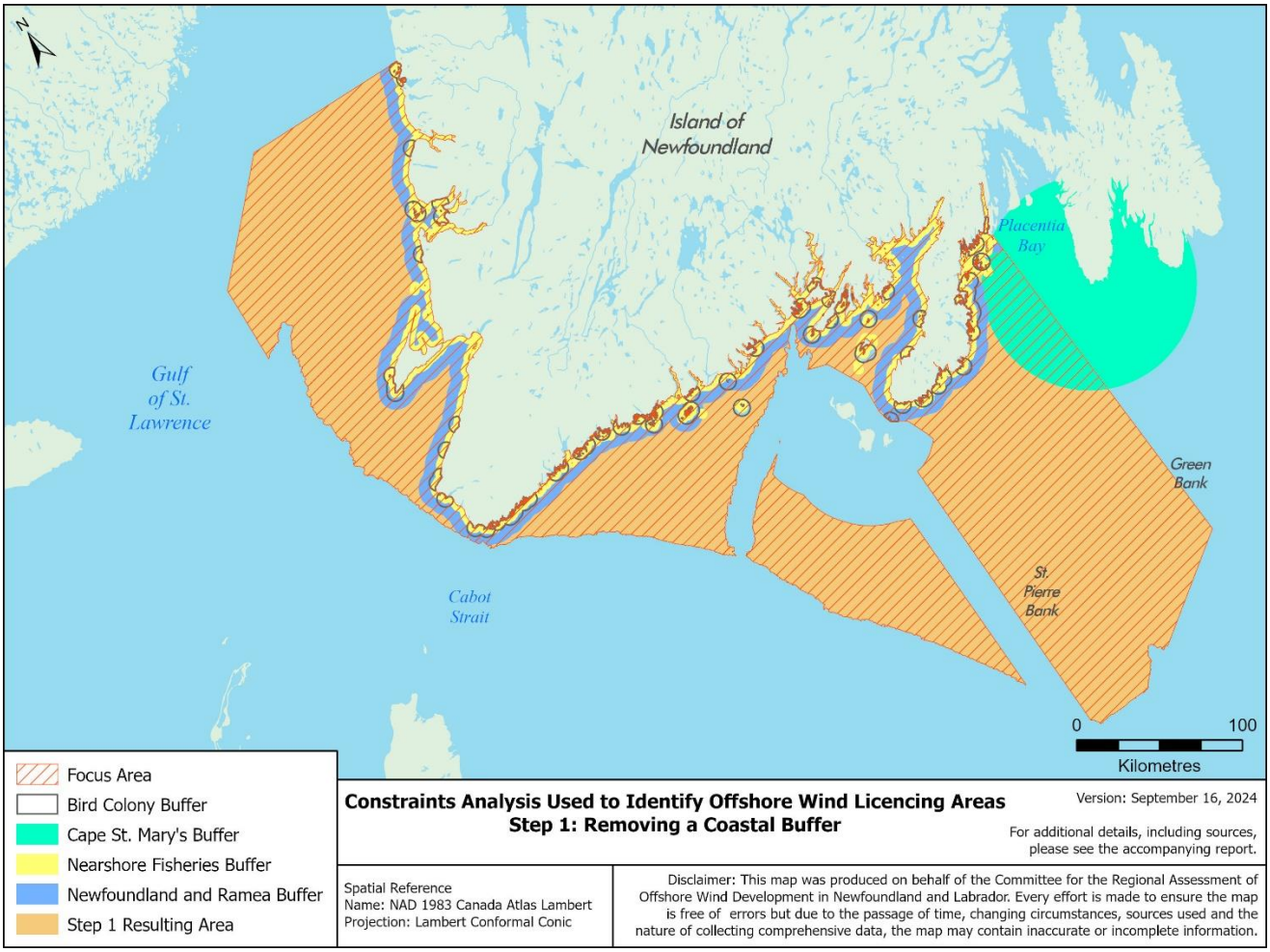


Figure Description: This map depicts the removal of a coastal buffer from the Focus Area and the Resulting Area 1. The coastal buffer included a 10 km buffer around the islands of Newfoundland and Ramea, a 5 km buffer around each coastal island with bird colonies, a 65 km buffer around Cape St. Mary's Bird Colony and Ecological Reserve, and a 3 km buffer around any other coastal island in consideration of nearshore fisheries. Resulting areas refer to remaining portions of the Focus Area after each step in the constraints analysis. The final resulting area, Step 9 Resulting Area, was used to identify initial offshore wind energy licencing areas.

Data Sources: IAAC, 2023a; NRCan, 2023; Regional Assessment Committee, 2024a; b; d; e; h.

Figure 6.4. Step 2: Removing Marine Critical Habitat

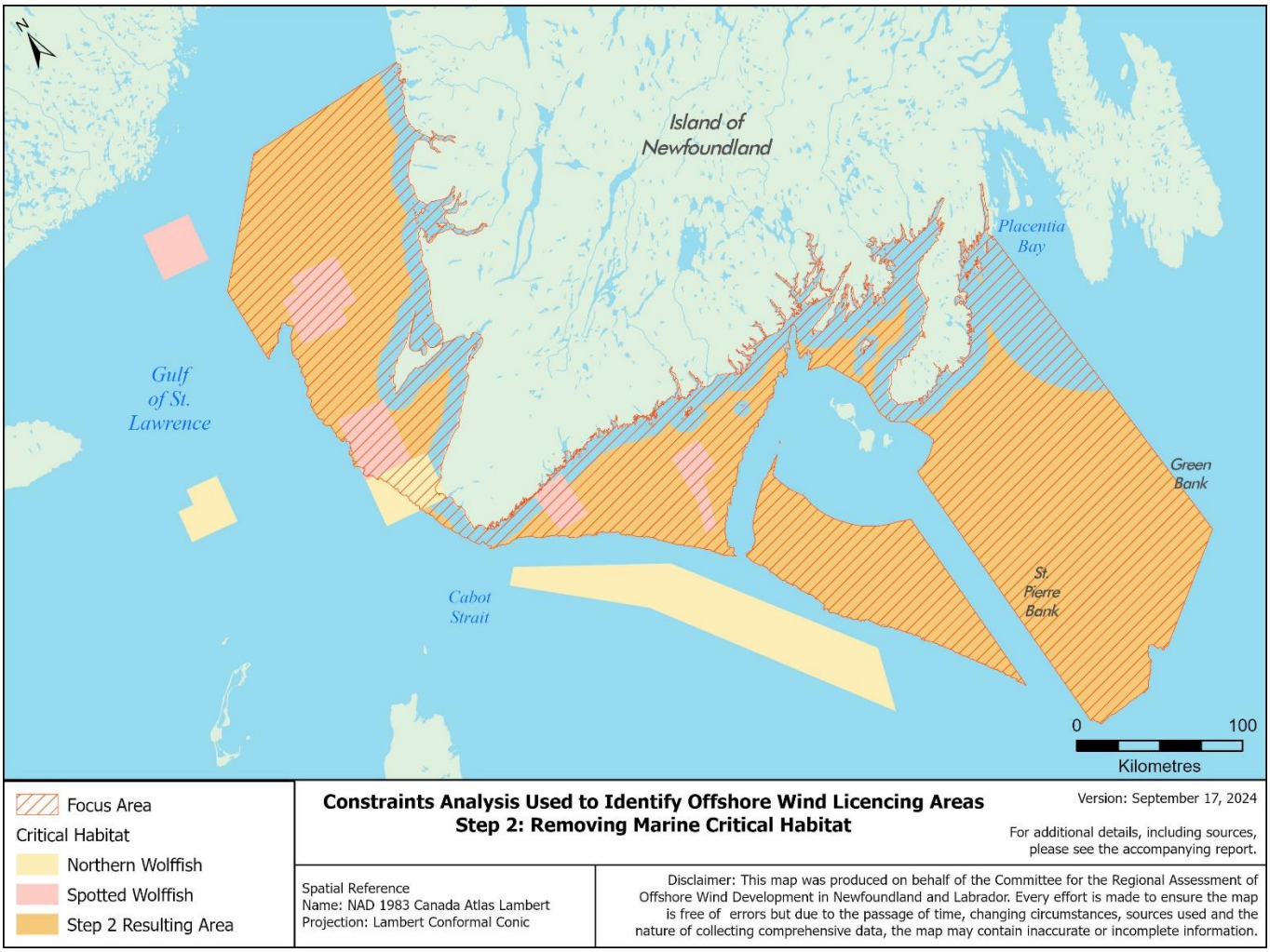


Figure Description: This map depicts the removal of all the above constraints and marine species at risk critical habitat from the Focus Area, and the Resulting Area 2.

Data Sources: DFO 2024b; IAAC, 2023a; NRCan, 2023; Regional Assessment Committee, 2024i.

Figure 6.5. Step 3: Removing Marine Protected Areas

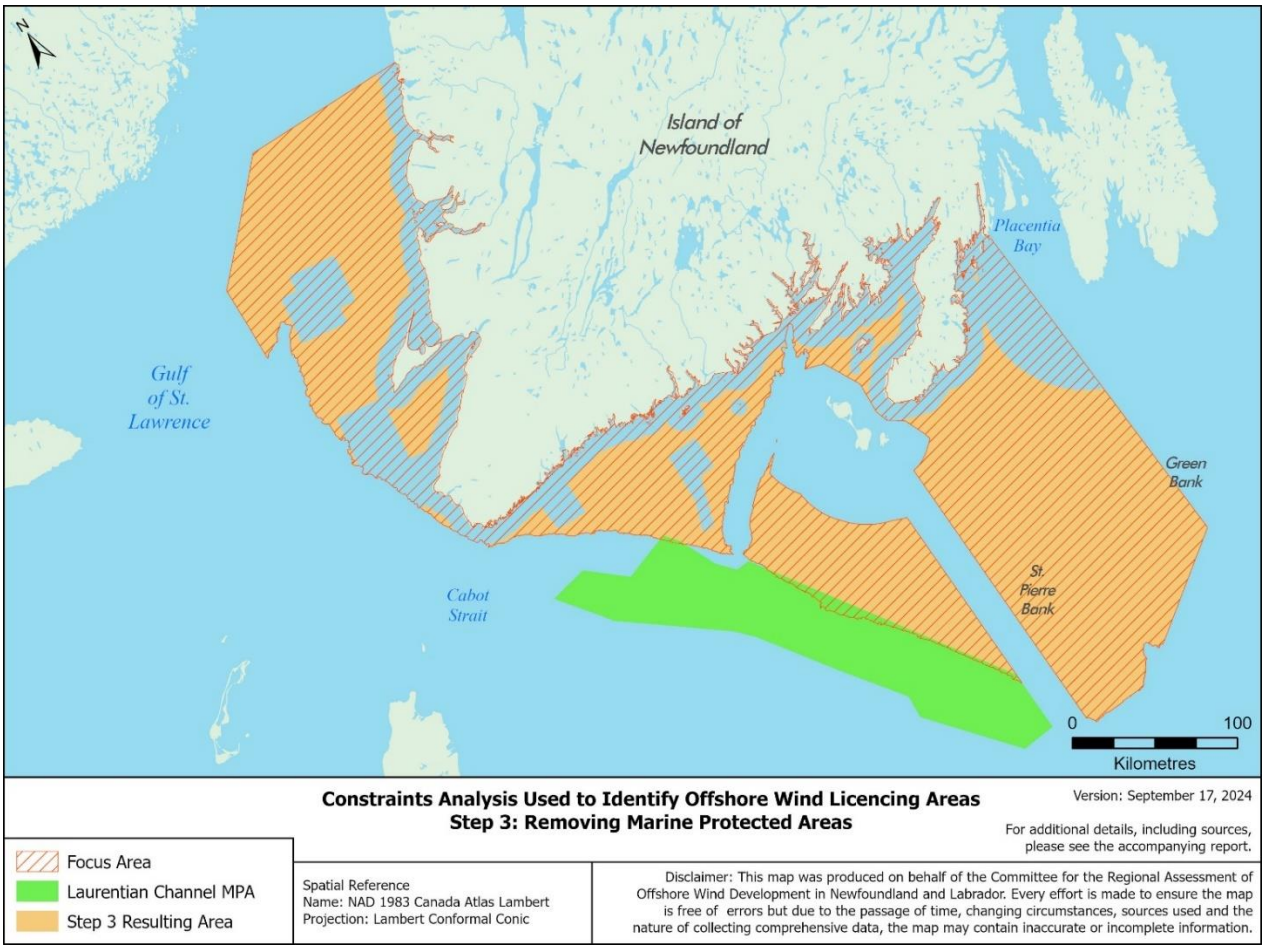


Figure Description: This map depicts the removal of all the above constraints and MPAs from the Focus Area, and the Resulting Area 3.

Data Sources: DFO, 2023x; IAAC, 2023a; NRCan, 2023; Regional Assessment Committee, 2024j.

Figure 6.6. Step 4: Removing Marine Traffic Routes

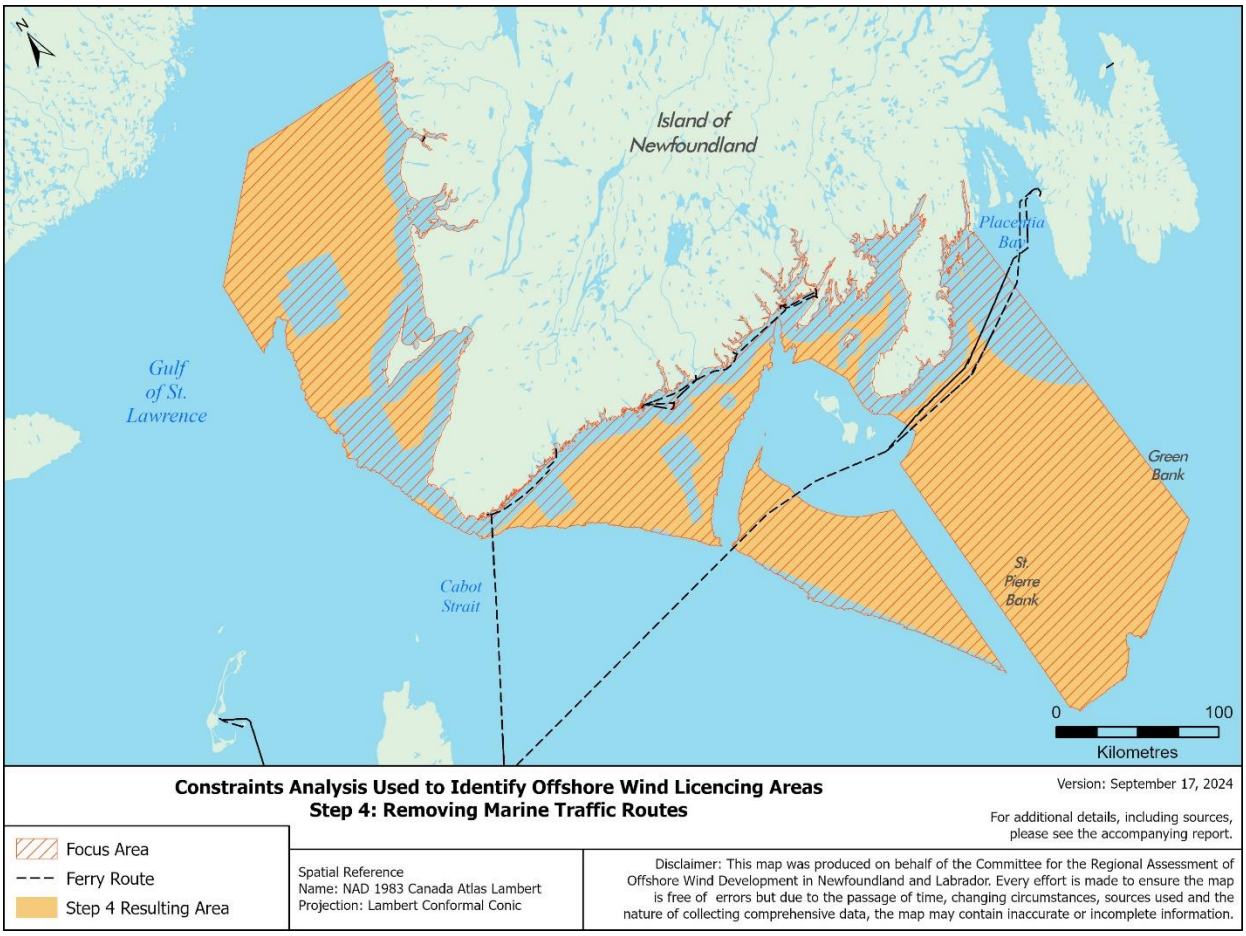


Figure Description: This map depicts the removal of all the above constraints and marine traffic routes from the Focus Area, and the Resulting Area 4. Marine traffic routes removed include only those delineated in the Canadian Hydrographic Service (2024) Vessel Traffic Routes dataset.

Data Sources: Canadian Hydrographic Service, 2024; IAAC, 2023a; NRCan, 2023; Regional Assessment Committee, 2024k.

Figure 6.7. Step 5: Removing Areas with High Vessel Traffic

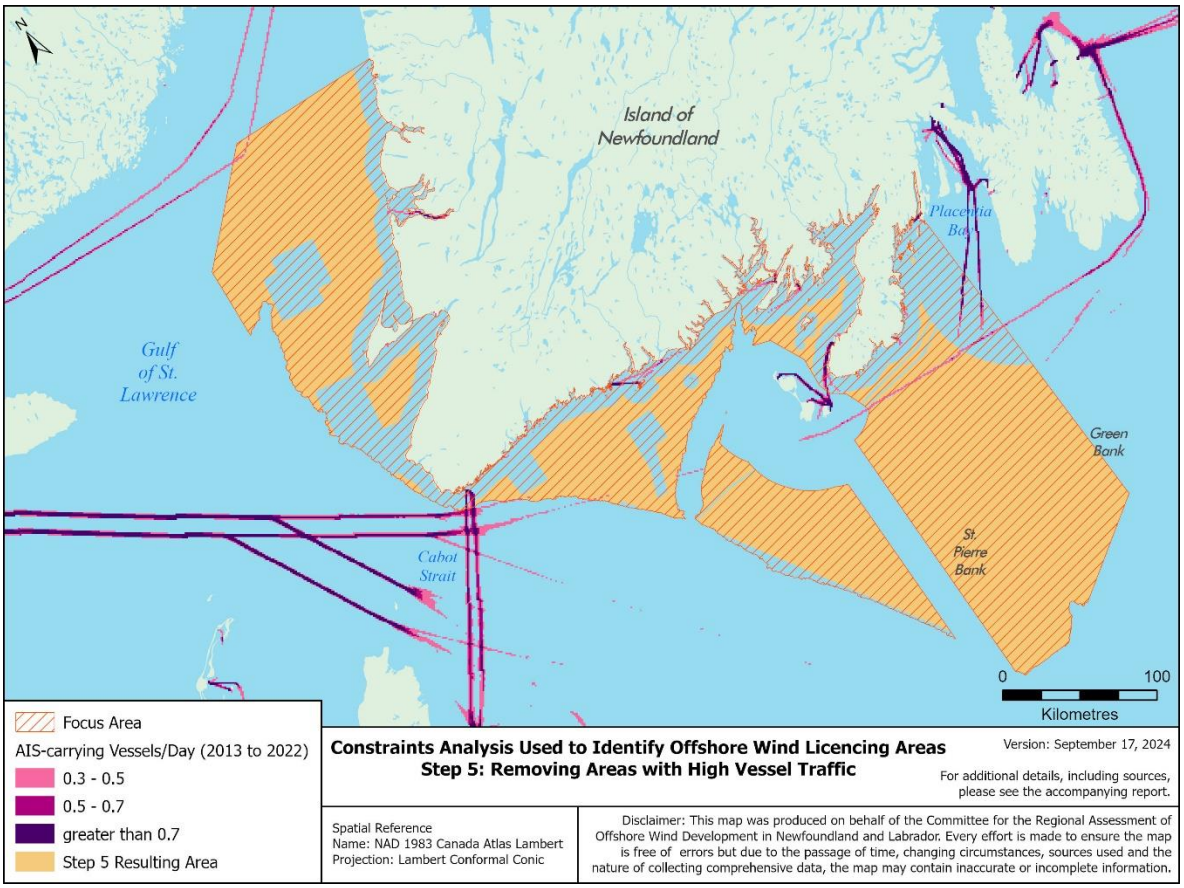


Figure Description: This map depicts the removal of all the above constraints and any areas with greater than 0.3 vessels per day, and the Resulting Area 5. All AIS carrying vessels were considered in the analysis.

Data Sources: DFO, 2024p; IAAC, 2023a; NRCan, 2023; Regional Assessment Committee, 2024l.

Figure 6.8. Step 6: Removing the South Coast Fjords National Marine Conservation Study Area

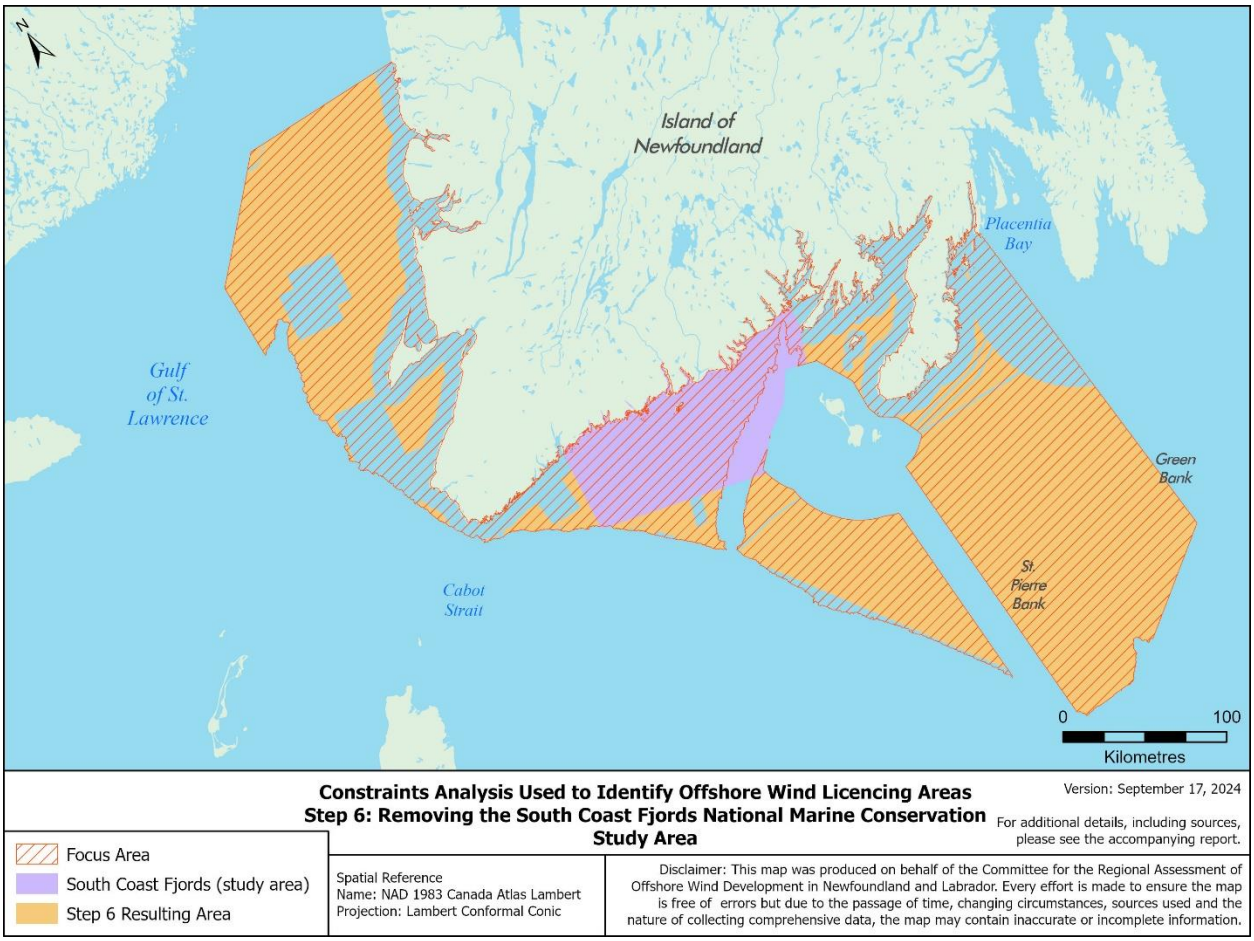


Figure Description: This map depicts the removal of all the above constraints and any existing or proposed NMCAs from the Focus Area, and the Resulting Area 6. As shown in the map, the proposed South Coast Fjords NMCA Study Area is the only NMCA in the Focus Area.

Data Sources: IAAC, 2023a; NRCAN, 2023; Parks Canada, 2024; Regional Assessment Committee, 2024m.

Figure 6.9. Step 7: Removing Areas Near National Parks and World Heritage Sites to Reduce Impacts to Viewscapes

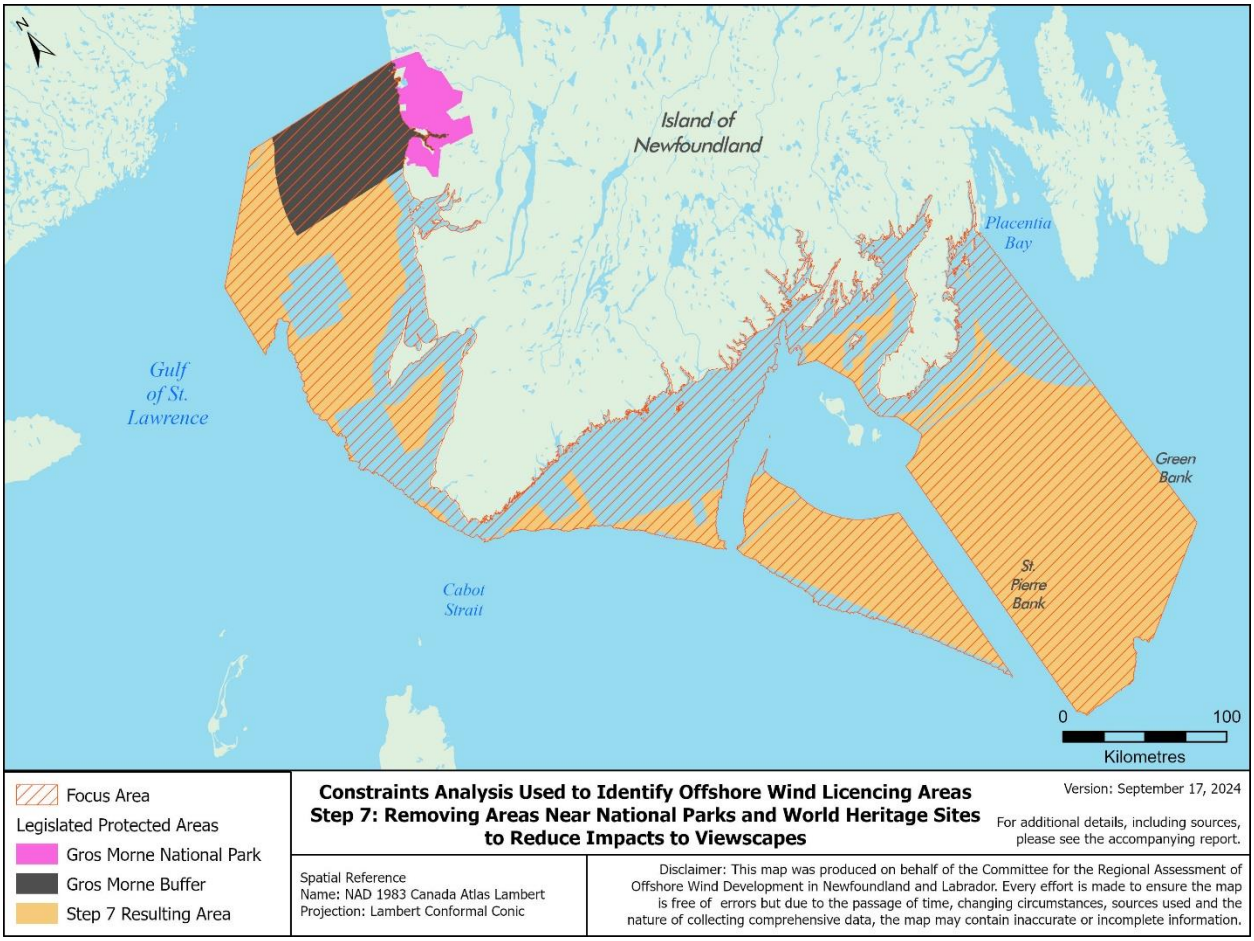


Figure Description: This map depicts the removal of all the above constraints and areas around national parks and WHSs from the Focus Area, and the Resulting Area 7. The Committee applied and removed an 80 km buffer perpendicular to the coastal boundary of Gros Morne National Park and WHS. Sandbanks Provincial Park (proposed redesignation to a national park) also occurs along the coastal boundaries of the Focus Area; however, the previously removed South Coast Fjords NMCA Study Area surrounds Sandbanks.

Data Sources: IAAC, 2023a; NRCAN, 2022; 2023; Regional Assessment Committee, 2024c; n.

Figure 6.10. Step 8: Removing High Density Fishing Areas

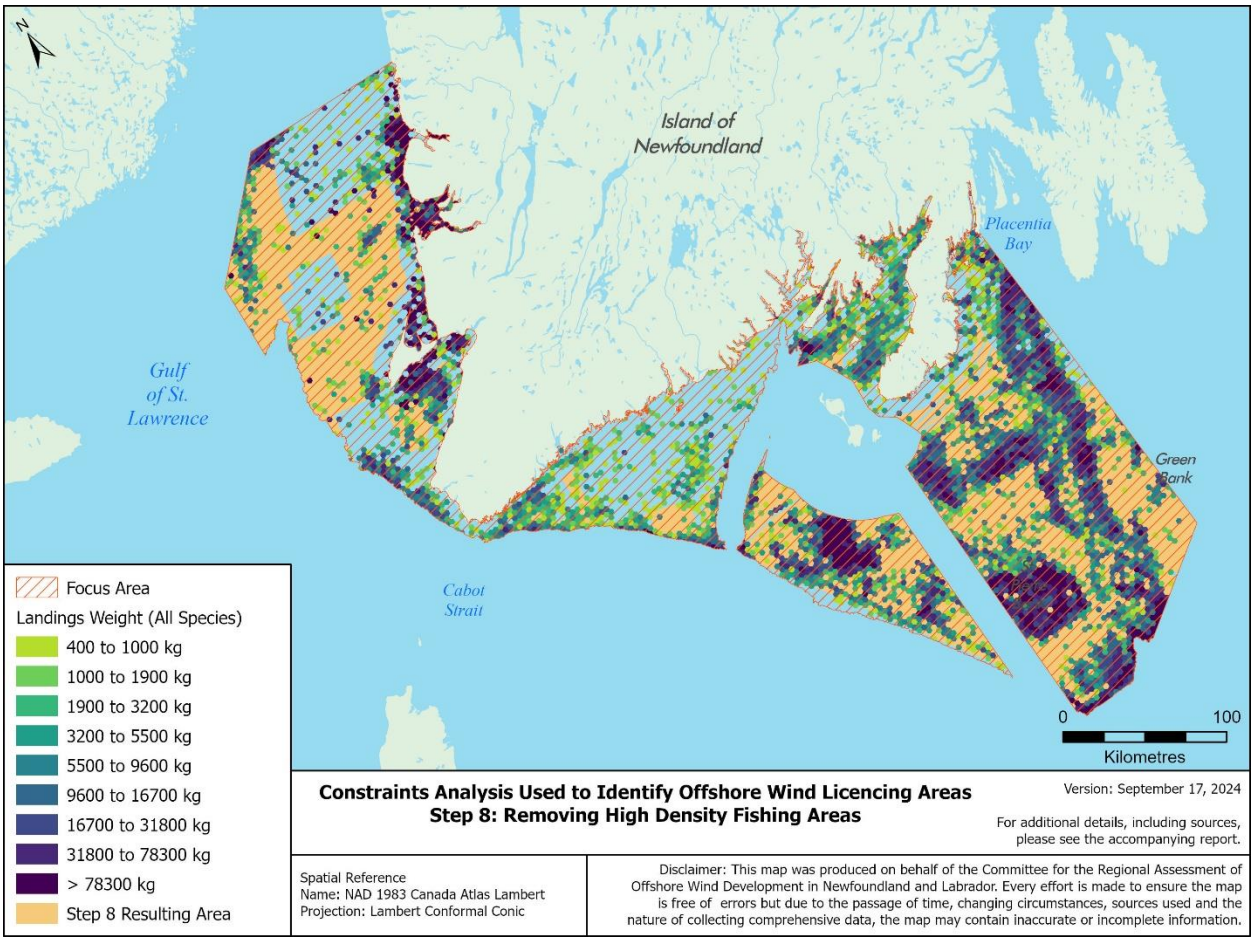


Figure Description: This map depicts the removal of all the above constraints and high-density fishing areas from the Focus Area, and the Resulting Area 8. High density fishing areas were identified based on DFO's (2023g) Eastern Canada Commercial Fishing, All Species dataset (2012 - 2021). Areas with an average catch density greater than 400 kg were removed from the Focus Area. This represents 90% of commercial fishing density accounted for in the dataset, after being clipped to the Focus Area.

Data Sources: DFO, 2023g; IAAC, 2023a; NRCan, 2023; Regional Assessment Committee, 2024o.

Figure 6.11. Step 9: Removing Community-based Coastal Resources

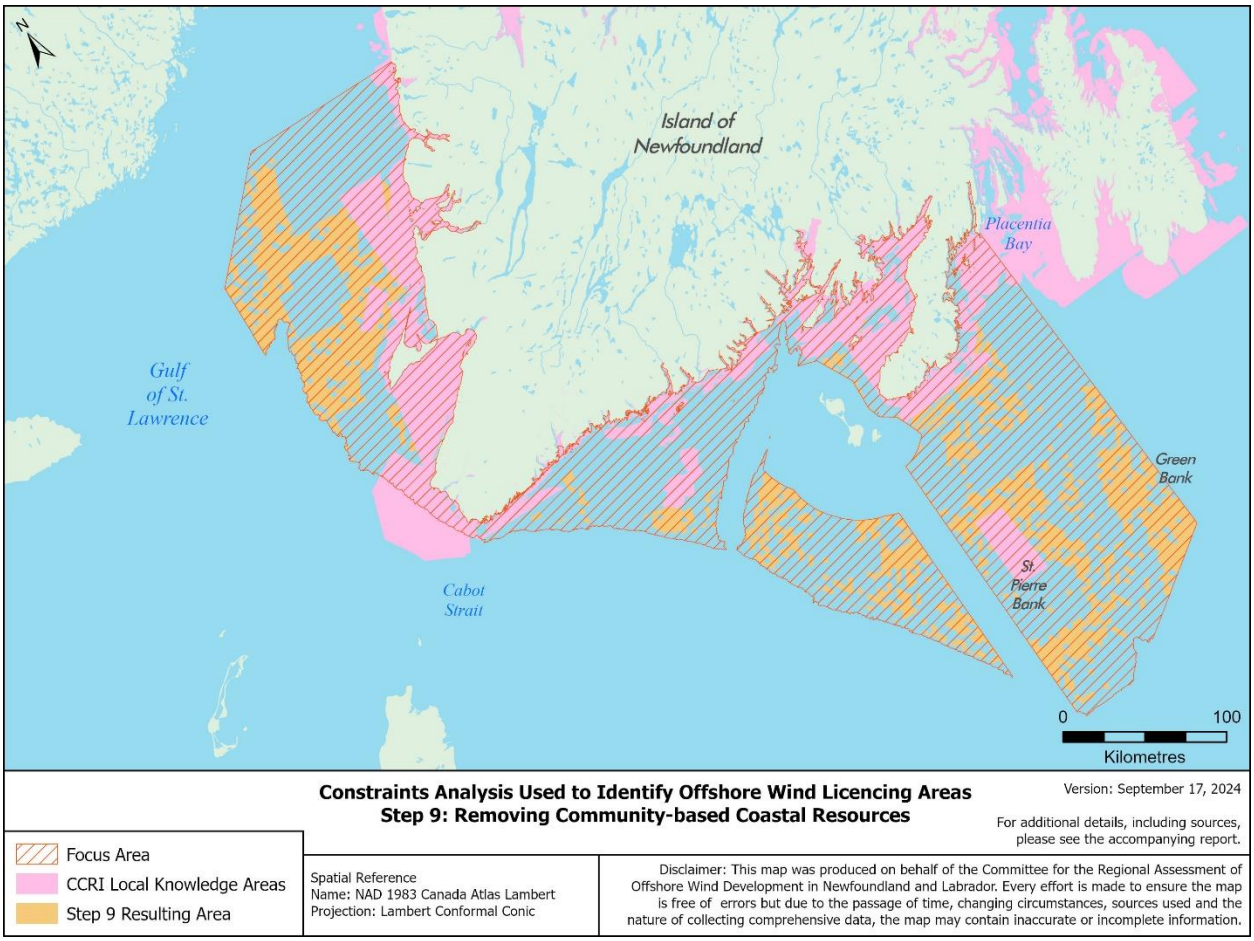


Figure Description: This map depicts the removal of all the above constraints and features identified in the CCRI, and the Resulting Area 9. The CCRI contains several decades' worth of local knowledge. Information was gathered through interviews with individuals who had extensive knowledge of the immediate geography and resources, having lived, worked and harvested the regions over a lifetime. CCRI local knowledge areas shown in the map include areas in the publicly available DFO (2023ff) dataset and groundfish data from DFOs forthcoming CCRI update. The unpublished CCRI groundfish data was provided to the Committee by DFO for use in the Regional Assessment.[50]

Data Sources: DFO, 2023ff; 2024f; IAAC, 2023a; NRCan, 2023; Regional Assessment Committee, 2024p.

[50] The dataset published in 2023 represents data collected from 1997 - 2007, and the soon to be published update will include data from 2021 - 2024.

Figure 6.12. Result: Initial Offshore Wind Energy Licencing Areas for Consideration

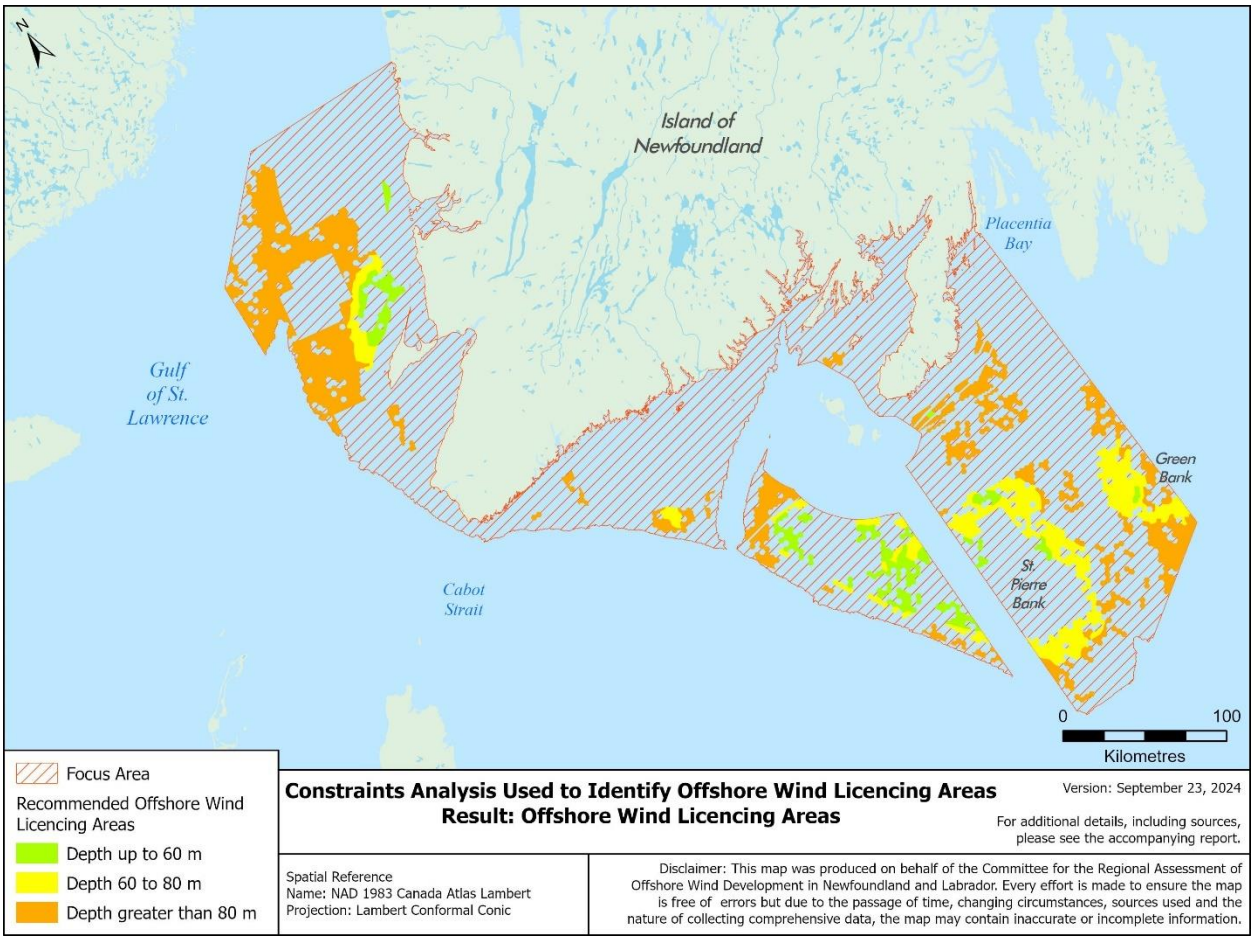


Figure Description: This map depicts initial offshore wind energy licencing areas for consideration, which resulted from the removal of all the above constraints. The map additionally depicts which of these areas may be suitable for technologies designed for depths up to 60 m, 60-80 m, and 80-300 m. The map was produced using Step 9 Resulting Area (from Figure 6.11). Additional steps were applied to complete the resulting offshore wind licencing areas such as filling small holes and removing slivers and isolated polygons. Licencing areas were categorized by water depth (up to 60 m, 60-80 m and greater than 80 m) and small, isolated resulting areas were combined with surrounding areas. Any separated areas that were less than 10 km² in size were also removed where appropriate. Further details on analysis steps are outlined in Appendix F: GIS Methods.

Data Sources: NRCan, 2023; Regional Assessment Committee, 2024f.

6.4 Initial Offshore Wind Energy Licencing Areas for Consideration

Initial *offshore wind energy licencing areas for consideration are shown in Figure 6.12 above. Overall, these areas total 16, 996 km²*.

Areas in green are areas where depth does not exceed 60 m (i.e. suitable for fixed bottom turbines). Areas in yellow are areas where depths are between 60 – 80 m (i.e. suitable for fixed bottom turbines in the foreseeable future). Areas in orange are areas where depths are between 80 – 300 m (i.e., suitable for floating turbines in the foreseeable future).

Specifically, the Committee identified:

- 24 areas where depths do not exceed 60 m, totaling an area of approximately 1,994 km².
- 19 areas where depths are between 60 – 80 m, totaling an area of approximately 4,942 km².
- 66 areas where depths are between 80 – 300 m, totaling an area of approximately 10,060 km².

Initial offshore wind energy licencing areas were classified according to these depths at the time of the Committee's analysis. Offshore wind development technology is quickly advancing, and newer technologies may allow for fixed installations up to 100 m (Buljan, 2024). This means greater than 4,942 km² may be suitable for fixed bottom turbines in the foreseeable future.

Figure 6.13 shows all initial offshore wind energy licencing areas where depth does not exceed 60 m. In the case that offshore wind development proceeds in the initial offshore wind energy licencing areas, the Committee anticipates developers would prefer shallower areas, where fixed bottom foundations are technically feasible. [51] Geological substrate will also be an important consideration for where, and what type of offshore wind development would proceed.[52] The Committee is aware that NRCan plans to undertake more detailed studies of the seabed geology offshore Newfoundland and Labrador.[53]

[51] This assumption is based on meetings held with offshore wind developers in October 2023.
[52] See Section 4 of this Report for information on foundation types, suitable depths, and ideal substrate type.
[53] Natural Resources Canada presented the Committee an overview of the Offshore Wind Development Program. The presentation is available on the Registry Page under document reference number 258.

Figure 6.13. Initial Offshore Wind Energy Licencing Areas for Consideration at Depths Suitable for Fixed Bottom Technologies

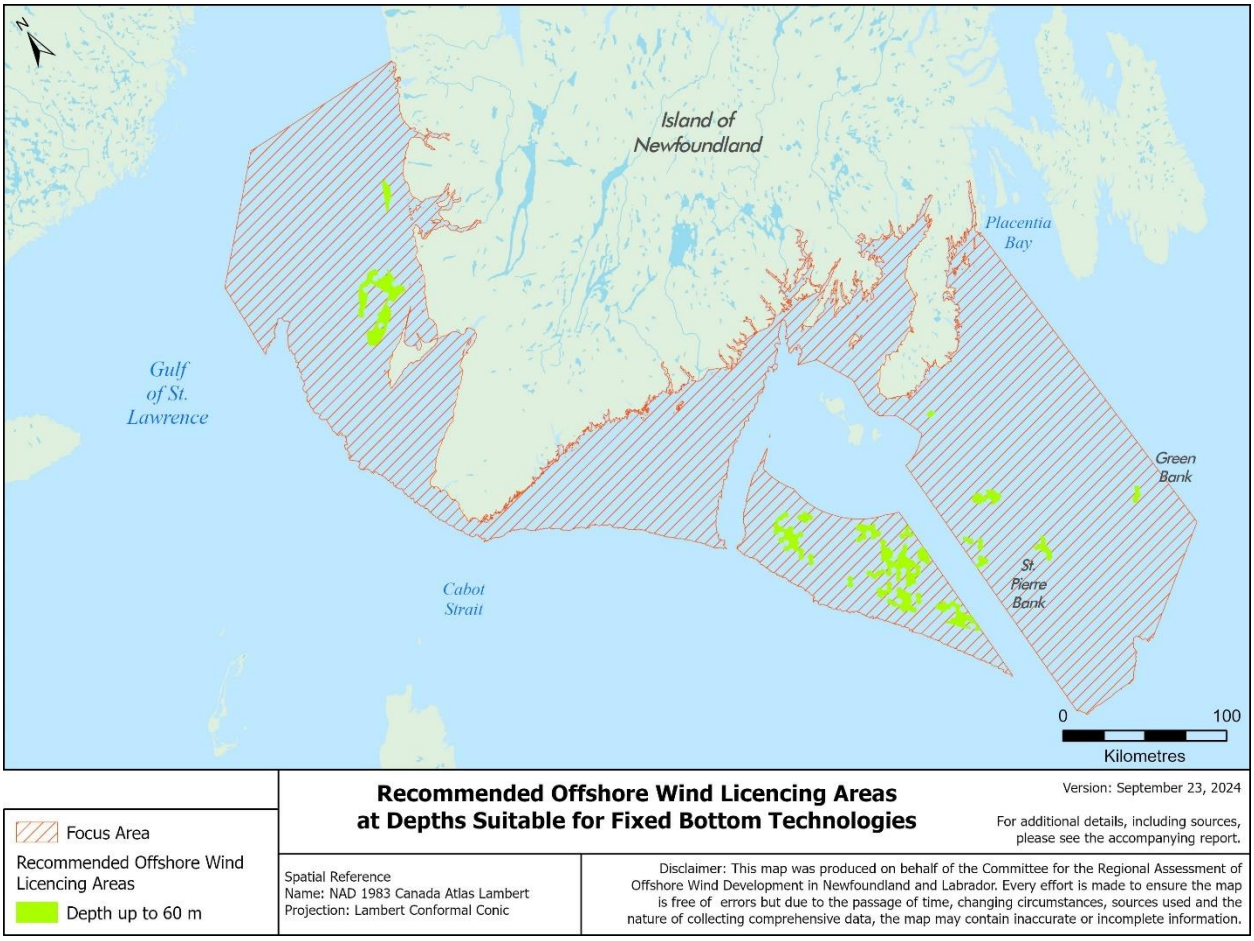


Figure Description: This map illustrates the initial offshore wind energy licencing areas for consideration identified by the Committee, where water depth is less than 60 m. The Committee anticipates developers would prefer shallower areas, where fixed bottom foundations are technically feasible. All initial offshore wind energy licencing areas recommended by the Committee are shown in Figure 6.12 above. Offshore wind development technologies are developing quickly. Fixed bottom foundations may be suitable in deeper waters overtime.

Data Sources: NRCan, 2023; Regional Assessment Committee, 2024g.

The licencing areas identified in this Regional Assessment are Committee recommendations. They were selected because, as a starting point, development in these areas could have a lesser impact on the environmental, health, social, and economic components considered under the Regional Assessment, when compared to other parts of the Focus Area.

The initial offshore wind energy licencing areas identified in this Report are not to suggest development will occur in those areas. These areas should be used to aid the governments of Canada and Newfoundland and Labrador to decide on licencing areas.

Furthermore, the Committee does not expect the initial offshore wind energy licencing areas would be the only licencing areas over time. Several constraints the Committee used to delineate initial licencing areas are dynamic in nature. The Committee also identified several data and information gaps in their work (see Section 7 of this Report). This should be considered when selecting licencing areas and siting projects.

The Committee anticipates licencing areas will evolve as more information and data becomes available and as experience is gained in the Canada-Newfoundland and Labrador offshore wind industry. The Committee also anticipates that multiple rounds of offshore wind licencing will take place in the Offshore Area.

6.4.1 Recommendations for Future Offshore Wind Licencing Processes

The Committee recommends the following to inform future planning and licencing processes for offshore wind development. Recommendations to address data gaps and limitations related to each component assessed under the Regional Assessment are under Section 7 of this Report.

- The Committee recommends that, as a high priority, the Government of Canada should reinstate a long-term commitment to funding MSP and key initiatives currently contributing to MSP.
  - The Government of Canada should continue to support DFO's development and maintenance of the Atlas to assist in MSP.
  - The Government of Canada should continue to support NRCan's development and maintenance of the OSDP.
  - The Government of Canada should facilitate effective communication and collaboration across departments and agencies with relevant data, information, expertise and ongoing initiatives relevant to MSP.
- The Committee recommends that, as a high priority, the governments of Canada and Newfoundland and Labrador should further develop a marine spatial plan and that this should continue to be supported by the further development of the Atlas.

  - The Government of Canada should continue to support DFO's MSP initiative for the Newfoundland and Labrador region.
  - The plan should incorporate known biotic and abiotic features of the area; current human uses, including all data submitted by fishers to DFO;[54] existing development; and protected areas.
  - A component of the plan should include zoning areas for potential development of marine based alternative energy projects, within which offshore wind areas could be selected for licencing consideration to help reduce conflict in advance of impact assessment processes.
  - MSP should be a participatory process done with all relevant government agencies, Indigenous peoples and stakeholders.
- The Committee recommends that the governments of Canada and Newfoundland and Labrador include Indigenous peoples and Indigenous knowledge in the offshore wind regulatory licencing processes and monitoring and baseline research.
- The Committee recommends that the governments of Canada and Newfoundland and Labrador include existing ocean users, such as local fishers, in the offshore wind regulatory licencing processes and monitoring and baseline research.
- The Committee recommends that the C-NLOER re-evaluate the constraints used in this Report and other initiatives informing licencing areas, as necessary or appropriate (determined by C-NLOER). This work should engage with relevant government agencies, Indigenous peoples and stakeholders to establish their validity over time.
- The Committee recommends that the C-NLOER require developers to implement a follow-up and monitoring program for all offshore wind development projects and that the C-NLOER maintain a data repository to track ongoing results.[55] Any follow-up and monitoring program must be transparent, with information available free to the public through a public repository. Tracked information should include:
  - Data on existing conditions (i.e., before development) and predicted baselines for comparison should be tracked.
  - Observed effects of offshore wind development should be monitored and tracked.
  - Mitigation measures implemented, and their effectiveness should be monitored and tracked.
  - Results of R&D and/or pilot projects should be monitored and tracked.
- The Committee recommends that the governments of Canada and Newfoundland and Labrador conduct multiple rounds of identifying offshore wind licencing areas as more information and data becomes available and as experience is gained in the Canada-Newfoundland and Labrador offshore wind industry.
- The Committee recommends that the federal Minister of Environment and Climate Change does not exclude future offshore wind projects within the Study Area from future project-level impact assessments, including at sites within the initial offshore wind licencing areas for consideration.
- The Committee recommends that, should portions of the Offshore Area become exclusively provincial jurisdiction, the provincial Minister of Environment and Climate Change require all offshore wind development projects undergo environmental assessments. The Committee also recommends that these assessments be considered as a case where cooperation and coordinated action between the federal and provincial governments (and possibly another

[54] Due to privacy screening and the 'Rule of Five', all data may not be displayed in a MSP.
[55] From the IAA: "Follow-up program means a program for verifying the accuracy of the impact assessment of a designated project and determining the effectiveness of any mitigation measures" (Impact Assessment Act, S.C. 2019, c. 28, s. 1.).

jurisdiction) is needed.[56] Offshore wind development projects within the bays could result in adverse effects within federal jurisdiction including:

- non-negligible adverse changes to fish and fish habitat, as defined in subsection 2(1) of the *Fisheries Act*, 1985*;* aquatic species, as defined in subsection 2(1) of *SARA*; and migratory birds, as defined in subsection 2(1) of the *Migratory Birds Convention Act,* 1994*.*
- with respect to the Indigenous peoples of Canada, a non-negligible adverse impact on physical and cultural heritage, the current use of lands and resources for traditional purposes, or any structure, site or thing that is of historical, archaeological, paleontological, or architectural significance.
- a non-negligible adverse change occurring in Canada to the health, social, or economic conditions of the Indigenous peoples of Canada.
- a non-negligible adverse change to the marine environment that is caused by pollution and that would occur outside Canada.
- a non-negligible adverse change — that is caused by pollution — to boundary waters or international waters, as those terms are defined in subsection 2(1) of the *Canada Water Act*, 1985, or to interprovincial waters.

- The Committee recommends that the governments of Canada and Newfoundland and Labrador, in collaboration with industry and researchers, support research and development regarding offshore wind turbines under various local conditions (e.g., icebergs and deeper waters). This includes exploring technologies and management approaches in areas where offshore oil and gas platform operators are exploring reducing emissions via electricity from offshore wind turbines.
  - Adequate funding through multi-year budget commitments from both federal and provincial governments should be provided to support initiatives and further research.
- The Committee recommends that the governments of Canada and Newfoundland and Labrador be transparent and continue engagement with Indigenous peoples, fisheries, stakeholders, and public as the offshore wind development regulatory framework and industry develop in the province.
  - Adequate funding support should be provided through a multi-year budget by both federal and provincial governments to support internal and external engagement and education about offshore wind.
- The Committee recommends that the governments of Canada and Newfoundland and Labrador consider all new information or advice noted in the Final Report (e.g., ECCC recommendation on increasing the bird colony buffer to 10 - 15 km). Engagement should continue with government departments with subject-matter experts to ensure the most up-to-date information and recommendations are utilized.

[56] From the IAA: Coordinated action is the collaboration between "jurisdictions that have powers, duties and functions in relation to the assessment of the effects of designated projects" (Impact Assessment Act, S.C. 2019, c. 28, s. 1.). In addition to federal and provincial authorities a jurisdiction can include, for example, an Indigenous governing body that has powers, duties or functions in relation to an assessment of the environmental effects of a designated project. Section 2 of the IAA should be referenced for the full definition of the term jurisdiction.

7. Assessment of Environmental, Health, Social, and Economic Components

This Regional Assessment considers the following environmental, health, social, and economic components:

- Indigenous Communities, Activities, Interests, and Rights
- Air Quality and GHGs
- Aerofauna
- Marine Fish and Fish Habitat
- Marine Mammals and Sea Turtles
- Protected and Special Areas
- Fisheries
- Other Ocean Uses
- Visual Aesthetics and Viewscapes
- Acoustic Environment
- Physical and Cultural Heritage
- Human Health
- Communities and Economy

The following is described for each component:

- Existing conditions
- Potential effects
- Mitigation and other measures
- Engagement outcomes
- Data gaps and limitations
- Committee conclusions and recommendations

While these components are overall the same as those listed in the Agreement, the Committee did make some revisions to the component list:

- The “Avifauna” component was changed to “Aerofauna.”
- The “Fisheries and Other Ocean Uses” component was split into two components, “Fisheries” and “Other Ocean Uses.”
- The “Visual Aesthetics / Viewscapes and Acoustic Environment” component was split into two components, “Visual Aesthetics and Viewscapes” and “Acoustic Environment.”
- The “Communities” and “Economy” components were combined into one component, “Communities and Economy.”

The Committee has clearly documented in this Report the rationale for doing so, including if and how Indigenous, fisheries, stakeholder, and public input informed and influenced these changes.

Figures 7.1 shows the Focus Area and reference points used throughout this section to describe existing conditions.

Figure 7.1. Environmental Setting Reference Features

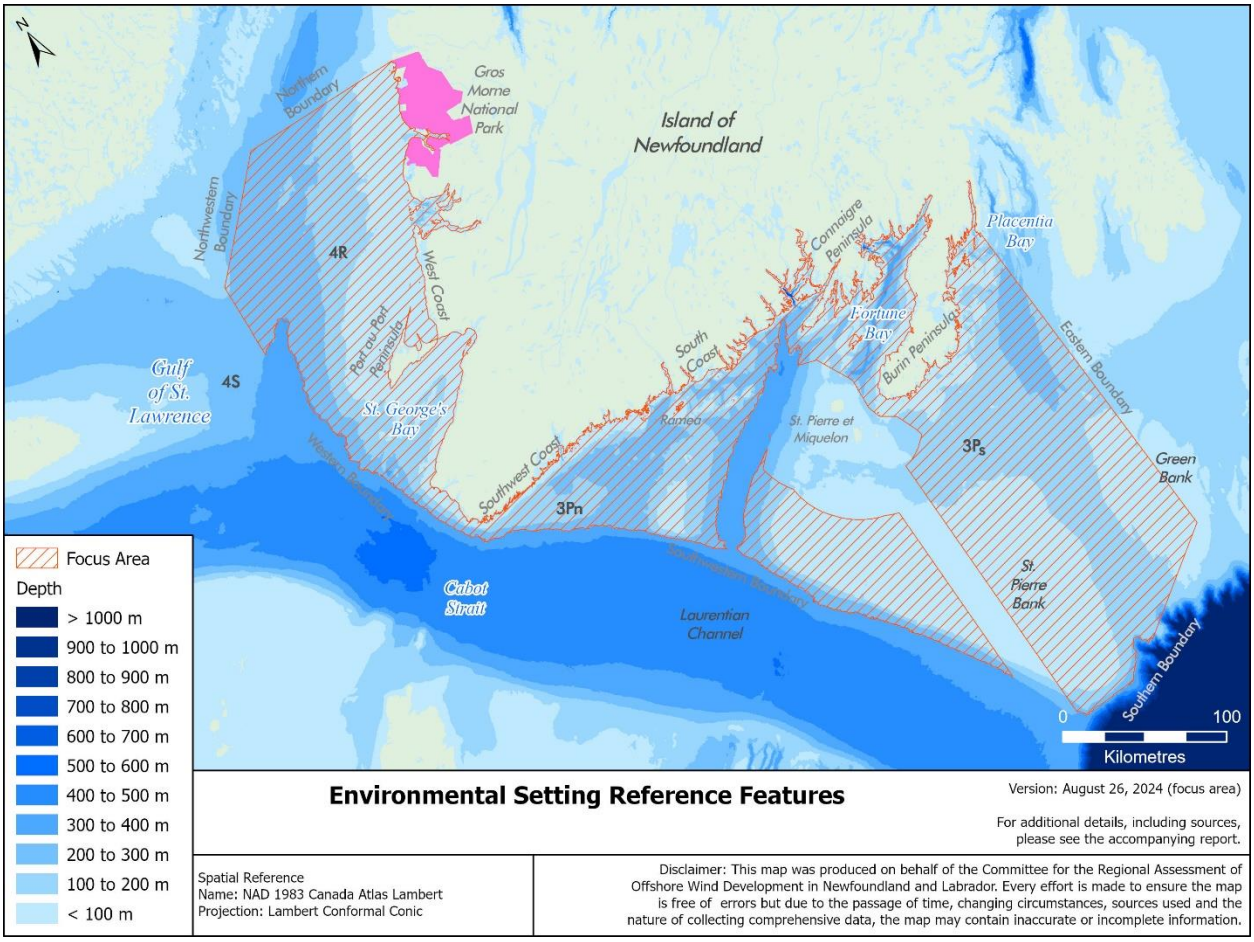


Figure Description: This figure shows common points of reference used to discuss existing conditions in the Regional Assessment Focus Area throughout the Report.
Data Sources: DFO, 2021g; GEBCO, 2024; IAAC, 2023a; NRCAN, 2022a; NRCAN, 2023.

Applying the Mitigation Hierarchy and the Relationship Between Constraints and Components

The mitigation hierarchy refers to the sequential approach to mitigating adverse impacts associated with development. While there are variations to latter categories in the hierarchy (e.g., some use avoid, minimize, restore, offset; others use avoid, minimize, compensate), the first two steps are always avoid and minimize. Avoidance refers to measures taken to avoid creating impacts from the outset. Avoidance is acknowledged as the easiest, least costly, and most effective way of reducing potential adverse impacts.

Minimization refers to measures taken to reduce the duration, intensity, and/or extent of adverse impacts that cannot be completely avoided (Biodiversity Consultancy, 2024; Crown Estate Scotland, 2024; Jedele et al., 2023).

In an emerging market, selecting licencing areas based on avoidance and minimization offers an early opportunity to mitigate potential adverse impacts at a regional scale. The hierarchy can then be applied at the project level for further mitigation of impacts.

The Committee applied the avoid and minimize steps of the mitigation hierarchy when identifying the initial offshore wind energy licencing areas. As described in Section 6 of this Report, the Committee undertook a constraints analysis based on avoiding and minimizing adverse impacts on environmental, health, social, and economic components. It is important to understand the relationship between the constraints used to identify the initial offshore wind energy licencing areas and the components assessed in the proceeding section. Table 7.1 summarizes those relationships, listing the constraints considered by the Committee to avoid or minimize offshore wind development impacts and the corresponding components assessed in this Report.

Table 7.1. Relationship between constraints and components

Constraints	Relevant Components
Critical Habitat	Indigenous Communities, Activities, Interests, and Rights; Aerofauna; Marine Fish and Fish Habitat; Protected and Special Areas
Bird Colonies and Foraging Areas	Indigenous Communities, Activities, Interests, and Rights; Aerofauna
Key habitats and Important Stopover Areas	Indigenous Communities, Activities, Interests, and Rights; Aerofauna
KBAs	Indigenous Communities, Activities, Interests, and Rights; Aerofauna
MPAs	Indigenous Communities, Activities, Interests, and Rights; Marine Fish and Fish Habitat; Marine Mammals and Sea Turtles; Protected and Special Areas; Fisheries
NMCAs	Indigenous Communities, Activities, Interests, and Rights Marine Fish and Fish Habitat; Marine Mammals and Sea Turtles; Protected and Special Areas; Fisheries; Other Ocean Uses; Communities and Economy
Marine Refuge and Fisheries Closure Areas	Indigenous Communities, Activities, Interests, and Rights Marine Fish and Fish Habitat; Protected and Special Areas; Fisheries
Lobster and Nearshore Fisheries	Indigenous Communities, Activities, Interests and Rights; Fisheries; Communities and Economy
Areas with High Commercial Fisheries Density	Indigenous Communities, Activities, Interests, and Rights; Fisheries; Communities and Economy
Community-Based Coastal Resources	Indigenous Communities, Activities, Interests, and Rights; Fisheries; Communities and Economy
Aquaculture Sites and Licences	Indigenous Communities, Activities, Interests, and Rights; Fisheries; Communities and Economy
Viewscapes – Gros Morne National Park (GMNP) and WHS, Sandbanks Provincial Park, Provincially Protected Areas	Indigenous Communities, Activities, Interests, and Rights Protected and Special Areas; Other Ocean Uses; Visual Aesthetics and Viewscapes; Communities and Economy
Viewscapes and Noise – Communities and Cottages	Indigenous Communities, Activities, Interests, and Rights; Visual Aesthetics and Viewscapes; Human Health; Communities and Economy
Airports and Inland and Marine Aerodromes	Communities and Economy

Constraints	Relevant Components
Marine Traffic	Indigenous Communities, Activities, Interests, and Rights; Fisheries; Other Ocean Uses; Communities and Economy

Table Description: This table provides a list of constraints considered by the Committee to avoid or minimize offshore wind development impacts and the corresponding components.

7.1 Indigenous Communities, Activities, Interests, and Rights

Indigenous peoples throughout Newfoundland and Labrador, the Maritimes, and Quebec have participated in and contributed to this Regional Assessment. The Committee's Indigenous Engagement - What We Heard Report (Appendix A) details all Indigenous engagement activities and summarizes all input received.

Indigenous peoples are best positioned to identify the potential positive and adverse effects of offshore wind development on their communities, activities, interests, and rights. Since the offshore wind industry has yet to be developed in Newfoundland and Labrador, the Committee has made no assumptions in this regard.

7.1.1 Indigenous Communities

Section 3 of this Report identifies all Indigenous communities and organizations with potential interest in this Regional Assessment.

Within the Study Area, Innu Nation, Nunatsiavut, and NCC are located in Labrador, and MFN, QFN, Benoit First Nation, Flat Bay Band Inc., Indian Head First Nations Inc., Port au Port Band Inc., St. George's Indian Band Council Inc., and Three Rivers Mi'kmaq Band Inc. are located in Newfoundland.

7.1.1.1 Traditional territories within and adjacent the Focus Area

Some Indigenous communities have provided descriptions of their traditional territories relative to the Focus Area:

- MFN has indicated the Focus Area is within their traditional territories.
- QFN has indicated the Focus Area is adjacent to their traditional territories. Within the Focus Area, QFN identifies highest areas of traditional use ranging from the Bay of Islands south to Codroy Valley, as well as the Burgeo area on the southwest coast.
- Port au Port Band Inc. describes their traditional territory as all communities between Kippens to Campbell's Creek. There are deep ancestral ties to the lands and waters of the Port au Port Peninsula and Bay St. George Region.

7.1.1.2 Effects Beyond the Focus Area

The potential effects of offshore wind development extend beyond a project site. As such, in addition to Indigenous groups in Newfoundland and Labrador, some Indigenous groups in New Brunswick, Nova Scotia, and Quebec have provided input on how offshore wind development may impact their activities, interests, and rights.

7.1.2 Input from Indigenous Groups

Where Indigenous peoples provided information and granted the Committee permission to share it, it is presented throughout this Report. Several Indigenous communities have

shared with the Committee that their cultures and traditions are intertwined with the air, land, water, and all living things. Information, perspectives, and recommendations provided by Indigenous groups are therefore not limited to this section and are instead presented throughout this Report (Table 7.1.1). Presenting Indigenous knowledge alongside scientific information in this way honours Etuaptmumk (the Mi'kmaq word for Two-Eyed Seeing).

Table 7.1.1. Input received from Indigenous groups and organizations for consideration in the Regional Assessment

Indigenous group	Report Section																	
	5 Defining the Regional Assessment Focus Area	6 Identifying Initial Offshore Wind Energy Licencing Areas	7.1 Indigenous Communities, Activities, Interests, and Rights	7.2 Air Quality and GHGs	7.3 Aerofauna	7.4 Marine Fish and Fish Habitat	7.5 Marine Mammals and Sea Turtles	7.6 Protected and Special Areas	7.7 Fisheries	7.8 Other Ocean Uses	7.9 Visual Aesthetics and Viewscapes	7.10 Acoustic Environment	7.11 Physical and Cultural Heritage	7.12 Health	7.13 Communities and Economy	8 Cumulative Effects	9 Accidental Effects / Effects of Environment on Offshore Wind	10 Sustainability / Climate Change	11 Intersectionality
MFN	•	•	•		•	•		•	•				•					•	
QFN	•	•	•		•	•		•	•						•	•			
Benoit First Nation			•		•	•	•		•									•	
Flat Bay Band Inc.			•		•	•	•						•	•	•		•		
Port au Port Band Inc.	•	•	•	•	•	•	•	•	•	•	•		•	•	•		•	•	

Indigenous group	Report Section																	
	5 Defining the Regional Assessment Focus Area	6 Identifying Initial Offshore Wind Energy Licencing Areas	7.1 Indigenous Communities, Activities, Interests, and Rights	7.2 Air Quality and GHGs	7.3 Aerofauna	7.4 Marine Fish and Fish Habitat	7.5 Marine Mammals and Sea Turtles	7.6 Protected and Special Areas	7.7 Fisheries	7.8 Other Ocean Uses	7.9 Visual Aesthetics and Viewscapes	7.10 Acoustic Environment	7.11 Physical and Cultural Heritage	7.12 Health	7.13 Communities and Economy	8 Cumulative Effects	9 Accidental Effects / Effects of Environment on Offshore Wind	10 Sustainability / Climate Change	11 Intersectionality
Indian Head First Nation	•	•				•			•				•						
Innu Nation	•	•	•												•	•			
WNNB			•			•													
KMK	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
NCC	•	•	•	•		•		•	•			•			•	•		•	
Sipekne'katik First Nation	•	•	•		•	•		•	•	•		•				•	•		

Indigenous group	Report Section																	
	5 Defining the Regional Assessment Focus Area	6 Identifying Initial Offshore Wind Energy Licencing Areas	7.1 Indigenous Communities, Activities, Interests, and Rights	7.2 Air Quality and GHGs	7.3 Aerofauna	7.4 Marine Fish and Fish Habitat	7.5 Marine Mammals and Sea Turtles	7.6 Protected and Special Areas	7.7 Fisheries	7.8 Other Ocean Uses	7.9 Visual Aesthetics and Viewscapes	7.10 Acoustic Environment	7.11 Physical and Cultural Heritage	7.12 Health	7.13 Communities and Economy	8 Cumulative Effects	9 Accidental Effects / Effects of Environment on Offshore Wind	10 Sustainability / Climate Change	11 Intersectionality
APC	•	•	•						•						•		•		
Keepers of the Circle			•												•		•		•

Table Description: The table indicates the Report section(s) that describe(s) how input from Indigenous groups informed the Regional Assessment and/or Report sections that contain information aligning with/revisions arising from Draft Report comments received from Indigenous groups.

Submissions to the Committee (for which the Committee was given permission to post) and Registry comments from Indigenous groups can be found on the Registry. The Indigenous Engagement – What We Heard (Appendix A of this Report) describes all Indigenous engagement activities, and the issues and concerns Indigenous peoples, communities, and organizations raised with and input they provided to the Committee.

7.1.3 Indigenous Activities, Rights, and Interests

In addition to information, concerns, and recommendations on specific Regional Assessment constraints, components, and topics (Table 7.1.1 above), some Indigenous groups also provided overarching comments they felt relevant to offshore wind development in Newfoundland and Labrador:

- Communities have the right to be fully informed and to participate in decision-making processes that affect their lands and resources. In the spirit of Truth and Reconciliation, governments and offshore wind project proponents should adopt the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP), commit to meaningful engagement and consultation, and obtain the free, prior, and informed consent of Indigenous peoples.
- Development of offshore wind energy has the potential to irreversibly alter the natural and cultural landscapes, subsistence and cultural practices, and ability to transfer Indigenous knowledge to future generations.
- The principle of "do no harm" should guide the development of renewable energy projects.
- Government and industry should consult with officially recognized First Nations if an offshore wind development project or proposed development is in waters adjacent to a First Nation or if an offshore wind development project impacts or has the potential to impact its treaty, Section 35 rights or title.
- Eagles have a high cultural significance in Mi'kmaq society. Based on their importance it was requested that any eagle mortalities that result from the construction, maintenance, operation, or decommissioning of offshore wind energy developments be treated with respect. It was also requested that all eagle carcasses be given to a representative of an appropriate Mi'kmaq community where the eagle carcass was found, as soon as possible after discovery. It is understood that delivery to the nearest Mi'kmaq representative could be delayed if the cause of death is required as part of a long-term monitoring and mitigation program.
- Lobster, Atlantic Salmon, American Eel, and trout are all culturally significant species found in various bodies of water where offshore wind may be developed. Potential impacts to these species and other Aboriginal and treaty rights must be consulted upon as this industry develops.

7.1.4 Committee Conclusions and Recommendations

Committee recommendations related to Indigenous Communities, Activities, Interests. and Rights are also relevant to other topics assessed under the Regional Assessment. and are presented throughout the Report, including:

- Section 6.4.1
- Section 7.3.7
- Section 7.6.7
- Section 7.7.8
- Section 7.9.6
- Section 7.11.6
- Section 7.13

- Section 8.6
- Section 11

7.2 Air Quality and GHGs

This section provides background information and overview of existing air quality and GHG emissions in Newfoundland and Labrador.

7.2.1 Air Quality

The ambient air quality in Newfoundland and Labrador is jointly monitored by the provincial Department of Environment and Climate Change (DOECC) and ECCC through the National Air Pollution Surveillance (NAPS) network. The NAPS monitoring stations in Newfoundland and Labrador are primarily established to monitor the air quality in urbanized areas and in locations away from the influences of industrial operations. In 2023 the DOECC operated monitors in six locations (St. John's, Mount Pearl, Grand Falls-Windsor, Corner Brook, Burin, and Port au Choix) as part of the NAPS network.

In addition, major industrial operations in Newfoundland and Labrador are mandated to monitor the air quality near their operations for select pollutants. These industrial monitoring programs are audited on a regular basis by the DOECC. In 2023, six monitoring networks were operated by industry on the Island of Newfoundland, and four in Labrador (Table 7.2.1).

The 2023 air quality monitoring report (DOECC, 2024a) provides location information for the monitoring stations in Newfoundland and Labrador and their respective pollutants measured in 2023, for both the NAPS network and those operated by industrial facilities. The report also provides a two-year tabular information set and a five-year graphical trend in Newfoundland and Labrador for each of the monitors and their respective pollutants. Pollutants measured at the monitoring networks include sulfur dioxide (SO_2), oxides of nitrogen (NO_x), carbon monoxide (CO), total particulate matter (TPM), particulate matter (particles that are 2.5 microns or less in diameter ($PM_{2.5}$) and particles that are 10 microns or less in diameter (PM_{10}), and ozone (O_3) (DOECC, 2024a). The NO_x includes nitric oxide (NO) and nitrogen dioxide (NO_2).

Table 7.2.1. Industrial Monitoring Networks in Newfoundland and Labrador

Operator/Industry	Area	Number of locations
Newfoundland and Labrador Hydro	Holyrood	6
Braya Renewable Fuels	Come-by-Chance	4
Corner Brook Pulp and Paper	Corner Brook, Main Street	1
Vale Newfoundland and Labrador Limited	Long Harbour	2
Canada Fluorspar Inc.	St Lawrence, Director Drive	1
CEMEX (formerly Atlantic Minerals Limited)	Port au Port Peninsula, Camp site	1
Iron Ore Company of Canada	Labrador City	3
Tacora Resources	Wabush	2
Vale Newfoundland and Labrador Limited	Voisey's Bay	3
Tata Steel Minerals Canada	Camp Site, near Schefferville	1

Table Description: This table provides a list of industries, the location of their monitoring stations, and the number of stations within each area.
Source: DOECC, 2024a.

Air quality in Newfoundland and Labrador communities is generally good as the ambient air quality standards are rarely exceeded for the pollutants being measured (DOECC, 2024a). Monitored exceedances and or elevated levels of air pollutants are rare and typically caused by forest fires as well as long-range transport from mainland Canada, U.S., and Europe (DOECC, 2024a). The Newfoundland and Labrador Air Pollution Control Regulations (*Air Pollution Control Regulations, 2022*), provides the maximum concentrations of air pollutants used in maintaining air quality in the province. Contaminants from all sources shall not exceed those standards to be compliant. Table 7.2.2 provides air quality standards for each of the pollutants measured by either the NAPS network or industrial facilities.

Table 7.2.2. Air Quality Standards in Newfoundland and Labrador

Pollutant	Averaging Period	Concentration in Parts Per Billion (ppb)	Concentration in Micrograms Per Cubic Meter (µg/m³)
CO	1-hour 8-hour	30,582 13,107	 N/A
NO_2	1-hour 24-hour 1-year	213 106 53	 N/A
SO_2	1-hour 3-hour 24-hour 1-year	344 229 115 23	 N/A
O_3	1-hour 8-hour	82 44	 N/A
$PM_{2.5}$	24-hour 1-hour	 N/A	25 8.8*
PM_{10}	24-hour	N/A	50
TPM	24-hour 1-hour	 N/A	120 60

Table Description: This table provides a list of pollutants measured by the NAPS network or industrial facilities, their maximum air quality standard concentration, and averaging periods.
* 3-year average of the annual average concentrations.
Source: Air Pollution Control Regulations, 2022.

7.2.2GHG Emissions

Following the Paris Agreement in 2015, Canada adopted 2005 as the base year for its GHG emission reduction targets and has committed to reduce its GHG emissions by 40 - 45% below 2005 levels by 2030. Prior to that, Canada had 1990 as its base year. The national environmental indicators for which emissions are estimated include seven GHGs (carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons, sulfur hexafluoride, and nitrogen trifluoride) (ECCC, 2024e). Canada's National Inventory Report (NIR) 1990 - 2022, released in April 2024 by ECCC, provides a more detailed profile of data related to Canada's GHG emissions as well as the provincial and territorial emission levels. Historical GHG emissions summary (1990 - 2022) for Newfoundland and Labrador can also be obtained at the DOECC website.

Around 80% of Canada's total GHG emissions in 2021 were related to the production and consumption of energy, mostly from the combustion of fossil fuels (Canada Energy Regulator, 2023).

7.2.3 Existing Conditions

7.2.3.1 Provincial Air Pollutant Emission Trends

This section provides a summary of Newfoundland and Labrador's emission trends for ammonia (NH_3), CO, $PM_{2.5}$, NO_x, sulfur oxides (SO_x) and volatile organic compounds (VOCs) between 1990 and 2022 from human activities. The air pollutant emissions indicators track emissions of these six key air pollutants. The interactive figures on the Air Pollutant Emissions' website, highlights the main emission sources as well as the provincial and territorial distributions of these pollutants from 1990 - 2022. The highest sources of each of the six key pollutants in Newfoundland and Labrador for 2022 are shown in Table 7.2.4 below.

Table 7.2.4. Air Pollutants and their Highest Emission Sources in Newfoundland and Labrador for 2022

Pollutant	Highest source	2022 emissions – all sources (kt)*	Emissions - highest sources (kt)*	% of 2022 total
NH_3	Agriculture (livestock, crop production, and fertilizer)	1.1	0.7	63.6%
CO	Home firewood burning	65.3	19.4	29.7%
$PM_{2.5}$	Dust and fires	15.9	10.9	68.6%
NO_x	Transportation (road, rail, air, and marine)	54.9	37.5	68.3%
SO_x	Ore and mineral industries	9.3	5.6	60.2%
VOCs	Home firewood burning	17.0	4.6	27.1%

Table Description: This table provides a summary of the leading sources of each of the six key pollutants in Newfoundland and Labrador as a percentage of all other sources, using 2022 emission numbers (the latest data at the time of compiling this Report).
* kt: kilotonnes
Source: ECCC, 2010

7.2.3.1.1 Data Source and Methods From ECCC

The emissions data are sourced from Canada's Air Pollutant Emissions Inventory (APEI) for the years 1990 - 2022. The APEI is a detailed inventory of air pollutant emissions at the national, provincial, and territorial level. It is developed using both facility-reported data,

consisting of emissions from relatively large industrial, commercial, and institutional facilities, and in-house estimates, which consider diffuse sources and other sources such as road and non-road vehicles, agricultural activities, construction, and solvent use. Together, these data sources (i.e., facility-reported data and the in-house estimates) provide a detailed overview of pollutants emissions across the country. It compiles emissions of 17 air pollutants contributing to smog, acid rain, and poor air quality since 1990. These pollutants reported in the APEI are extracted from the National Pollutant Release Inventory (NPRI) (ECCC, 2024c).

The NPRI is ECCC's database of pollutant releases (into air, water, and land), disposals, and transfers for recycling from industrial, commercial, and institutional facilities. Data from these facilities are provided by the operators of the facilities as mandated by the *Canadian Environmental Protection Act* (1999) (CEPA). Under CEPA, owners or operators of facilities that manufacture, process, or otherwise use or release one or more substances tracked by the NPRI, and meet substance-specific reporting thresholds and other requirements must report their pollutants releases, disposals, and transfers every year. Facility data for local and regional scale air pollutant emissions, from the NPRI can be accessed through ECCC's interactive map.

Emissions data from individual facilities submitted to the NPRI remain the primary source of industrial air pollution data in Canada, and are supplemented with well-documented, science-based estimation tools to quantify total emissions (ECCC, 2024c). To produce a complete national inventory of emissions, complementary in-house estimates are developed by ECCC for subsectors with limited coverage in the NPRI, as many facilities do not meet the reporting thresholds. Sources of air pollutants that are not subject to reporting to the NPRI (i.e., residential fuel combustion, transportation and mobile equipment, or fires) are covered solely through the calculation of in-house emission estimates. A complementary in-house estimate is not required in situations where the NPRI facility data provide complete coverage of air pollutant emissions.

Generally, in-house estimates are calculated from emission factors and activity data, comprised of statistical production or process data at the provincial, territorial, or national level.[57] Activity data are typically provided by provincial/territorial agencies, federal government departments, and industry associations. The estimates are based on current data available at the time of inventory development, with data updates each year.

Figure 7.2.1 shows the emission trends of the six key pollutants for Newfoundland and Labrador from 1990 - 2022. Except NO_x and NH_3 which showed increase in emissions in 2022 relative to 1990, the rest of the pollutants showed a decrease in emissions. The largest emission reductions in Newfoundland and Labrador were recorded for SO_x, which decreased by 87% (9.3 kt) relative to 1990 (70.3 kt). This was followed by CO emissions

[57] The U.S. Environmental Protection Agency defines an emission factor as "a representative value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant" (U.S. EPA, 2016).

(69% reduction), VOCs (52%), and $PM_{2.5}$ (25%). On the other hand, NO_X and NH_3 emissions were up by 8% and 10% respectively in 2022 compared to emissions in 1990 (Air pollutant emissions - Canada.ca) (ECCC, 2010). According to ECCC (2023e), the COVID 19 pandemic and the associated economic slowdown impacted the results between 2019 and 2021. Hence, the long-term trend should be interpreted with caution when it comes to the observed decreases between 2019 and 2021.

Figure 7.2.1. Emissions of Six Air Pollutants, Newfoundland and Labrador, 1990 - 2022

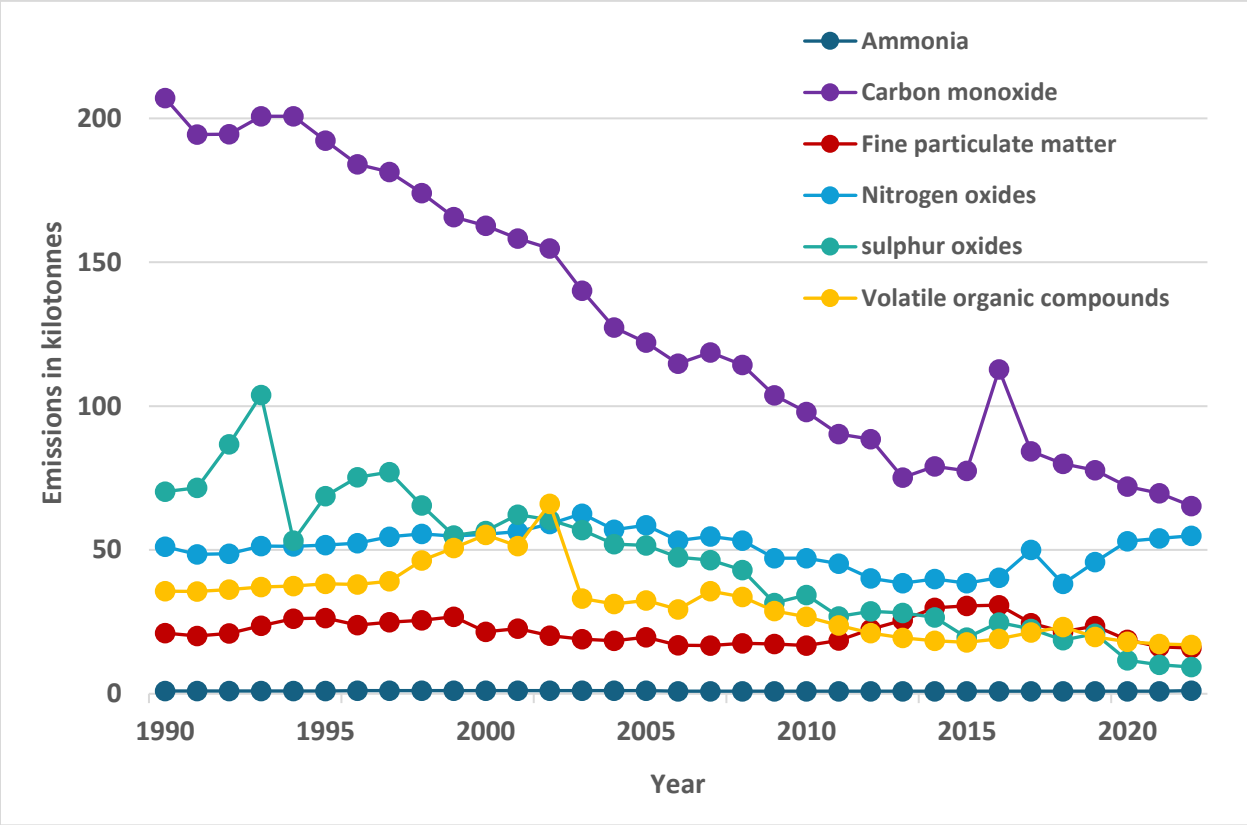


Figure Description: This figure shows the emission trends of the six key pollutants in Newfoundland and Labrador from 1990 - 2022.
Data Source: ECCC, 2010.

7.2.3.2 Provincial GHG Emission Trends

GHG emissions for Newfoundland and Labrador for the Canadian economic sector (anthropogenic sources and sinks), accounted for approximately 1.2% of Canada's overall GHG emissions in 2022, making it the ninth largest provincial/territorial emitter in the country. GHG emissions in Newfoundland and Labrador were 8.6 megatonnes of CO_2 equivalent (Mt CO_2 eq) in 2022, decreasing by 3.4% (0.3 Mt CO_2 eq) from 8.9 Mt CO_2 eq in 2020. The sharp decrease in GHG emissions from 2019 to 2021 (~24%), has been attributed partly to the economic slowdown due to the COVID 19 pandemic which affected a wide range of economic sectors, including energy and transport sectors. Newfoundland and Labrador's GHG emissions decreased by 16.5% (1.7 Mt CO_2 eq) between 2005 and

2022, and 9.5% (0.9 Mt CO_2 eq) between 1990 and 2022 (ECCC, 2024f; DOECC, n.d.-e). Figure 7.2.2 shows the historical GHG emissions for Newfoundland and Labrador dating back to 1990.

Figure 7.2.2. GHG Emissions for Newfoundland and Labrador by Canadian Economic Sector, 1990 - 2022

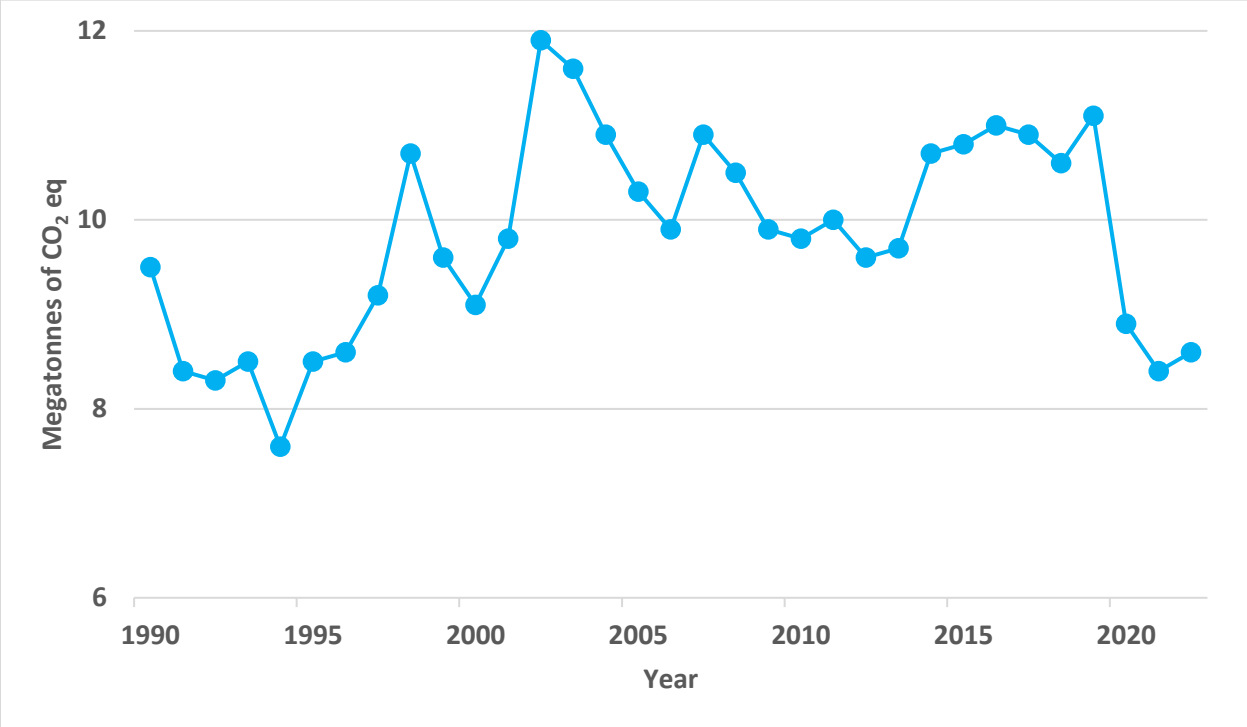


Figure Description: This figure shows the historical GHG emission trend in Newfoundland and Labrador from 1990 - 2022.
Data Sources: ECCC, 2024f; DOECC, n.d.-e

7.2.3.2.1 Data Source and Methods From ECCC

Estimates of GHG emissions are provided at the national, provincial, and territorial levels, by economic sectors. The major economic sector activities considered for GHG emissions within the NIR 1990 - 2022, are energy, industrial processes and product use, agriculture, and waste. Chapters 3 - 6 of the NIR, provide comprehensive details of the temporal coverage for each data source used for the indicators.

Generally, GHG emissions are estimated by multiplying activity data by the associated emission factor (ECCC, 2024f). Activity data refer to the quantitative amount of anthropogenic activity, resulting in emissions during a given time period. Emission factors are based on samples of measurement data and are representative rates of emissions for a given activity level under a given set of operating conditions. It is the estimated average emission rate of a given pollutant for a given source, relative to units of activity. Table 7.2.5 shows Newfoundland and Labrador's GHG emissions in kt of CO_2 equivalent (kt CO_2 eq), for the major Canadian economic sector activities for selected years.

Table 7.2.5. GHG Emissions for Newfoundland and Labrador by Canadian Economic Sector, Selected Years

Economic Sector	1990	2005	2019	2020	2021	2022[58]
	kt CO_2 eq					
Energy	8,721	9,427	10,186	7,939	7,520	7702
Industrial Process and Product use	98	154	220	237	228	208
Agriculture	50	63	81	81	79	78
Waste	601	631	615	623	606	618
Total GHG	9,470	10,276	11,102	8,880	8,433	8,606

Table Description: This tables provides a list of the major Canadian economic sectors and their respective GHG emissions (CO_2 equivalent) in Newfoundland and Labrador for 1990, 2005, 2019, 2020, 2021, and 2022.
Sources: ECCC, 2024f; DOECC, n.d.-e

Key notes from Table 7.2.5 are:

- Between 2020 and 2021, GHG emissions from Energy, Industrial Processes and Product Use, Agriculture, and Waste decreased by 419 kt CO_2 eq (5%), 9 kt CO_2 eq (4%), 2 kt CO_2 eq (3%), and 17 kt CO_2 eq (3%) respectively.
- Between 1990 and 2021, GHG emissions from Energy decreased by 1,201 kt CO_2 eq (14%), while emissions from Industrial Processes and Product Use, Agriculture, and Waste increased by 130 kt CO_2 eq (133%), 29 kt CO_2 eq (58%), and 5 kt CO_2 eq (1%) respectively.
- Between 2005 and 2021, GHG emissions from Energy and Waste decreased by 1,907 kt CO_2 eq (20%) and 25 kt CO_2 eq (4%) respectively, while Industrial Processes and Product Use, and Agriculture increased by 74 kt CO_2 eq (48%) and 16 kt CO_2 eq (25%) respectively.
- Between 2005 and 2022, GHG emissions from Energy, Agriculture and Waste decreased by 1,725 kt CO_2 eq (18%), 3 kt CO_2 eq (5%) and 13 kt CO_2 eq (2%) respectively, while Industrial Processes and Product Use saw an increase of 54 kt CO_2 eq (35%).

[58] Estimates for 2022 are based on preliminary information and are subject to revision in the next submission year (Historical GHG emissions summary, Newfoundland and Labrador, 1990 - 2022).

7.2.4Potential Effects

A primary benefit of wind-generated electricity is that it does not directly emit air pollutants and GHGs that are known to affect the climate and human health (Browning & Lenox, 2020; Qiu et al., 2022). This has the potential to help Canada achieve its environmental obligations and climate change commitments (see Section 10 of this Report). Studies in other jurisdictions demonstrate that wind energy can be successfully integrated into electricity grids and doing so can reduce combustion-based electricity generation and provide air quality and GHG emission benefits (Browning & Lenox, 2020; Millstein et al., 2017; Nordman & VanderMolen, 2014). Wind turbine electricity generation reduces air pollution by displacing a more polluting form of electricity generation. The degree of environmental and health benefits that are realized by wind energy capture depends on the production type and fuel that it replaces (Holttinen & Tuhkanen, 2004). For example, if a fossil fueled power plant is displaced, a wind farm could result in a relative reduction in air pollution. The pollution-reduction potential of wind energy has been studied extensively, and Nordman & VanderMolen (2014) provide a summary of their conclusions on the pollution-reduction potential of wind energy supported by a number of peer-reviewed scientific literature.

7.2.4.1 Embodied Carbon in Offshore Wind Development

Embodied Carbon refers to the total GHG emissions generated during the lifecycle of a product, including extraction, manufacturing, transportation, installation, and disposal. Despite its GHG reduction potential and the associated air quality benefits, wind energy, like any other industrial activity, can impact the environment (Corio, 2022). The life cycle of a wind farm encompasses several phases, each contributing to its overall environmental impact and energy consumption.

The manufacturing phase involves the extraction and processing of raw materials, as well as the production of wind turbine components (e.g., rotor, nacelle, tower, foundation, and connection cables). This stage is typically energy-intensive and contributes significantly to the overall environmental impact of a wind farm (71 - 79% of the global warming impact). Key components with significant environmental impacts include high-voltage direct current export cable, floating platforms, and composite blades (Struthers et al., 2023). The transportation and on-site installation phase involve the movement of wind turbine components to the site and erecting the turbines. This primarily relies on carbon-based fuels for machinery and vehicles. During the operational life of a wind farm, energy is consumed for various activities such as transportation of personnel and spare parts to the site, and use of oils and lubricants for turbine maintenance. For floating wind farms in Scotland, operations and maintenance comprise between 9% and 16% of the global warming impacts (Struthers et al., 2023). Decommissioning involves dismantling and transporting materials to disposal or recycling sites. This process requires energy for machinery and vehicle operation.

Emissions during the last three phases are mainly caused by fossil fuel combustion because of vessel use (International Council on Clean Transportation, 2020). Air

contaminants associated with vessel use include NO_x, SO_2, particulate matter, CO_2, and CH_4 (NYSERDA, 2018b). The scope of the impacts on the environment will differ among the three phases in terms of time and space as well as the choice of technical solutions, protective measures, and working methods for mooring and construction.

The energy consumed throughout the life cycle, particularly during manufacturing and transportation, contributes to the wind farm's embodied energy. This results in indirect GHG emissions, even though wind turbines themselves do not produce emissions during operation. It's worth noting that that despite the indirect emissions, wind energy has a significantly lower environmental impact compared to fossil fuel-based energy sources. The average life cycle GHG emissions remains amongst the lowest, second to hydropower (Blue & Jeyakumar, 2022). Studies have shown that that wind turbines typically recover the energy used in their life cycle within a year of operation (Bonou et al., 2016; Haapala & Prempreeda, 2014), though this estimate may vary depending on specific conditions and calculation methods.

As part of the Regional Assessment, ECCC provided the Committee with an outline of potential equipment used in the construction, operations, and decommissioning phases.[59] Vessel activities during an offshore wind project lifetime includes tugboat use, cable installation vessels, survey vessels, helicopters, and other construction and support vessels (Corio, 2022). There is also the potential for air contaminant emissions from backup generators at the turbines or power transmission facilities during offshore wind operations (U.S. EPA, 2022a). Figure 7.2.3 show types of vessels during offshore wind project lifetime.

[59] Response to the Committee's request for advice from ECCC is available on the Registry under document reference number 275.

Figure 7.2.3. Offshore Wind Farm Activities and Emission Sources

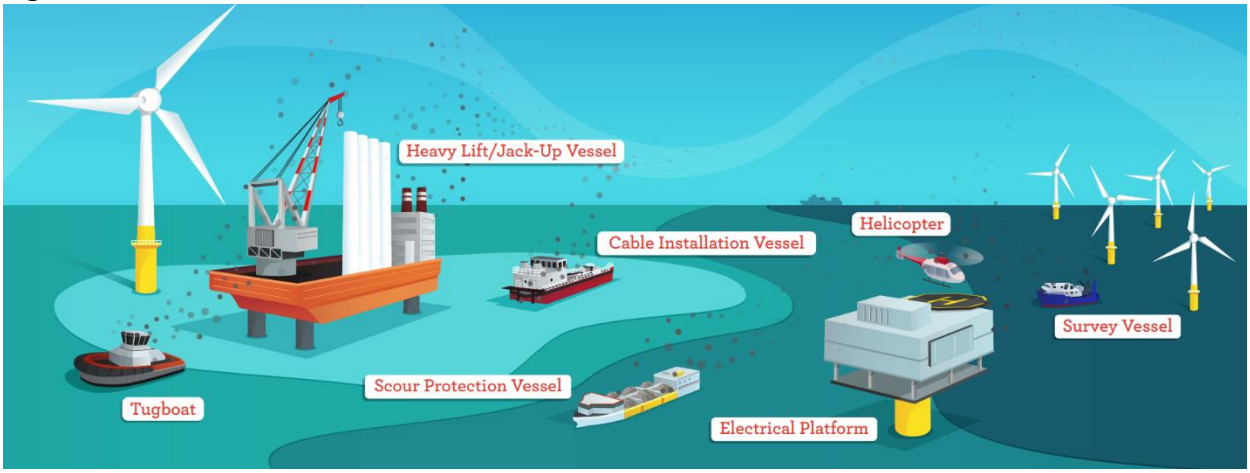


Figure Description: This figure shows types of vessels during an offshore wind project lifetime (i.e., Jack-up vessel, Cable installation vessel, Helicopter, Survey vessel, Tugboat, Scour protection vessel, Electrical platform, etc.).
Source: Corio, 2022.

Atmospheric emissions associated with individual offshore wind projects will vary depending on the number of vessels required and the time that these vessels are in the field. These project air emissions would very likely be conducted at project specific level. According to the U.K. Department for Business, Energy and Industrial Strategy, these project emission assessments conducted at project specific level for majority of offshore wind farms as of 2022 have concluded to have negligible to no effect offshore, and have in most cases, scoped out the issue of air emission impact from environmental impact assessment (U.K. BEIS, 2022) For instance, the scoping of two projects (the Norfolk Boreas and Vanguard), considered that for vessels up to 12 during construction, the associated air emission would be small in comparison to the total shipping activity in the southern North Sea. They also indicated that, marine exhaust emissions were limited in line with the provisions of International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78. Similarly, the issue was scoped out for Hornsea Project Three on the grounds that aerial emissions would be rapidly dispersed offshore, and the proposed wind farm would be a long distance away from any static sources of emissions and aerial emissions from vessel and helicopter movements during development were going to be small compared with total emissions for the south North Sea.

7.2.4.2 Air Quality, GHGs and Human Health Impact

Poor air quality has been linked to respiratory and cardiovascular illness, hospitalization, and mortality. Harmful health outcomes related to air pollution include respiratory symptoms (e.g., acute irritation and respiratory problems), the development or worsening of existing respiratory and/or cardiovascular diseases, cancer, and premature death (Health Canada, 2016).

Table 7.2.7 summarizes the human health impacts of each of the six key pollutants discussed above in Section 7.2.3.1 of this Report.

Table 7.2.7. Air Pollutants and their Corresponding Human Health Impacts

Pollutant	Health impacts
NH_3	• NH_3 can be poisonous if inhaled in large quantities, and it is irritating to the eyes, nose and throat. • Combines with sulphates and nitrates in the air to form secondary $PM_{2.5}$.
CO	• A poisonous gas which, when inhaled, reduces the blood's capacity to carry oxygen to organs and tissues into the blood stream, affecting human health. • For people with heart disease, exposure to low doses can result in chest pain. • For healthier people, high level exposure affects the central nervous system.
$PM_{2.5}$	• It's either emitted directly into the air (in solid/liquid form) or formed in the air from precursor substances such as SO_X, NO_X, VOCs and NH_3. • When inhaled deeply into the lungs, even small amounts can cause serious health problems. • It can damage vegetation and structures, contribute to haze and reduce visibility.
NOx (includes emissions of (NO and N_2O)	• N_2O can have adverse effects on human health and the environment. • At significant levels and exposure, inhalation can result in irritation and burning to the skin and eyes, nose and throat. Prolonged exposure can lead to permanent lung damage. • Contributes to acid rain, which can lead to the acidification of aquatic and terrestrial ecosystems. • Contributes to the eutrophication of lakes and to the formation of ground-level O_3 and $PM_{2.5}$.
SO_x	• The SO_X emissions released by human activities consist mostly of SO_2 and can affect the respiratory systems of humans and animals. • Causes damage to vegetation, buildings and materials. • Contributes to the formation of acid rain and $PM_{2.5}$.
VOCs	• VOCs are the primary precursors to the formation of ground level O_3 and $PM_{2.5}$ which are the main contributors to the formation of smog.

Table Description: This table provides a summary of the human health impacts associated with NH_3, CO, $PM_{2.5}$, NO_X, SO_X, and VOCs.
Sources: DOECC, 2024a; ECCC, 2010

GHG emissions and their increasing concentrations in the atmosphere are already having an impact on the environment, the economy, and human health (ECCC, 20224e). According to the United States Environmental Protection Agency (U.S. EPA), more people may be exposed to extreme weather like heat, floods, droughts, storms, and wildfires as a result of climate change (U.S. EPA, 2022b). The health effects are wide-ranging, and the impacts will vary depending on a person's age, medical condition, income, and where they live. Extreme weather due to climate change will likely impact other components (see Section 9 of this Report). Figure 7.2.4 shows the direct and indirect human health impacts of climate change as a result of increasing concentration of CO_2, rising temperatures, rising sea levels, and extreme weather events.

Figure 7.2.4. Impact of Climate Change on the Environment and Human Health

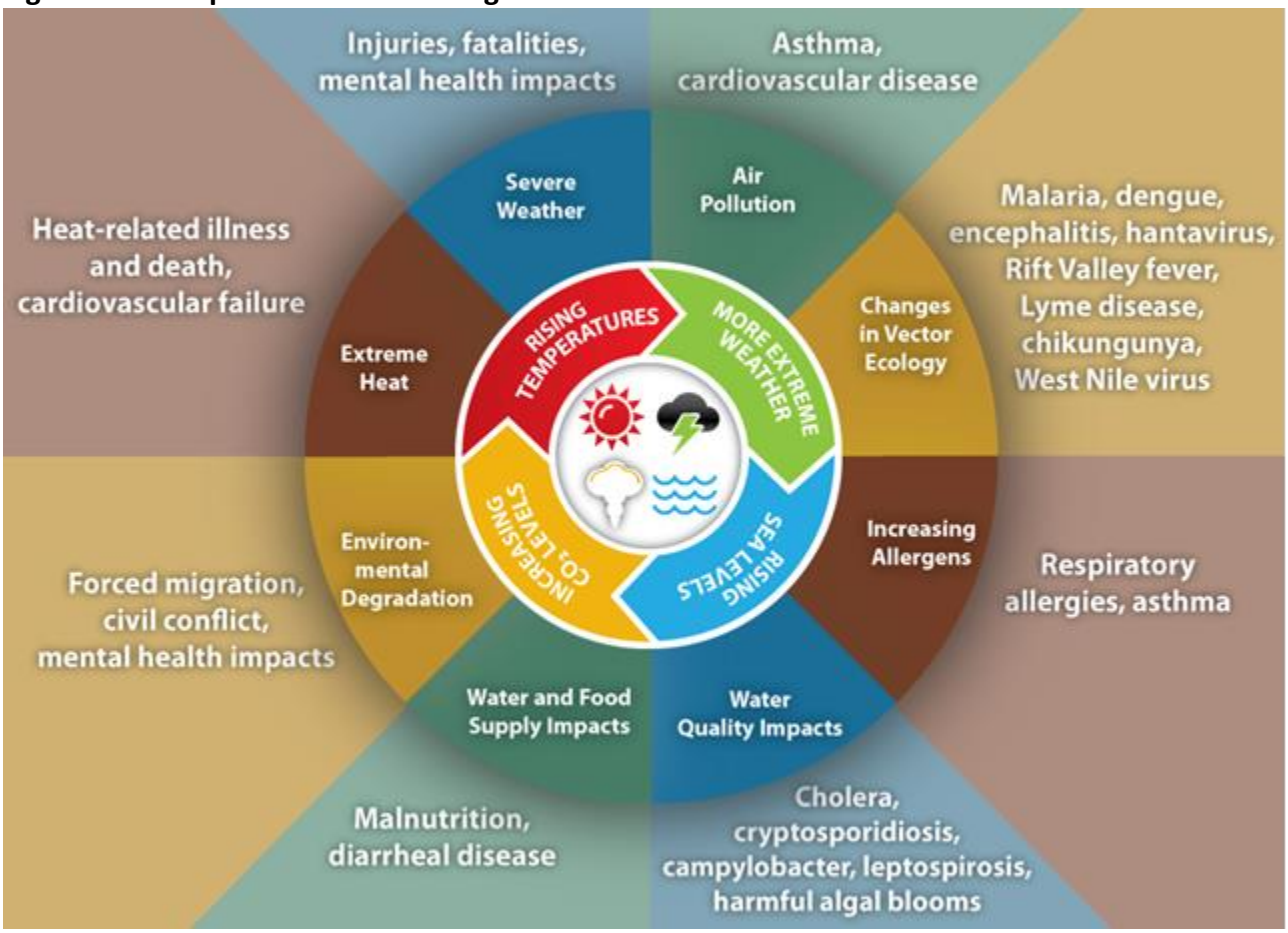


Figure Description: This figure shows the direct and indirect effects of climate change on the environment and human beings, as a result of increasing concentration of CO_2, rising temperatures, rising sea levels, and extreme weather events.
Source: U.S. CDC, 2022.

7.2.5 Mitigation and Other Measures

This section outlines mitigation measures that the Committee recommends for air quality and GHG emissions. Potential emissions, impacts (including cumulative effects), and mitigation measures for each phase of offshore wind development should also be identified during the planning phase of any given project. Air quality monitoring plans to maintain safe air emission levels should also be developed for every phase of offshore wind development. According to New York State Energy Research and Development Authority (2017d), air pollutant emission inventories and ambient air monitoring plans are standard practices for projects that are anticipated to impact the offshore atmospheric environment.

The concentration of air pollutants in exhaust gas due to vessel activities depends on the type of vessel and how the vessel is operated, the fuel used, and the emissions control mechanisms put in place (International Council on Clean Transportation, 2020). To minimize the potential impacts of offshore wind development activities on air quality and GHG emissions, the Committee recommends the following:

- Offshore wind projects, if designated, should follow all applicable climate change and GHG guidance presented in the Strategic Assessment of Climate Change (SACC) and the Technical Guides, which may include consideration of the GHG emissions from the construction (including pre-construction), operations, and decommissioning phases of offshore wind projects, as well as mitigation measures.
- Coordinate activities during the construction and decommissioning phases in a way that reduces number of vessel trips.
- Use high-quality fuel that contains low sulfur levels to the extent practicable to reduce air pollution. Other fuel types such as hydrogen or biofuels will help mitigate GHG emissions.
- Ensure emission control mechanisms for marine vessels and backup generators are properly maintained and installed.
- Select vessel engines designed to reduce air pollution (e.g., hybrid-electric, or fully electric crew transfer vessel).
- Develop air pollutant/contaminant emission inventories and ambient air monitoring plans at the planning phase of an offshore wind development project.
- Follow provincial, federal, and international guidelines on vessel emissions.
- Limit vessel engine idling time.

7.2.6 Engagement Outcomes

No concerns were raised specifically regarding air quality and GHGs. Concerns raised by participants were related to the indirect effects of GHG emissions on fisheries (e.g., warming of the ocean) (see Section 7.7 of this Report).

7.2.7 Data Gaps and Limitations

No data gaps directly related to air quality and GHG emissions were identified for offshore wind development by the Committee. However, the Committee is of the view that by

accurately assessing and forecasting wind resources, more offshore wind farms could be deployed, reducing emissions of CO_2 (Showalter, 2022). Addressing the following gaps would likely improve understanding of offshore wind energy's potential to reduce pollutant and GHG emissions.

- **Limited observation data**: Field measurements and observations of atmospheric conditions at offshore wind sites, especially in the atmospheric boundary layer over the ocean, are lacking. As a result, it is difficult to validate wind energy models and understand the complex interactions between wind, waves, and turbines (Gottschall & Dörenkämper, 2021; Shaw et al., 2022).
- **Gaps in modelling capabilities**: Currently available atmospheric and wind energy models have limitations in accurately simulating offshore conditions over a wide range of spatial and temporal scales. Data assimilation methods and model validation need to be improved (Shaw et al., 2022).
- **Limited understanding of harsh ocean environments**: There is the need for better data on precipitation, waves, currents, and other factors that may contribute to turbine erosion and degradation on offshore platforms (Shaw et al., 2022).
- **Lack of seasonal data**: Large-scale offshore wind field studies featuring measurements throughout the year are required for model evaluation and to provide insights into key atmospheric and oceanic properties (Shaw et al., 2022).

7.2.8 Committee Conclusions and Recommendations

Overall, the main data gaps and limitations pertain to comprehensive offshore wind measurements and modeling. Addressing them through expanded data collection, improved models, and enhanced validation could support more accurate resource assessments and forecasts for offshore wind development. By doing so, clean energy generation and GHG reductions can be maximized. The Committee therefore recommends:

- The government of Canada through relevant agencies, and research institutions conduct large-scale offshore wind field studies across seasons to gather more comprehensive data, deploy long-term wind profilers and other measurement equipment similar to onshore sites, conduct model validation across multiple time and spatial scales, improve data assimilation methods for weather predictions, gather observations across multiple conditions from sea breezes to large storms, and focus on measurements in the challenging atmospheric boundary layer over oceans.

7.3 Aerofauna

Acknowledgement Note

This section is largely attributed to information and text provided by experts at ECCC. Over the course of this Regional Assessment, ECCC provided the Committee with various mapping and research products about aerofauna in Atlantic Canada and potential impacts of offshore wind development on aerofauna. The Committee considered this information alongside their own review of offshore wind development in other jurisdictions and publicly available data and information.

In some instances, the Committee granted ECCC confidentiality in accordance with the Confidentiality Procedure. Where permitted, the Committee posted ECCC's submissions on the Registry under document reference numbers 275 and 370.

Aerofauna includes any animal that may fly or glide. In this Report, aerofauna specifically refers to birds, bats, and flying insects.

Several avian species (i.e., birds) rely on marine and coastal environments for breeding, foraging, and migration. Accordingly, the placement of wind farms in coastal and offshore ecosystems has raised concerns about potential impacts to avian biodiversity, particularly for marine and migratory birds (Leemans & Collier, 2022).

While bats are less frequently associated with offshore environments compared to birds, they have also been found far from shore with no associated roost sites (ECCC, 2023l; 2024a; Stantec Consulting Limited, 2016a). Similarly, insects, such as the Monarch (*Danaus plexippus*) (SARA - Endangered), may occur offshore and interact with offshore energy infrastructure (ECCC, 2023l). In response to advice from ECCC (ECCC, 2023l), the Committee changed the "avifauna" component to "aerofauna" so that bats and flying insects could also be considered in addition to birds.

7.3.1 Legislative Background

Under the IAA, project-level impact assessments must take into account changes to the environment that are likely to be caused by carrying out the project (*IAA,* 2019, c.28, s. 22(1)). This may include changes to the atmosphere, soil, wetlands, marine areas, vegetation, animals, fish, and birds (IAAC, 2020b). Project determinations by the IAAC and Minister of Environment and Climate Change Canada (i.e., whether an impact assessment is required, and whether the adverse effects of a designated project are in the public interest) focus on preventing and mitigating adverse effects in areas of federal jurisdiction (*IAA*, 2019, c.28, s. 16(2), 60(1)). Regarding aerofauna, species at risk and migratory birds are within federal jurisdiction.

More information on the SARA (2002), and its protections is under Section 7.6 of this Report. A summary of aerofauna species at risk in the Focus Area is under Section 7.3.2.2.1 of this Report.

The federal *Migratory Birds Convention Act,* 1994, and its regulations protect most migratory birds, nests, and eggs anywhere they are found in Canada, including ocean waters. Under the *Migratory Birds Convention Act* (1994) and the associated Migratory Bird Regulations (MBR 2022), migratory birds are always protected, and all migratory bird nests are protected when they contain a live bird or viable egg. The nests of 18 species listed in Schedule 1 of the MBR 2022 are protected year-round. For other protected migratory birds, nesting zones and nesting calendars provide useful information. The Island of Newfoundland occurs in Nesting Zone D: Quebec-Labrador and Newfoundland sub-zones of Boreal Softwood Shield and of Taiga Shield and Hudson and has a regional nesting period from mid-April to mid-August (ECCC, 2018c).

MBSs and NWAs also protect migratory birds. These areas are described under Section 7.6 of this Report. No MBS currently occur in the Regional Assessment Focus Area. However, migratory birds may pass through the Focus Area when transiting to MBSs in Newfoundland and Quebec. No NWAs currently exist on the Island of Newfoundland. Proponents should confirm whether any NWAs have been established and/or if areas are under consideration for establishment as NWAs before proceeding with any offshore wind development projects. These areas are important for conservation and have potential implications for development. Established NWAs are listed under Schedule 1 of the Wildlife Area Regulations. Areas under consideration for establishment are published in the Canada Gazette.

ECCC is currently developing guidance to support the consideration of aerofauna in offshore wind development environmental assessments. These include guidance and protocols for monitoring impacts from offshore wind development on migratory birds and aerial species at risk, and standard operating procedures related to bats and offshore wind development (ECCC, 2024a).

Regarding provincial protections, wildlife in Newfoundland and Labrador is managed under the provincial *Wild Life Act (1990)* and its regulations. The Newfoundland and Labrador *Endangered Species Act* (2001) also protects aerofauna species at risk and their habitats. Provincial regulatory bodies like the DOECC may have additional impact assessment requirements for offshore projects in provincial waters.

Finally, several programs and strategies also aim to protect aerofauna. For example, Bird Conservation Regional Strategies developed under the North American Bird Conservation Initiative, 1999, support compliance with the *Migratory Birds Convention Act* (1994) and aim to protect species with declining populations. The Bird Conservation Strategy for Bird Conservation Region 8 and Marine Biogeographic Units 10 and 12 in Newfoundland and Labrador applies to the Focus Area and was last updated in 2013 (CWS, 2013).

7.3.2 Existing Conditions

Newfoundland and Labrador host the greatest diversity of marine birds in Canada. At the edge of the Grand Banks, cold waters from the Labrador Current meet warm waters of the Gulf Stream and support both arctic and subarctic marine birds (e.g., murres (*Uria* spp.) and Atlantic Puffins (*Fratercula arctica*)) and birds that breed in temperate and subtropical

regions (e.g., shearwaters, gannets, and storm petrels). Newfoundland and Labrador are also important for other aerofauna. For example, bird colonies throughout the province provide important habitat for many marine birds, shorebirds, and waterfowl.

A variety of aerofauna may be found throughout the Regional Assessment Focus Area, and in adjacent marine and coastal areas. Depending on the taxa, species may have important habitat here (e.g., for breeding, foraging, roosting, non-breeding etc.) and many species fly through or use stopover sites, staging areas, and moulting areas in and adjacent to the Focus Area.

7.3.2.1 Overview of Aerofauna Occurrence in the Focus Areas

For this overview, aerofauna is divided into categories: marine birds, shorebirds and coastal waterbirds, waterfowl, waterbirds, landbirds, extralimital species, and non-avian species. The following text and maps provide a summary of each group and some key species.

7.3.2.1.1 Marine Birds

Marine birds live partially or exclusively at sea. As a result, they are likely to interact with offshore wind energy development. Furthermore, they are slow to recover from perturbations, because they are typically long-lived species with low fecundity, delayed recruitment, and low rates of population growth.

Eastern Canada Seabirds at-Sea Data

Figures 7.3.1, 7.3.3, and 7.3.5 show marine bird density and distribution across the Focus Area, based on publicly available Eastern Canada Seabirds at-Sea (ECSAS) data.[60] ECSAS data are collected from ships of opportunity, resulting in low survey effort and high variation in some areas, especially during winter months. Findings should, therefore, be considered in conjunction with maps showing temporal and spatial gaps in ECSAS survey effort (Figures 7.3.2, 7.3.4, and 7.3.6). Furthermore, ECCC advised the Committee that this data is a good resource for identifying areas where seabirds at sea are found in eastern Canada, but density estimates need to be interpreted with caution (ECCC, 2023k). Ongoing work by ECCC such as forthcoming predictive density models and, especially vulnerability models, will be important for filling this gap (discussed later in this section).

[60] Data and visuals showing density and distribution estimates for individual marine bird species (and some shorebirds) can also be accessed through the Open Science and Data Platform.

Figure 7.3.1. Seasonal Density and Distribution of Marine Birds in the Regional Assessment Focus Area, April - July

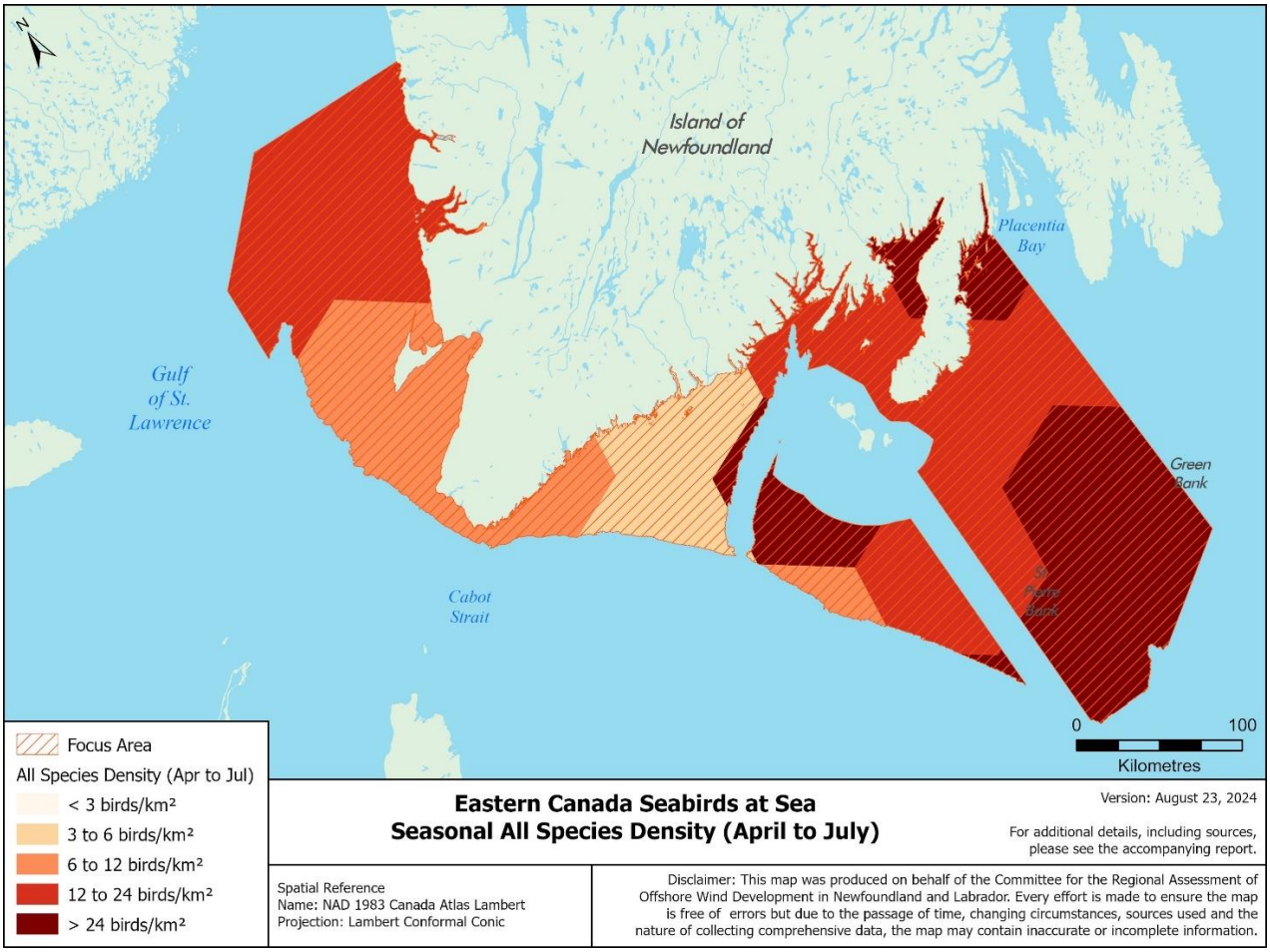


Figure Description: This map shows marine bird density and distribution across the Focus Area from April - July. Figure 7.3.2 shows survey effort during this period. April - July, August - November, and December - March roughly represent Spring migration and nesting periods of nidifugous species;[61] moult, chick-rearing period of nidifugous species, and second half of nesting of nidicolous species;[62] and Fall migration and wintering. Species-specific maps are available through the Open Science and Data Platform.

Data Sources: ECCC, 2023c; IAAC, 2023a; NRCan, 2023.

[61] Nidifugous species leave the nest shortly after hatching or birth.
[62] Nidicolous species remain in the nest for longer periods (e.g., many gulls and terns).

Figure 7.3.2. Eastern Canada Seabirds at-Sea Survey Effort, April - July

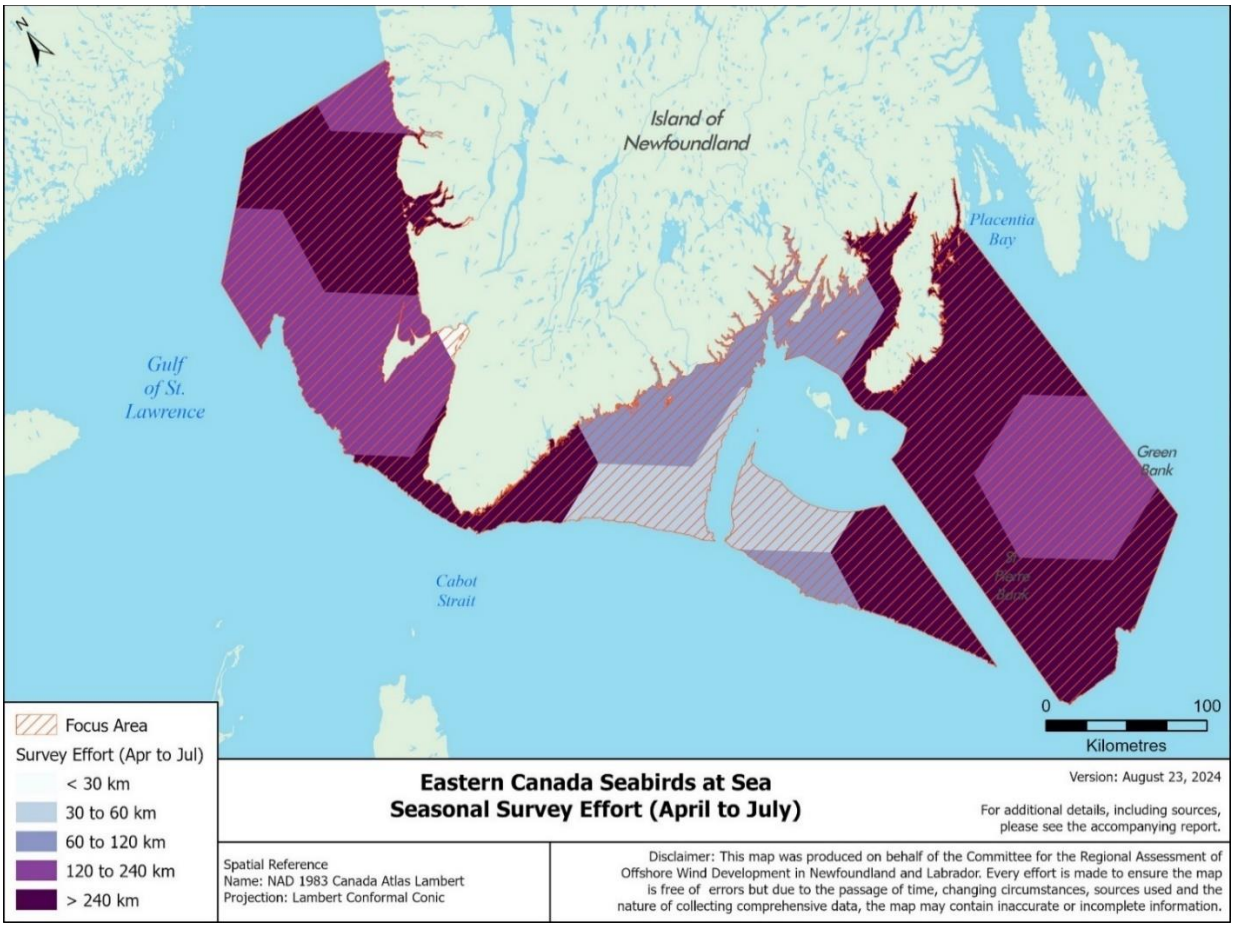


Figure Description: This map shows Eastern Canada Seabird at Sea survey effort across the Focus Area from April - July. Survey effort is measured as kilometers surveyed within each 100 km hexagonal cell. Variation in survey effort could influence density information shown in Figure 7.3.1.

Data Sources: ECCC, 2023c; IAAC, 2023a; NRCan, 2023.

Figure 7.3.3. Seasonal Density and Distribution of Marine Birds in the Regional Assessment Focus Area, August - November

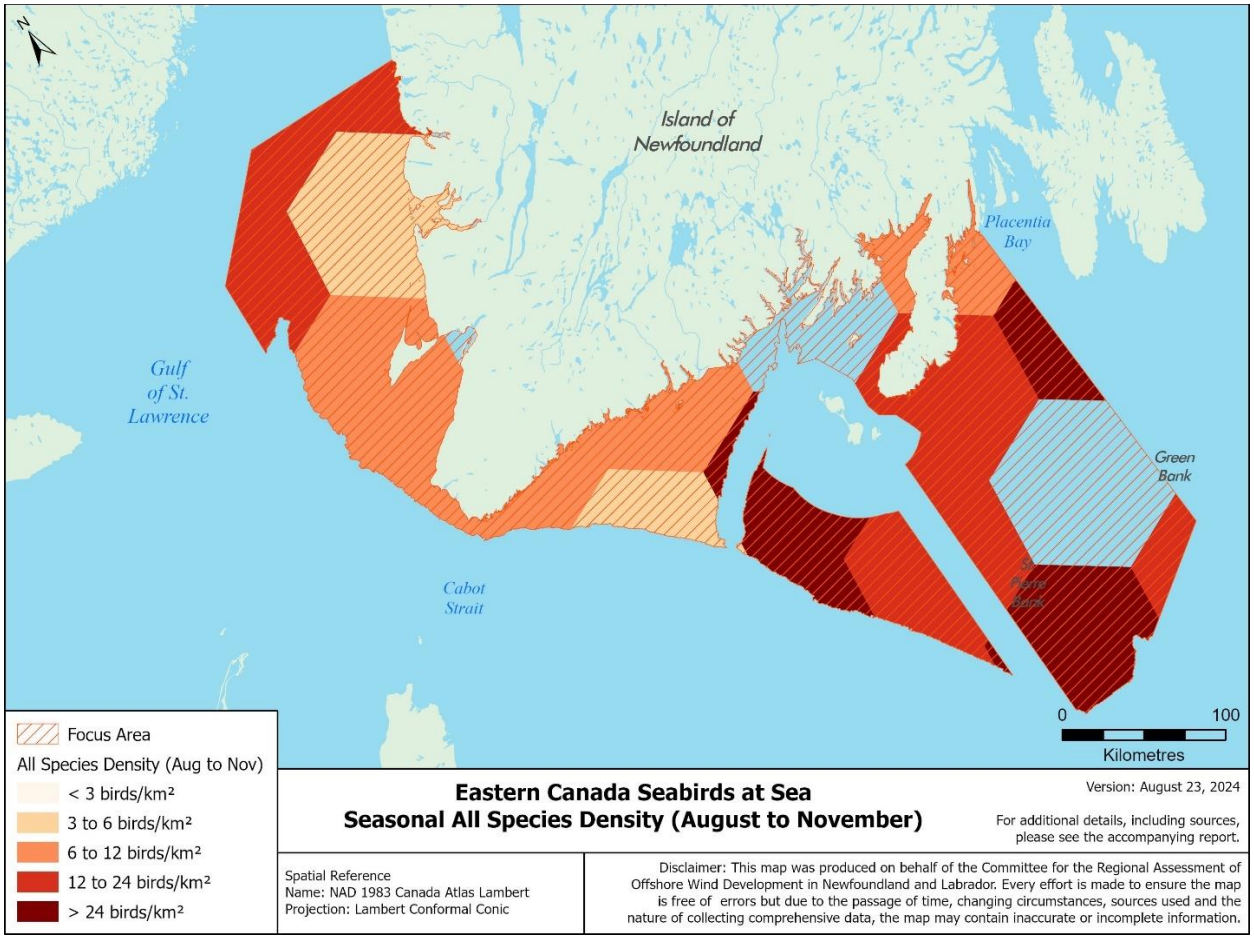


Figure Description: This map shows marine bird density and distribution across the Focus Area from August - November. Portions of the Focus Area with no species density data (i.e., symbology shows cross hatch only) had very low survey effort (< 30 km) or were not surveyed. Figure 7.3.4 shows survey effort during this period. April - July, August - November, and December - March roughly represent Spring migration and nesting periods of nidifugous species; moult, chick-rearing period of nidifugous species, and second half of nesting of nidicolous species; and Fall migration and wintering. Species-specific maps are available through the Open Science and Data Platform.

Data Sources: ECCC, 2023c; IAAC, 2023a; NRCan, 2023.

Figure 7.3.4. Eastern Canada Seabirds at-Sea Survey Effort, August - November

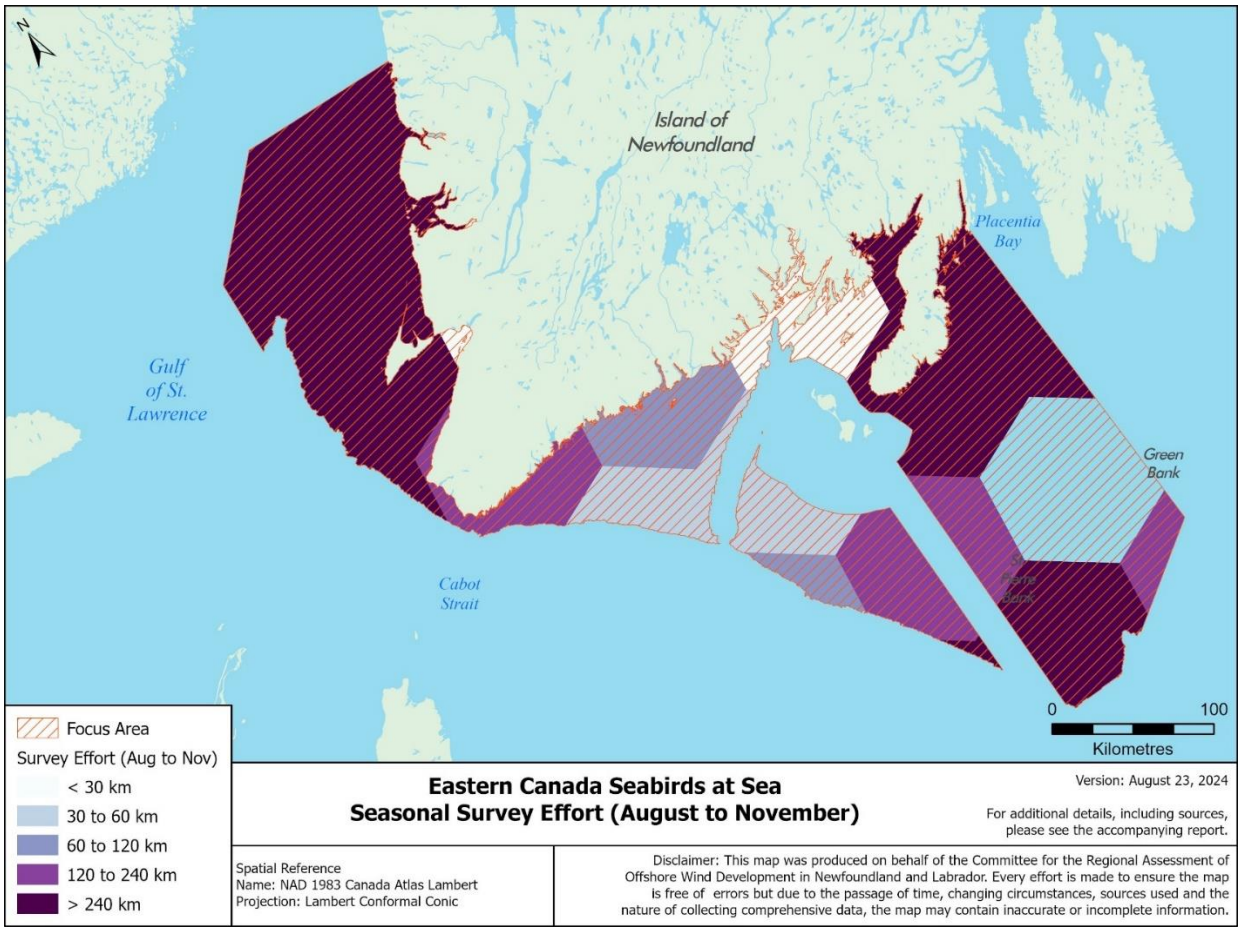


Figure Description: This map shows Eastern Canada Seabird at Sea survey effort across the Focus Area from August - November. Survey effort is measured as kilometers surveyed within each 100 km hexagonal cell. Portions of the Focus Area with no survey effort data (i.e., symbology shows cross hatch only) were not surveyed. Variation in survey effort could influence density information shown in Figure 7.3.1.

Data Sources: ECCC, 2023c; IAAC, 2023a; NRCan, 2023.

Figure 7.3.5. Seasonal Density and Distribution of Marine Birds in the Regional Assessment Focus Area, December - March

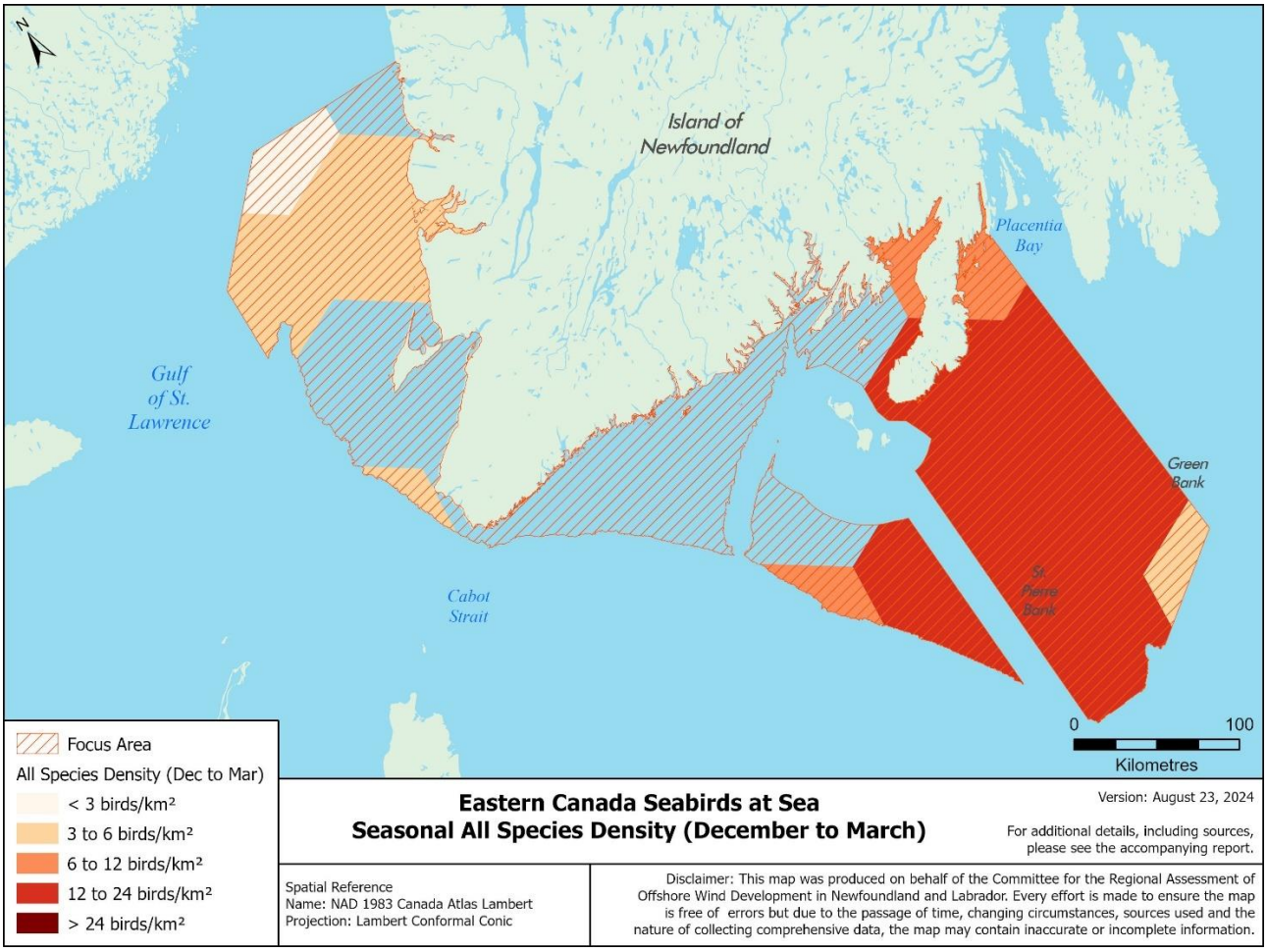


Figure Description: This map shows marine bird density and distribution across the Focus Area from December - March. Portions of the Focus Area with no species density data (i.e., symbology shows cross hatch only) had very low survey effort (< 30 km) or were not surveyed. Figure 7.3.2 shows survey effort during this period. April - July, August - November, and December - March roughly represent Spring migration and nesting periods of nidifugous species; moult, chick-rearing period of nidifugous species, and second half of nesting of nidicolous species; and Fall migration and wintering. Species-specific maps are available through the Open Science and Data Platform.

Data Sources: ECCC, 2023c; IAAC, 2023a; NRCan, 2023.

Figure 7.3.6. Eastern Canada Seabirds at-Sea Survey Effort, December - March

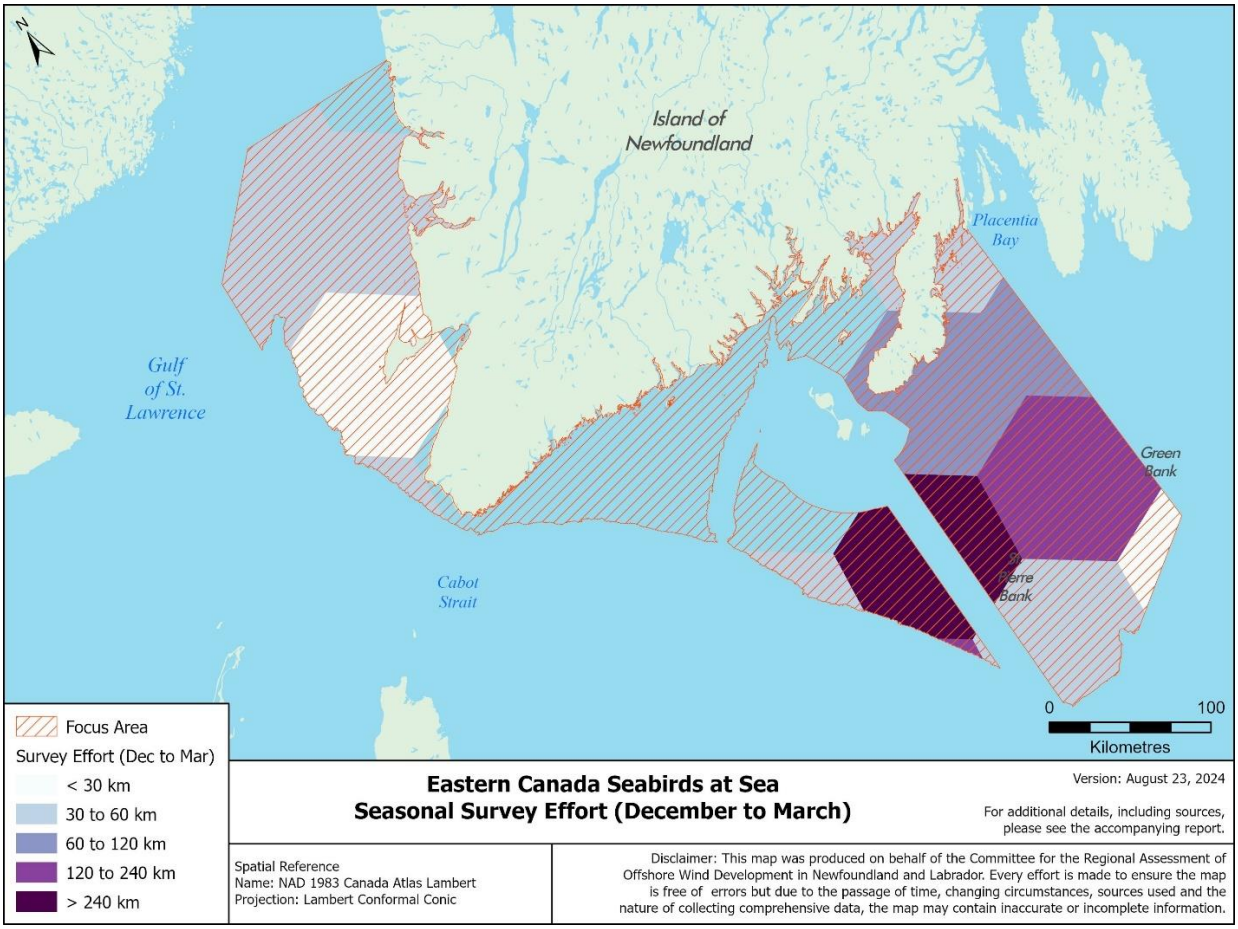


Figure Description: This map shows Eastern Canada Seabird at Sea survey effort across the Focus Area from December - March. Survey effort is measured as kilometers surveyed within each 100 km hexagonal cell. Portions of the Focus Area with no survey effort data (i.e., symbology shows cross hatch only) were not surveyed. Variation in survey effort could influence density information shown in Figure 7.3.5.

Data Sources: ECCC, 2023c; IAAC, 2023a; NRCan, 2023.

ECCC provided the Committee with confidential maps similar to the publicly available ECSAS maps (ECCC, 2023b; 2024a). These included a series of maps showing seasonal and annual density and distribution of seabirds in Atlantic Canada and maps showing predictive density models for some taxa. Both products were based on an updated, unpublished version of ECSAS data. Publicly available data is post-stratified using 100 km hexagonal cells (i.e., shows average individual/km^2 for 100 km hexagonal cells across Atlantic Canada) while the updated version applies a finer scale (50 km hexagonal cells). The density and distribution maps provided showed data classified according to quantile ranges and identified high density areas. Maps showing predictive density models showed locations of low and high density, predicted based on environmental variables. Extraction

and analysis for these models was like those described in Fifield et al. (2017). High density areas were displayed using standard deviation stretch.

The Committee reviewed these products to identify species with potentially high-density areas in the Focus Area. The Committee used a low threshold (50th percentile) to identify 'high density areas' given data limitations associated with ECSAS data. Species with high-density areas in the Focus Area during any season and in either product were identified. Based on the provided maps, the Focus Area may overlap relatively high-density areas for the following species in Atlantic Canada: Atlantic Puffin, Black-legged Kittiwake (*Rissa tridactyla*), Large Gulls (*Larus* spp.), murres, Northern Gannet, Razorbill (*Alca torda*), Black Guillemot (*Cepphus grille*), Dovekie (*Alle alle*), loons (*Gavia* spp.), Northern Fulmar (*Fulmarus glacialis*), phalaropes (*Phalaropus* spp.), shearwaters, and Wilson's (*Oceanites oceanicus*) and Leach's Storm-petrels. This suggests the Focus Area is important for these species. However, this should not be taken to mean these are the only marine bird species for which offshore wind development in the Focus Area is a concern. While distribution and density information are key considerations, specific habitat characteristics, the sensitivity of a species to development, and conservation status are also important to consider.

It should also be noted that the predictive density models are preliminary, and results are subject to change. ECCC advised they do not anticipate this will greatly change the general distribution patterns currently presented.

Movement Data

In addition to information on density and distribution based on ECSAS data, ECCC provided the Committee with maps showing spatial and temporal distribution of marine birds (as well as select waterfowl and shorebirds) based on movement data.

Data was extracted from various sources (public data, ECCC internal data, and unpublished research) and included birds recorded at colonies within Atlantic Canada and birds passing through the region. Data was modeled for individual species over different seasons using one of three approaches: dynamic Brownian bridge movement models (dBBMM), kernel densities, or individual tracks. The specific approach was selected based on the accuracy of tracking devices used, and sample size (i.e., the number of individuals and number of locations recorded). DBBMMs provide a more accurate estimate of spatial use than kernel densities. Tracks estimate individuals' movement.

These models are not necessarily representative of populations in the area. In individual movement studies, sample sizes should be selected to represent the specific species and population in the study area. Furthermore, based on current literature, a minimum of 30 devices per species and colony should be deployed to ensure adequate representation (ECCC, 2024a). This was not apparent in all data used. However, the models do suggest that certain species occur in the Focus Area and contribute to understanding their distribution.

Models show the following species in the Focus Area. The model type is indicated in brackets: Atlantic Puffin (kernel), Black-legged Kittiwake (kernel, tracks), Common Murre

(dBBMM, kernel), Cory's Shearwater (*Calonectris diomedea*) (kernel, tracks), Great Shearwater (*Puffinus gravis*) (dBBMM), Herring Gull (*Larus argentatus*) (dBBMM), Long-tailed Jaeger (*Stercorarius longicaudus*) (kernel), Manx Shearwater (*Puffinus puffinus*) (kernel), Northern Gannet (dBBMM, kernel), Parasitic Jaeger (*Stercorarius parasiticus*) (kernel, tracks), Razorbill (kernel), Sooty Shearwater (*Puffinus griseus*) (kernel), Thick-billed Murre (*Uria lomvia*) (kernel), Whimbrel (*Numenius phaeopus*) (dBBMM), White-tailed Tropicbird (*Phaethon lepturus*) (kernel), and White-winged Scoter (*Melanitta fusca*) (dBBMM).

Models did not show the following in the Focus Area, but this does not indicate their absence (see below): Atlantic Puffin (dBBMM), Black Guillemot (kernel), Great Black-backed Gull (*Larus marinus*) (dBBMM), Glaucous Gull (*Larus hyperboreus*) (kernel and tracks), Ivory Gull (*Pagophila eburnean*) (tracks), Long-tailed Jaeger (tracks), Northern Fulmar (tracks), Razorbill (dBBMM), Roseate Tern (*Sterna dougallii*)(dBBMM), American Black Duck (*Anas rubripes*) (dBBMM), Black Scoter (*Melanitta americana*) (dBBMM), Canada Goose (*Branta canadensis*) (tracks), Common Eider (*Somateria mollissima*) (dBBMM, tracks), Long-tailed Duck (*Clangula hyemalis*) (dBBMM), Red-throated Loon (*Gavia stellata*) (dBBMM), and Surf Scoter (*Melanitta perspicillata*) (dBBMM).

All movement models provided by ECCC are available on the Registry.[63] Section 7.3.2.1.2 of this Report discusses additional movement data for shorebirds.

Overall, this work involved an extensive review of movement data in the Atlantic Canada offshore region, but available data is limited. ECCC recommended the following when interpreting the movement information they provided:

> As the available tracking data is limited in terms of number of individuals and spatial coverage, absence should be interpreted as a gap in data collection rather than no birds being present. Similarly, high usage areas might only reflect important areas for the tagged population and not the whole population. These products provide a baseline for the species studied and should be used as an indicator of where future efforts could be directed to increase knowledge of seasonal space use. (ECCC, 2024a).

Movement data is a considerable gap in this region. The Committee suggests a number of recommendations, based on input from ECCC to help address this gap (see Section 7.3.7 of this Report).

[63] These submissions are available on the Registry under document reference number 275, Marine Bird Movement.

Bird Colonies and Foraging Distribution

Bird colonies support high densities of marine birds and waterfowl during sensitive life periods, like breeding. During breeding, nesting, and chick-rearing, large congregations of birds are tied to the colony, restricting their foraging to the surrounding waters. These restricted movements may cause individuals to be more at risk of displacement or collision within their natural foraging range around colonies. Species also travel to and from colonies and overwintering areas.

The Banque Informatisée des Oiseaux de Mer au Québec and Atlantic Colonial Waterbird Database contain records of individual colony counts, by species, for known colonies located in Eastern Canada. Some colonies are censused annually, but most are visited less frequently. Different census methods are also used depending on bird type. Some records are publicly available on Open Government (ECCC, 2016a).

Some work has also been completed by Ronconi et al. (2022), to model seabird foraging distribution around colonies during breeding season. They used tracking data around 'training colonies' from 520 individuals of 14 seabird species, and machine learning to build predictive models for each species. These models estimate the probability of an individual (from the given species) using a location around 'prediction colonies' (i.e., colonies without tracking data) based on environmental variables related to bathymetry, ocean ruggedness, track distance from colonies, and distance from coastlines. They further combined these models with information on colony size to generate prediction surfaces that estimate colony centered density and distribution for each species (Figures 7.3.7 through 7.3.18). ECCC advised that, for the species included, these results could be good sources of information for broad-scale assessments and conservation planning (ECCC, 2023l; 2024a). Study species included Common Eider, Leach's Storm-petrel,[64] Northern Gannet, Great Black-backed Gull, Herring Gull, Black-legged Kittiwake, Common Tern (*Sterna hirundo*), Arctic Tern (*Sterna paradisaea*), Roseate Tern, Razorbill, Atlantic Puffin, Common Murre (*Uria aalge*), Thick-billed Murre, and Black Guillemot.

Limitations associated with this information source should also be noted. For example, some bird colonies are not represented in the maps below. Data gaps also remain for certain species and colonies related to the collection of tracking data and presents a need for follow-up research related to colonial foraging. As a part of their study, Ronconi et al. (2022), scored the reliability of their model inputs on a scale of 4 (minimum) - 12 (maximum). Scores were based on the quality and quantity of tracking data, and the completeness and accuracy of colony data which were each scored on a scale of 1 (low) - 3 (high) and summed for the overall reliability score. The reliability of input data varies across species, and is particularly low for Black-Legged Kittiwake, Arctic Tern, Common Tern, Black Guillemot, and Common Eider. The Committee is also of the view that the

[64] Due to the difficulties in distinguishing foraging patterns of smaller colonies, ECCC advised using the Dynamic Brownian Bridge Movement Models specific to Leach's Storm-petrel, rather than predictive or theoretical foraging radii.

quantity and quality (i.e., accuracy based on devices used) of avifauna tracking data, in general, is a limitation for understanding species distribution, and that more research should validate Ronconi et al.'s findings. Therefore, this information should be interpreted with caution.

An additional limitation for species such as Puffin and Storm-petrel, is that the foraging patterns of smaller colonies are difficult to distinguish from larger colonies.

Figure 7.3.7. Colony Centered Predicted Density for Common Eider

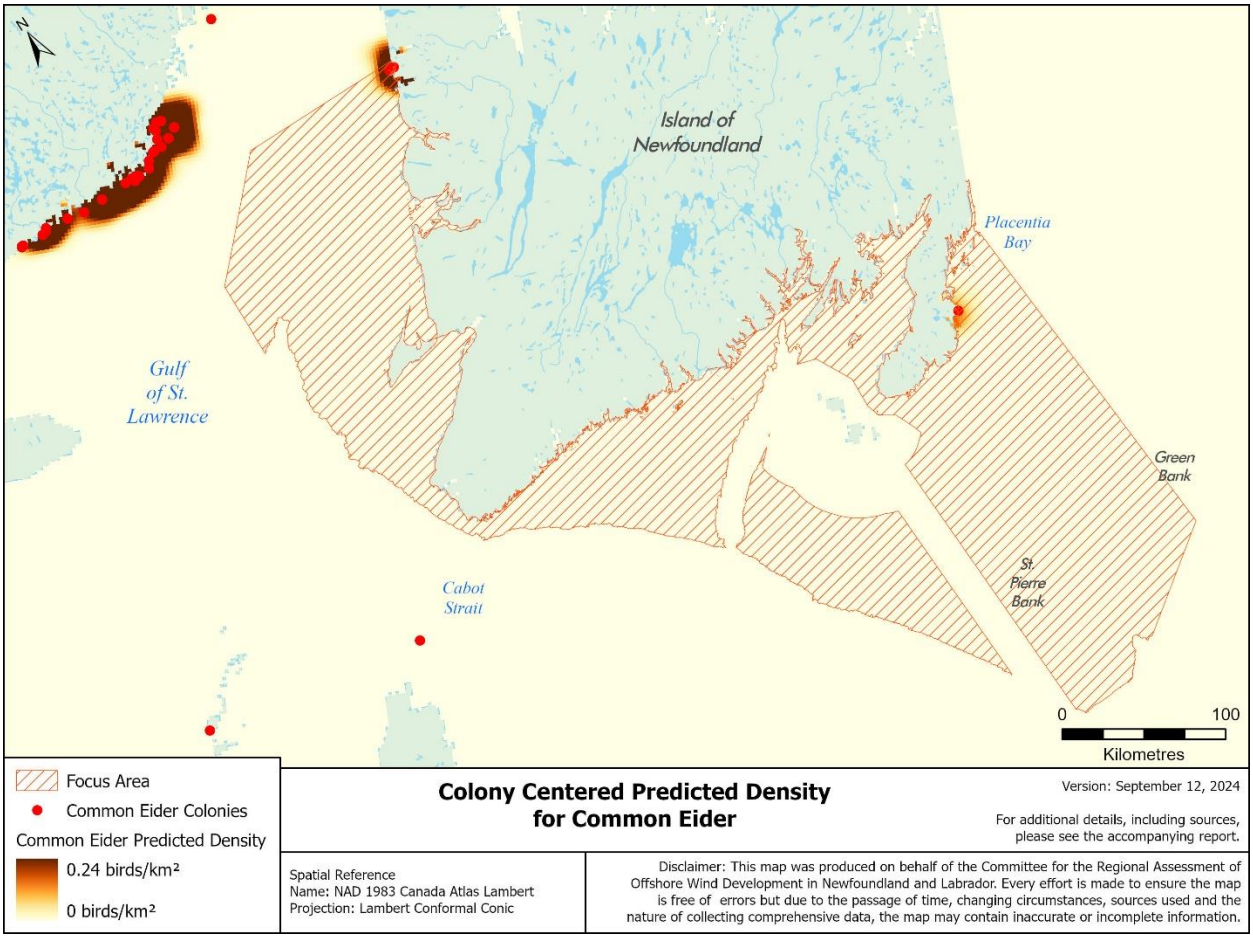


Figure Description: This map shows predicted density for Common Eider around bird colonies. Predictions are based on modelling completed by Ronconi et al. (2022). Models were built based on tracking data from individuals around select colonies; environmental variables expected to predict species' presence (based on the tracking data) including the location's distance from the coast, distance from an individual's breeding colony, bathymetry, slope, and ruggedness; and colony size. Ronconi et al. (2022), also scored the reliability of their model inputs on a scale of 4 (minimum) - 12 (maximum). Scores were based on the quality and quantity of tracking data, and the completeness and accuracy of colony data which were each scored on a scale of 1 (low) - 3 (high) and summed for the overall reliability score. Quality of tracking data refers to the device type used, because devices differ in accuracy (VHF (Very High Frequency) and GLS (Geolocation-Sensing) score 1, PTT scores 2, and GPS scores 3). Quantity sores are based on number of individuals, number of sites and number of bird locations. Colony data are scored based on completeness (likelihood that all colonies are represented in the database) and accuracy (related to census method and/or date of most recent estimate). Common Eider scored quality: 2; quantity: 1; completeness: 2; accuracy: 1; total: 6. The Committee is aware of some known colonies that are not represented in this data.

Data Sources: IAAC, 2023a; Lieske et al., 2020b; NRCan, 2023; Ronconi et al., 2022.

Figure 7.3.8. Colony Centered Predicted Density for Leach's Storm-petrel

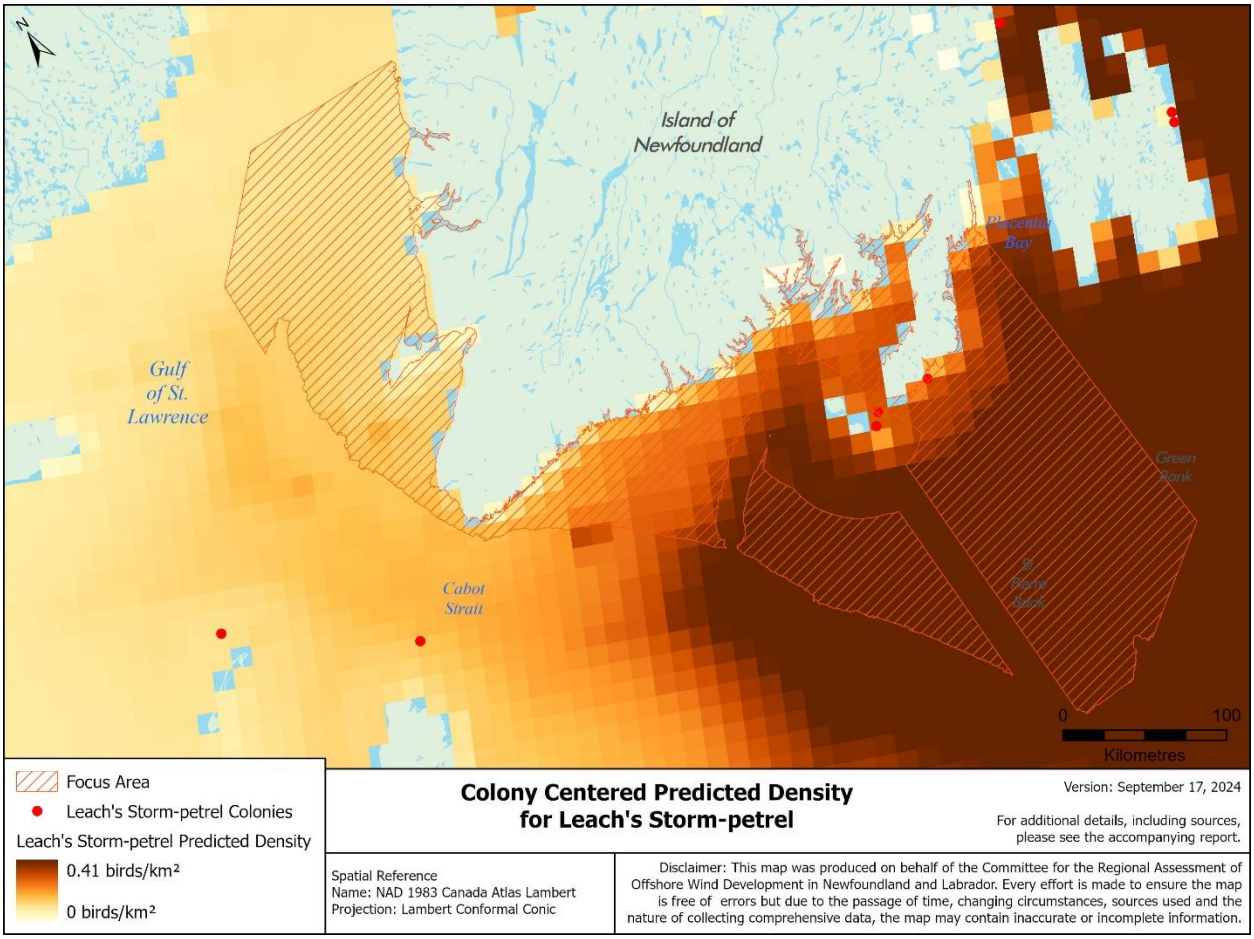


Figure Description: This map shows predicted density for Leach's Storm-petrel around bird colonies. Predictions are based on modelling completed by Ronconi et al. (2022). Models were built based on tracking data from individuals around select colonies; environmental variables expected to predict species' presence (based on the tracking data) including the location's distance from the coast, distance from an individual's breeding colony, bathymetry, slope, and ruggedness; and colony size. Ronconi et al. (2022), also scored the reliability of their model inputs on a scale of 4 (minimum) - 12 (maximum). Scores were based on the quality and quantity of tracking data, and the completeness and accuracy of colony data which were each scored on a scale of 1 (low) - 3 (high) and summed for the overall reliability score. Quality of tracking data refers to the device type used, because devices differ in accuracy (VHF and GLS score 1, PTT scores 2, and GPS scores 3). Quantity sores are based on number of individuals, number of sites and number of bird locations. Colony data are scored based on completeness (likelihood that all colonies are represented in the database) and accuracy (related to census method and/or date of most recent estimate). Leach's Storm-petrel scored quality: 2; quantity: 3; completeness: 2; accuracy: 2; total: 9.

Data Sources: IAAC, 2023a; Lieske et al., 2020b; NRCan, 2023; Ronconi et al., 2022.

Figure 7.3.9. Colony Centered Predicted Density for Northern Gannet

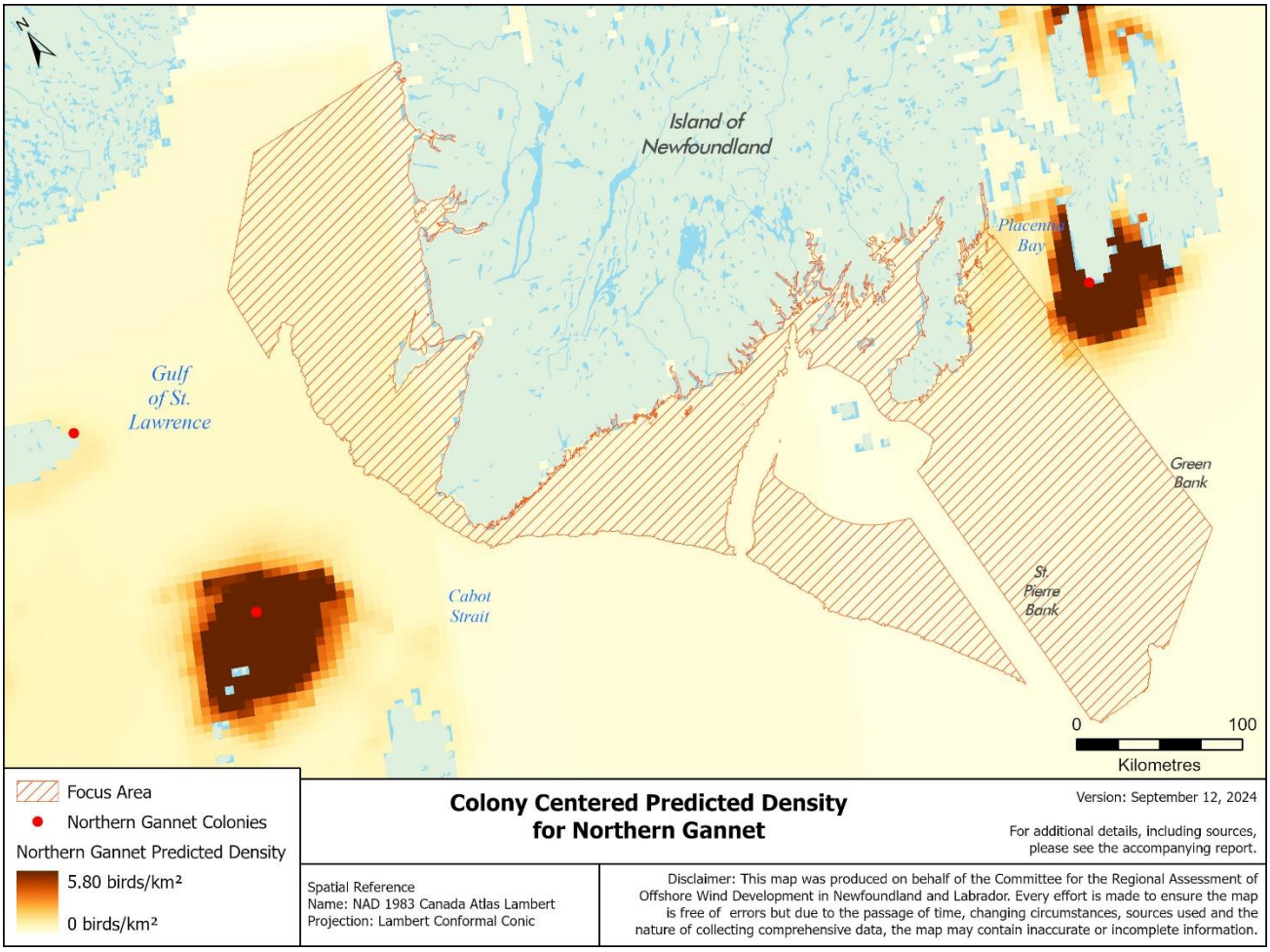


Figure Description: This map shows predicted density for Northern Gannet around bird colonies. Predictions are based on modelling completed by Ronconi et al. (2022). Models were built based on tracking data from individuals around select colonies; environmental variables expected to predict species' presence (based on the tracking data) including the location's distance from the coast, distance from an individual's breeding colony, bathymetry, slope, and ruggedness; and colony size. Ronconi et al. (2022), also scored the reliability of their model inputs on a scale of 4 (minimum) - 12 (maximum). Scores were based on the quality and quantity of tracking data, and the completeness and accuracy of colony data which were each scored on a scale of 1 (low) - 3 (high) and summed for the overall reliability score. Quality of tracking data refers to the device type used, because devices differ in accuracy (VHF and GLS score 1, PTT scores 2, and GPS scores 3). Quantity scores are based on number of individuals, number of sites and number of bird locations. Colony data are scored based on completeness (likelihood that all colonies are represented in the database) and accuracy (related to census method and/or date of most recent estimate). Northern Gannet scored quality: 3; quantity: 3; completeness: 3; accuracy: 3; total: 12. The Committee is aware of some known colonies that are not represented in this data.

Data Sources: IAAC, 2023a; Lieske et al., 2020b; NRCan, 2023; Ronconi et al., 2022.

Figure 7.3.10. Colony Centered Predicted Density for Colonial Seabirds – Great Black-backed Gull

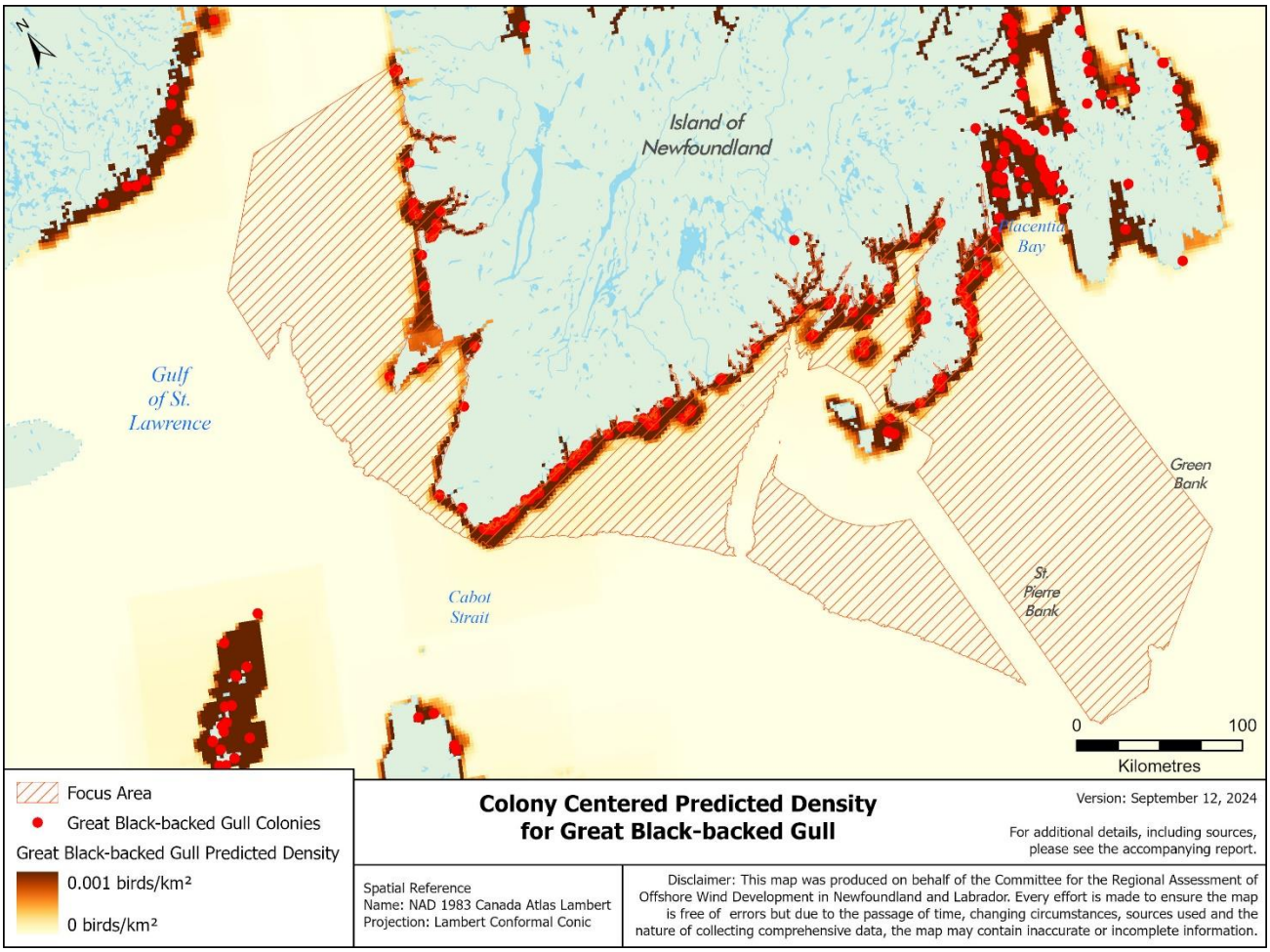


Figure Description: This map shows predicted density for Great Black-backed Gull around bird colonies. Predictions are based on modelling completed by Ronconi et al. (2022). Models were built based on tracking data from individuals around select colonies; environmental variables expected to predict species' presence (based on the tracking data) including the location's distance from the coast, distance from an individual's breeding colony, bathymetry, slope, and ruggedness; and colony size. Ronconi et al. (2022), also scored the reliability of their model inputs on a scale of 4 (minimum) - 12 (maximum). Scores were based on the quality and quantity of tracking data, and the completeness and accuracy of colony data which were each scored on a scale of 1 (low) - 3 (high) and summed for the overall reliability score. Quality of tracking data refers to the device type used, because devices differ in accuracy (VHF and GLS score 1, PTT scores 2, and GPS scores 3). Quantity scores are based on number of individuals, number of sites and number of bird locations. Colony data are scored based on completeness (likelihood that all colonies are represented in the database) and accuracy (related to census method and/or date of most recent estimate). Great Black-backed Gull scored quality: 2; quantity: 2; completeness: 3; accuracy: 2; total: 9.

Data Sources: IAAC, 2023a; Lieske et al., 2020b; NRCan, 2023; Ronconi et al., 2022.

Figure 7.3.11. Colony Centered Predicted Density for Colonial Seabirds – Herring Gull

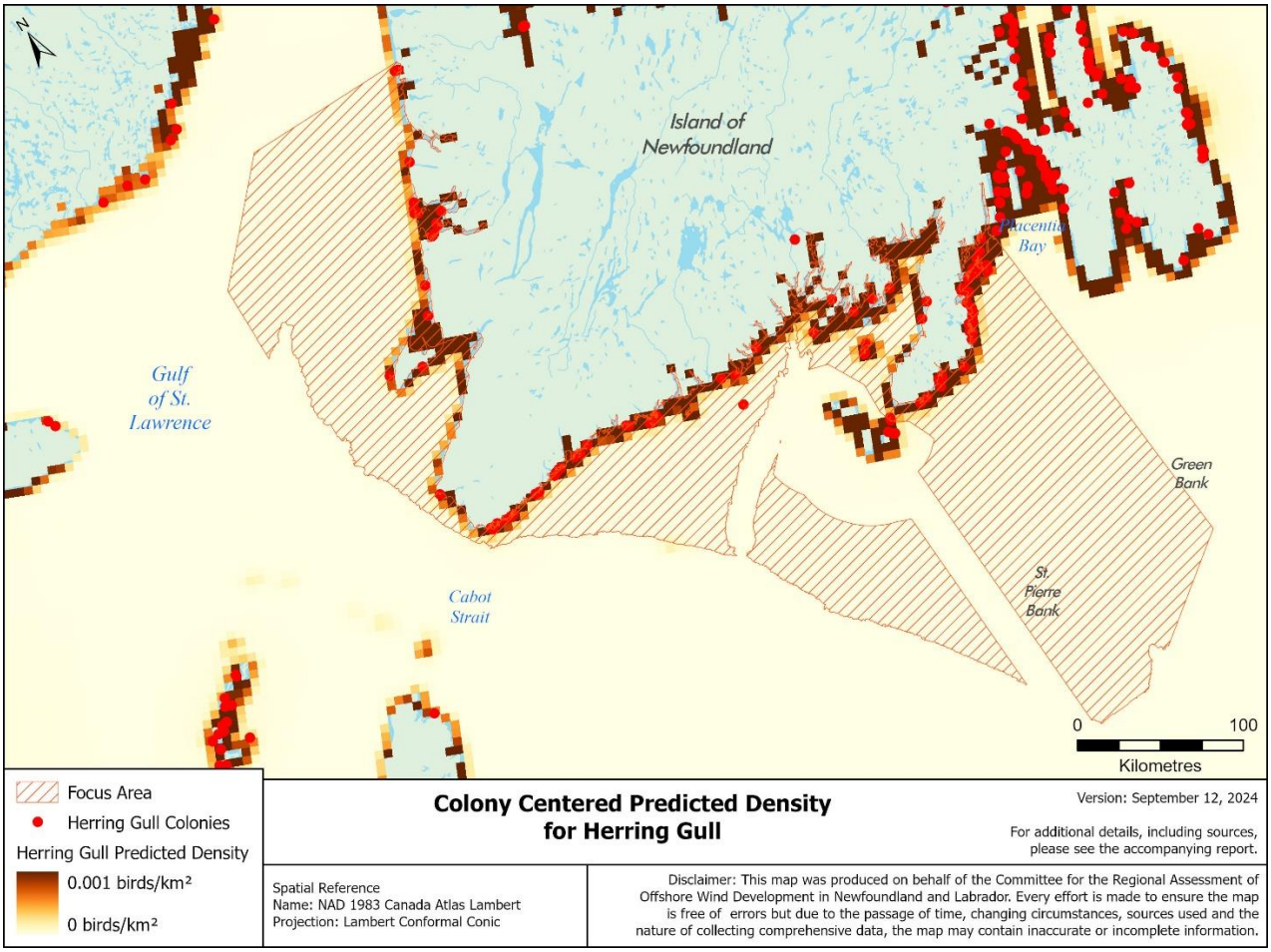


Figure Description: This map shows predicted density for Herring Gull around bird colonies. Predictions are based on modelling completed by Ronconi et al. (2022). Models were built based on tracking data from individuals around select colonies; environmental variables expected to predict species' presence (based on the tracking data) including the location's distance from the coast, distance from an individual's breeding colony, bathymetry, slope, and ruggedness; and colony size. Ronconi et al. (2022), also scored the reliability of their model inputs on a scale of 4 (minimum) - 12 (maximum). Scores were based on the quality and quantity of tracking data, and the completeness and accuracy of colony data which were each scored on a scale of 1 (low) - 3 (high) and summed for the overall reliability score. Quality of tracking data refers to the device type used, because devices differ in accuracy (VHF and GLS score 1, PTT scores 2, and GPS scores 3). Quantity scores are based on number of individuals, number of sites and number of bird locations. Colony data are scored based on completeness (likelihood that all colonies are represented in the database) and accuracy (related to census method and/or date of most recent estimate). Herring Gull scored quality: 3; quantity: 3; completeness: 3; accuracy: 2; total: 11.

Data Sources: IAAC, 2023a; Lieske et al., 2020b; NRCan, 2023; Ronconi et al., 2022.

Figure 7.3.12. Colony Centered Predicted Density for Colonial Seabirds – Black-legged Kittiwake

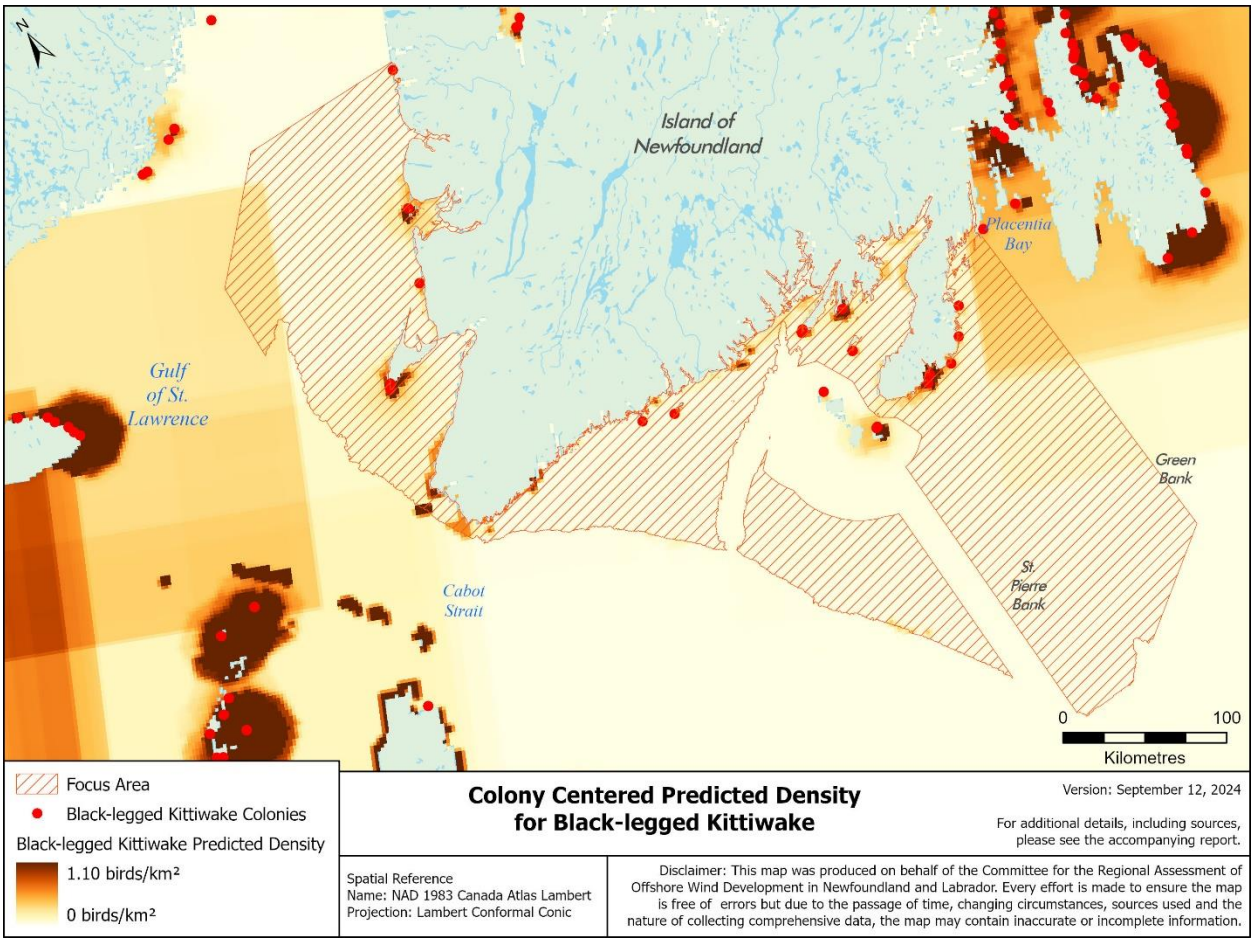


Figure Description: This map shows predicted density for Black-legged Kittiwake around bird colonies. Predictions are based on modelling completed by Ronconi et al. (2022). Models were built based on tracking data from individuals around select colonies; environmental variables expected to predict species' presence (based on the tracking data) including the location's distance from the coast, distance from an individual's breeding colony, bathymetry, slope, and ruggedness; and colony size. Ronconi et al. (2022), also scored the reliability of their model inputs on a scale of 4 (minimum) - 12 (maximum). Scores were based on the quality and quantity of tracking data, and the completeness and accuracy of colony data which were each scored on a scale of 1 (low) - 3 (high) and summed for the overall reliability score. Quality of tracking data refers to the device type used, because devices differ in accuracy (VHF and GLS score 1, PTT scores 2, and GPS scores 3). Quantity scores are based on number of individuals, number of sites and number of bird locations. Colony data are scored based on completeness (likelihood that all colonies are represented in the database) and accuracy (related to census method and/or date of most recent estimate). Black-legged Kittiwake scored quality: 3; quantity: 1; completeness: 2; accuracy: 2; total: 8.

Data Sources: IAAC, 2023a; Lieske et al., 2020b; NRCan, 2023; Ronconi et al., 2022.

Figure 7.3.13. Colony Centered Predicted Density for Colonial Seabirds – Tern Species

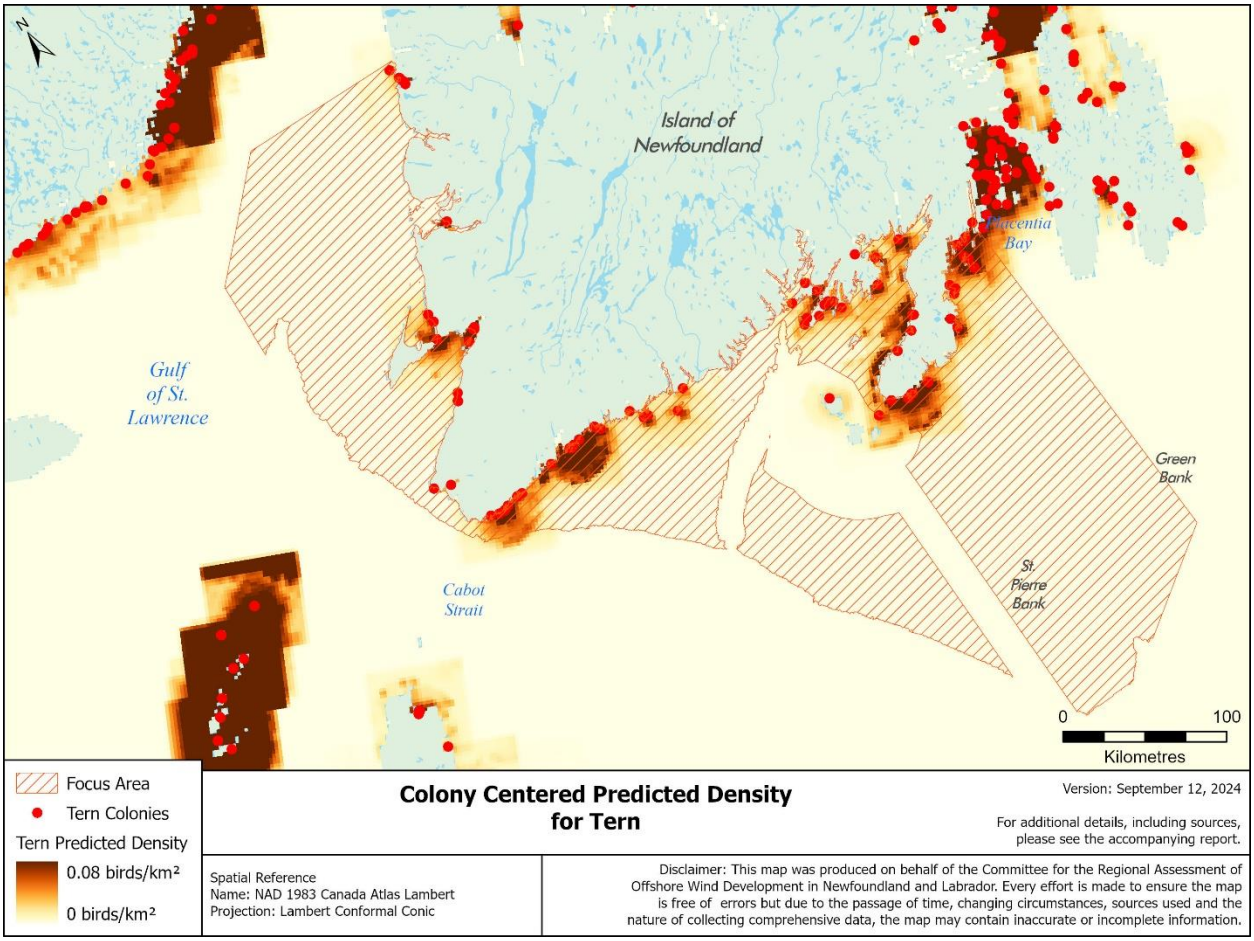


Figure Description: This map shows predicted density for tern species around bird colonies. Predictions are based on modelling completed by Ronconi et al. (2022). Models were built based on tracking data from individuals around select colonies; environmental variables expected to predict species' presence (based on the tracking data) including the location's distance from the coast, distance from an individual's breeding colony, bathymetry, slope, and ruggedness; and colony size. Ronconi et al. (2022), also scored the reliability of their model inputs on a scale of 4 (minimum) - 12 (maximum). Scores were based on the quality and quantity of tracking data, and the completeness and accuracy of colony data which were each scored on a scale of 1 (low) - 3 (high) and summed for the overall reliability score. Quality of tracking data refers to the device type used, because devices differ in accuracy (VHF and GLS score 1, PTT scores 2, and GPS scores 3). Quantity sores are based on number of individuals, number of sites and number of bird locations. Colony data are scored based on completeness (likelihood that all colonies are represented in the database) and accuracy (related to census method and/or date of most recent estimate). Roseate Tern scored quality: 2; quantity: 2; completeness: 3; accuracy: 3; total: 10. Arctic Tern scored quality: 1; quantity: 1; completeness: 3; accuracy: 2; total: 7. Common Tern scored quality: 1; quantity: 1; completeness: 3; accuracy: 2; total: 7. The Committee is aware of some colonies represented in this data that no longer exist.

Data Sources: IAAC, 2023a; Lieske et al., 2020b; NRCan, 2023; Ronconi et al., 2022.

Figure 7.3.14. Colony Centered Predicted Density for Colonial Seabirds – Razorbill

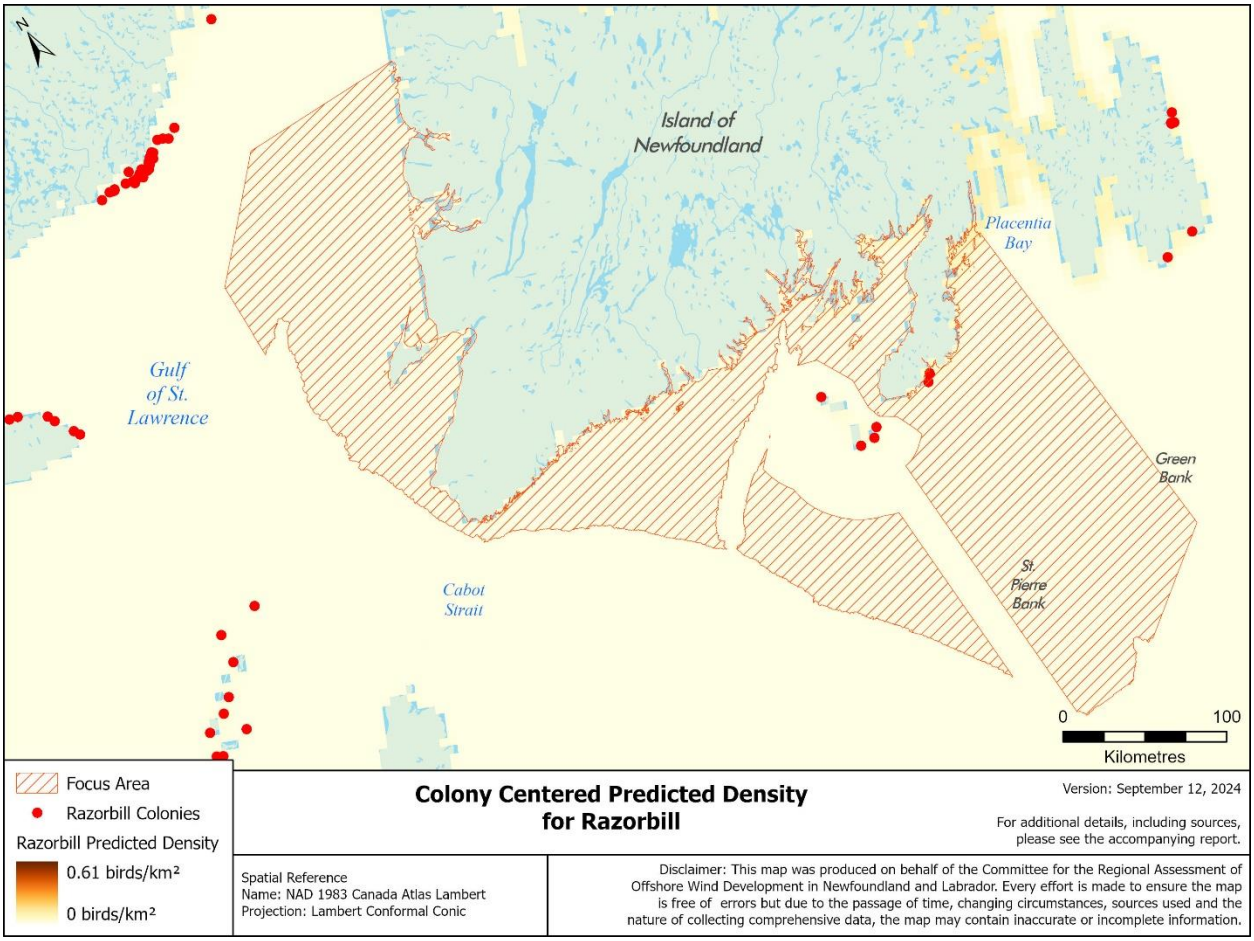


Figure Description: This map shows predicted density for Razorbill around bird colonies. Predictions are based on modelling completed by Ronconi et al. (2022). Models were built based on tracking data from individuals around select colonies; environmental variables expected to predict species' presence (based on the tracking data) including the location's distance from the coast, distance from an individual's breeding colony, bathymetry, slope, and ruggedness; and colony size. Ronconi et al. (2022), also scored the reliability of their model inputs on a scale of 4 (minimum) - 12 (maximum). Scores were based on the quality and quantity of tracking data, and the completeness and accuracy of colony data which were each scored on a scale of 1 (low) - 3 (high) and summed for the overall reliability score. Quality of tracking data refers to the device type used, because devices differ in accuracy (VHF and GLS score 1, PTT scores 2, and GPS scores 3). Quantity scores are based on number of individuals, number of sites and number of bird locations. Colony data are scored based on completeness (likelihood that all colonies are represented in the database) and accuracy (related to census method and/or date of most recent estimate). Razorbill scored quality: 3; quantity: 3; completeness: 3; accuracy: 2; total: 11.

Data Sources: IAAC, 2023a; Lieske et al., 2020b; NRCan, 2023; Ronconi et al., 2022.

Figure 7.3.15. Colony Centered Predicted Density for Colonial Seabirds – Atlantic Puffin

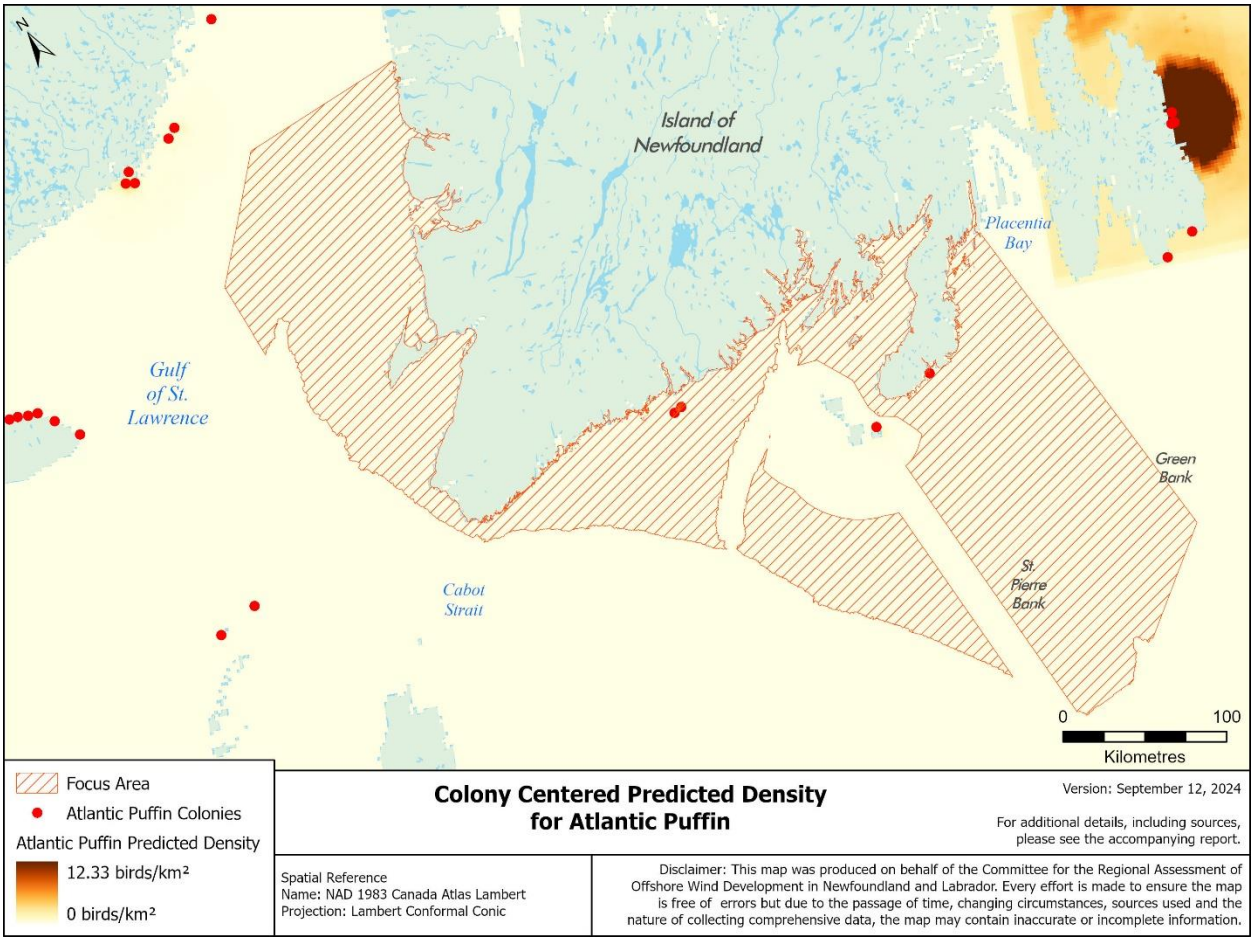


Figure Description: This map shows predicted density for Atlantic Puffin around bird colonies. Predictions are based on modelling completed by Ronconi et al. (2022). Models were built based on tracking data from individuals around select colonies; environmental variables expected to predict species' presence (based on the tracking data) including the location's distance from the coast, distance from an individual's breeding colony, bathymetry, slope, and ruggedness; and colony size. Ronconi et al. (2022), also scored the reliability of their model inputs on a scale of 4 (minimum) - 12 (maximum). Scores were based on the quality and quantity of tracking data, and the completeness and accuracy of colony data which were each scored on a scale of 1 (low) - 3 (high) and summed for the overall reliability score. Quality of tracking data refers to the device type used, because devices differ in accuracy (VHF and GLS score 1, PTT scores 2, and GPS scores 3). Quantity scores are based on number of individuals, number of sites and number of bird locations. Colony data are scored based on completeness (likelihood that all colonies are represented in the database) and accuracy (related to census method and/or date of most recent estimate). Atlantic Puffin scored quality: 3; quantity: 2; completeness: 3; accuracy: 3; total: 11.

Data Sources: IAAC, 2023a; Lieske et al., 2020b; NRCan, 2023; Ronconi et al., 2022.

Figure 7.3.16. Colony Centered Predicted Density for Colonial Seabirds – Common Murre

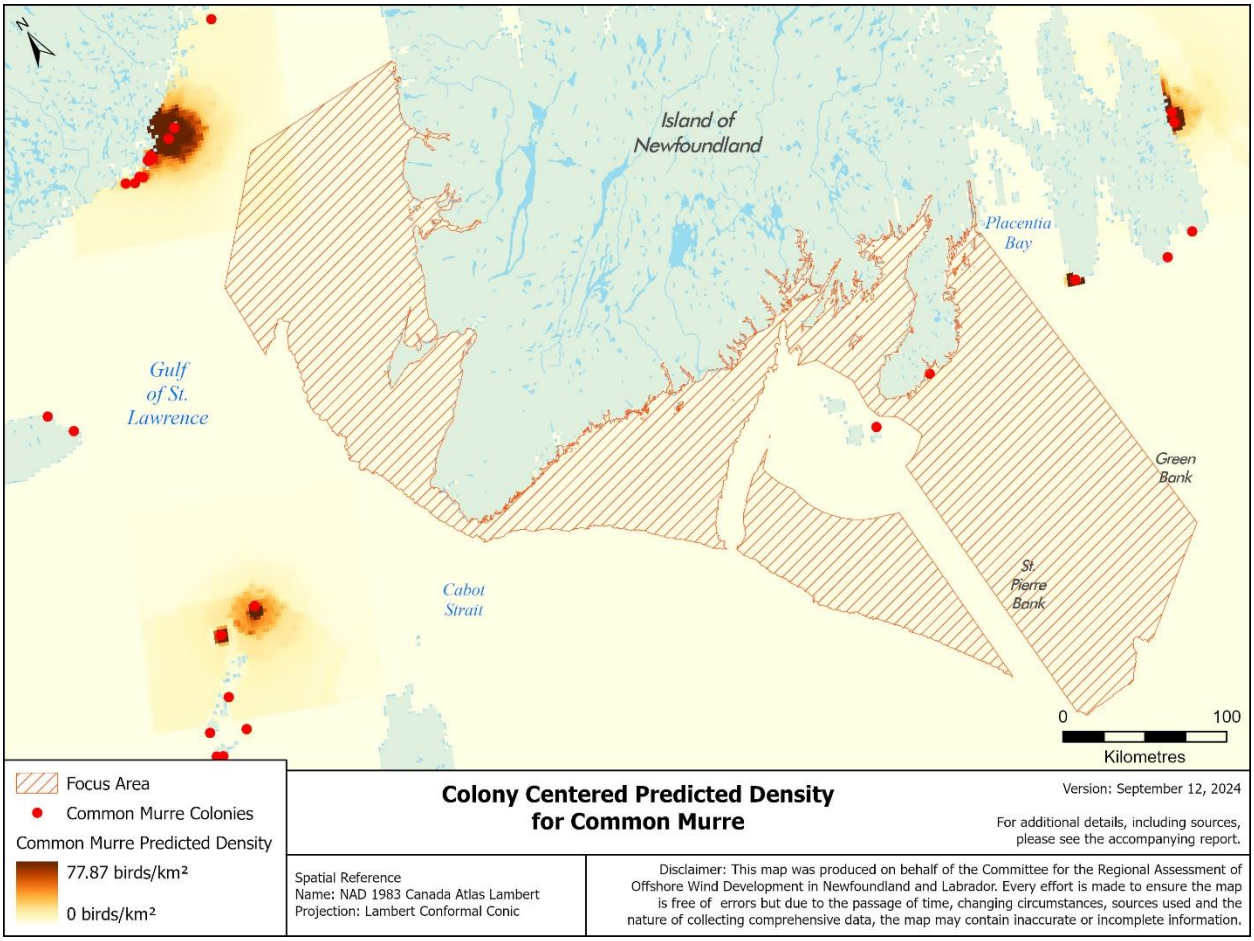


Figure Description: This map shows predicted density for Common Murre around bird colonies. Predictions are based on modelling completed by Ronconi et al. (2022). Models were built based on tracking data from individuals around select colonies; environmental variables expected to predict species' presence (based on the tracking data) including the location's distance from the coast, distance from an individual's breeding colony, bathymetry, slope, and ruggedness; and colony size. Ronconi et al. (2022), also scored the reliability of their model inputs on a scale of 4 (minimum) - 12 (maximum). Scores were based on the quality and quantity of tracking data, and the completeness and accuracy of colony data which were each scored on a scale of 1 (low) - 3 (high) and summed for the overall reliability score. Quality of tracking data refers to the device type used, because devices differ in accuracy (VHF and GLS score 1, PTT scores 2, and GPS scores 3). Quantity scores are based on number of individuals, number of sites and number of bird locations. Colony data are scored based on completeness (likelihood that all colonies are represented in the database) and accuracy (related to census method and/or date of most recent estimate). Common Murre scored quality: 3; quantity: 3; completeness: 3; accuracy: 3; total: 12.

Data Sources: IAAC, 2023a; Lieske et al., 2020b; NRCan, 2023; Ronconi et al., 2022.

Figure 7.3.17. Colony Centered Predicted Density for Colonial Seabirds – Thick-billed Murre

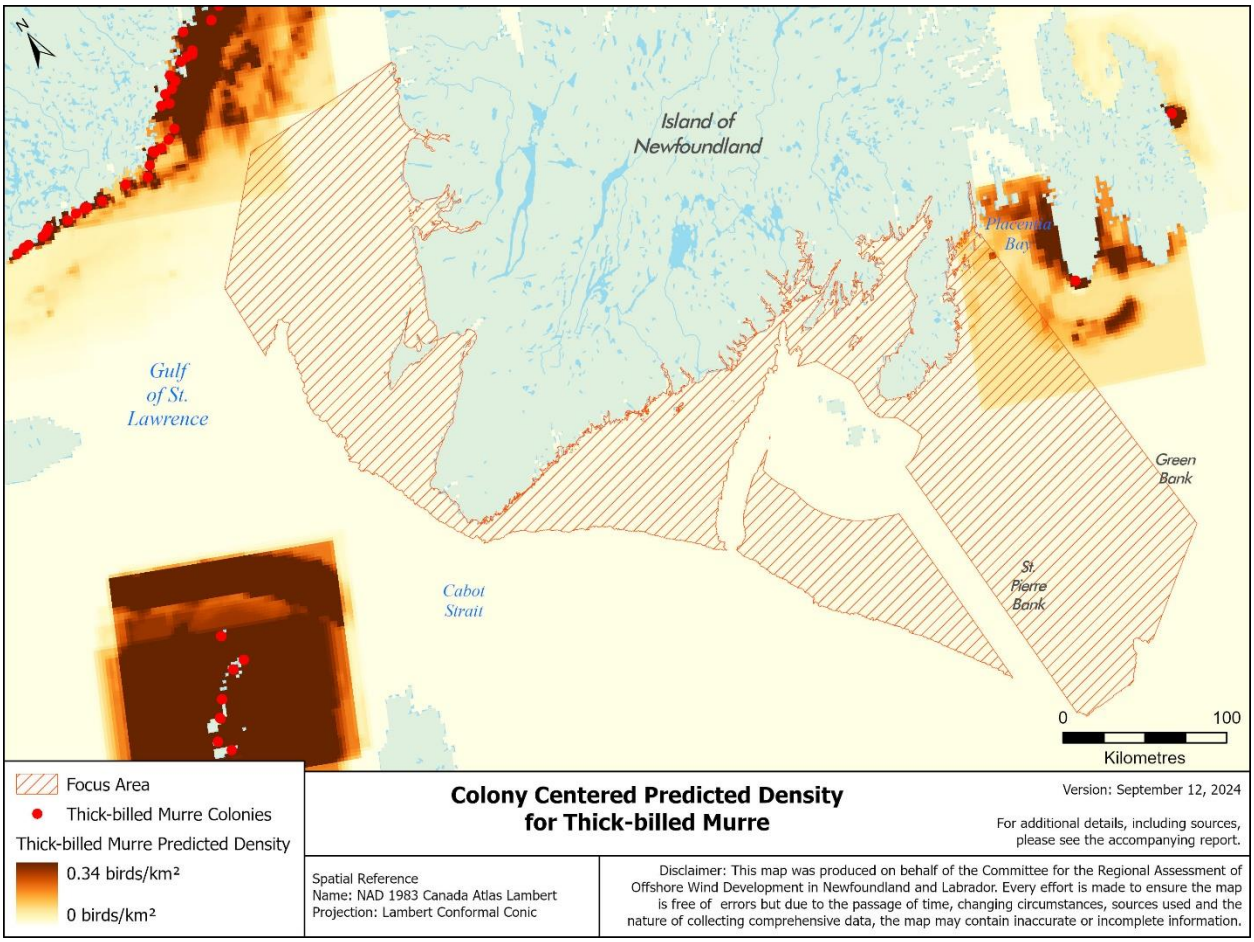


Figure Description: This map shows predicted density for Thick-billed Murre around bird colonies. Predictions are based on modelling completed by Ronconi et al. (2022). Models were built based on tracking data from individuals around select colonies; environmental variables expected to predict species' presence (based on the tracking data) including the location's distance from the coast, distance from an individual's breeding colony, bathymetry, slope, and ruggedness; and colony size. Ronconi et al. (2022), also scored the reliability of their model inputs on a scale of 4 (minimum) - 12 (maximum). Scores were based on the quality and quantity of tracking data, and the completeness and accuracy of colony data which were each scored on a scale of 1 (low) - 3 (high) and summed for the overall reliability score. Quality of tracking data refers to the device type used, because devices differ in accuracy (VHF and GLS score 1, PTT scores 2, and GPS scores 3). Quantity scores are based on number of individuals, number of sites and number of bird locations. Colony data are scored based on completeness (likelihood that all colonies are represented in the database) and accuracy (related to census method and/or date of most recent estimate). Thick-billed Murre scored quality: 3; quantity: 2; completeness: 3; accuracy: 3; total: 11.

Data Sources: IAAC, 2023a; Lieske et al., 2020b; NRCan, 2023; Ronconi et al., 2022.

Figure 7.3.18. Colony Centered Predicted Density for Colonial Seabirds – Black Guillemot

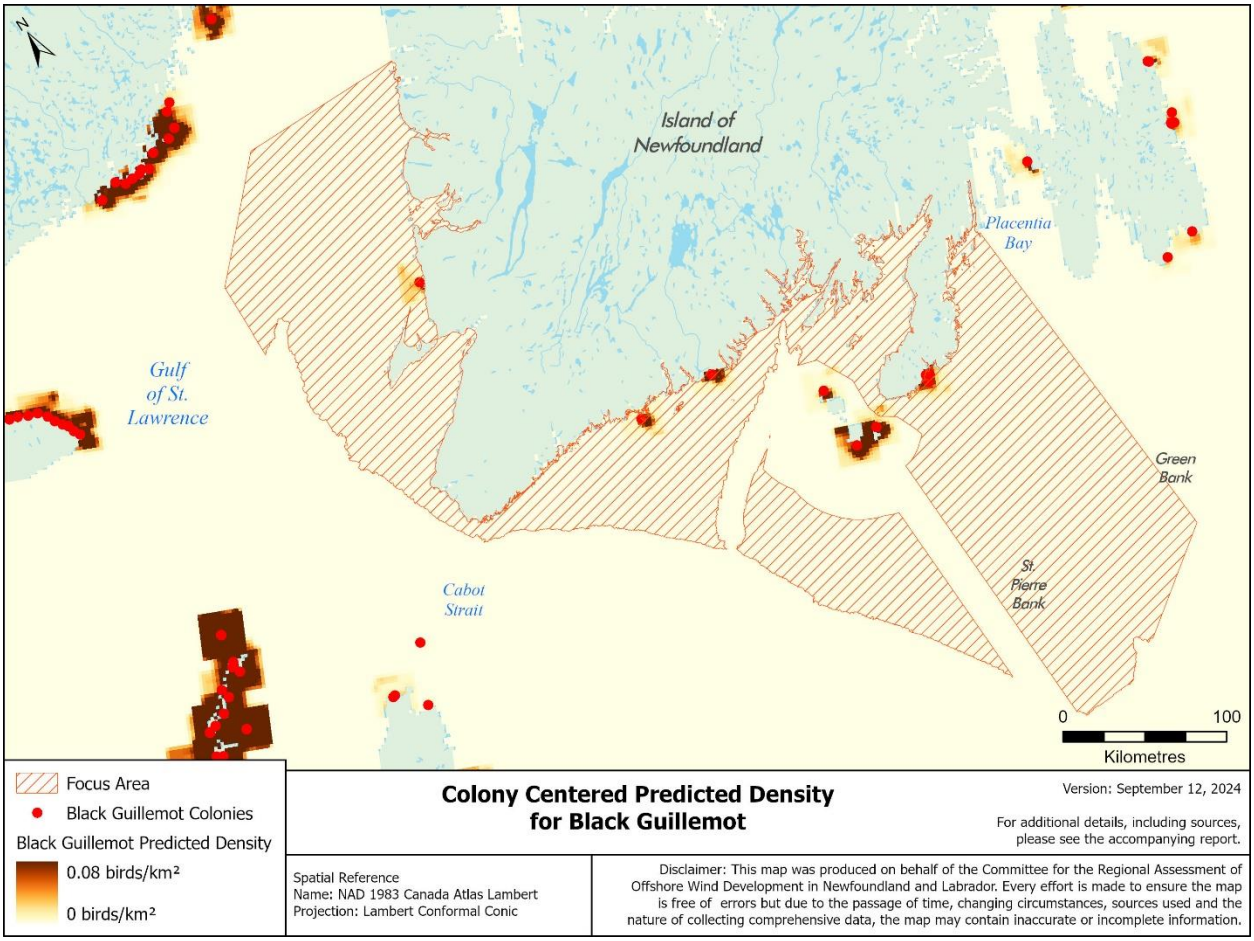


Figure Description: This map shows predicted density for Black Guillemot around bird colonies. Predictions are based on modelling completed by Ronconi et al. (2022). Models were built based on tracking data from individuals around select colonies; environmental variables expected to predict species' presence (based on the tracking data) including the location's distance from the coast, distance from an individual's breeding colony, bathymetry, slope, and ruggedness; and colony size. Ronconi et al. (2022), also scored the reliability of their model inputs on a scale of 4 (minimum) - 12 (maximum). Scores were based on the quality and quantity of tracking data, and the completeness and accuracy of colony data which were each scored on a scale of 1 (low) - 3 (high) and summed for the overall reliability score. Quality of tracking data refers to the device type used, because devices differ in accuracy (VHF and GLS score 1, PTT scores 2, and GPS scores 3). Quantity scores are based on number of individuals, number of sites and number of bird locations. Colony data are scored based on completeness (likelihood that all colonies are represented in the database) and accuracy (related to census method and/or date of most recent estimate). Black Guillemot scored quality: 3; quantity: 1; completeness: 1; accuracy: 1; total: 6. The Committee is aware of some known colonies that are not represented in this data.

Data Sources: IAAC, 2023a; Lieske et al., 2020b; NRCan, 2023; Ronconi et al., 2022.

For species with insufficient tracking data, ECCC additionally provided the Committee with maps showing theoretical foraging radii for individual species, and foraging guilds. They developed foraging radii models following the work of Critchley et al. (2018). They identified species-specific foraging ranges from peer-reviewed publications and established specific buffers around each colony for each species (Table 7.3.2). They further estimated foraging distribution around each colony. They assumed bird density would decrease with distance from the colony, and calculated weighted density using colony population estimates from the Atlantic Colonial Waterbird Database (ECCC, 2023a), the Banque Informatisée des Oiseaux de Mer au Québec (ECCC 2023d), and the Maine Seabird Database (U.S. Fish and Wildlife Service, 2023). The largest known colony size for each site and species between 1974 - 2024 was considered. A precautionary approach (i.e., largest population size over last 50 years) was taken to account for variation in survey timing and methods, cyclical nature of some populations, and the fact that some colonies may re-establish. Lastly, these colony-specific foraging distributions were summed for each species across the entire range, as well as summed by foraging guild and entire population to assess the distribution of all species collectively. The resulting maps are available on the Registry under document reference number 275. This information should be considered in light of data limitations (e.g., low sample sizes, limited number of sources).

Table 7.3.2. Mean Maximum Foraging Range Extracted from Literature

Species	Mean max (km)	Mean max SD (km)	Buffer Radii (km)	Sample size	Source	Study location	Reference
Arctic Tern	27.8	10.1	37.9	2	D	Atlantic Canada	Ronconi et al., 2022
Atlantic Puffin	82.8	42.5	125.3	3	D	Atlantic Canada	Ronconi et al., 2022
Black Guillemot	11.5	0.1	11.6	2	D	Atlantic Canada	Ronconi et al., 2022
Black Tern (*Chlidonias niger*)	2.4*	1.2	3.6		O	U.S.	Chapman Mosher, 1986
Black-crowned Night Heron (*Nycticorax nycticorax*)	4*		4		O	Maine, U.S.	Maine Department of Inland Fisheries and Wildlife, n.d.
Black-legged Kittiwake	129.9		129.9	1	D	Atlantic Canada	Ronconi et al., 2022
Caspian Tern (*Hydroprogne caspia*)	18.6	6.7	25.3	14	D	Baltic Sea	Beal et al., 2021
Common Eider	12.1	2.1	14.2	4	D	Atlantic Canada	Ronconi et al., 2022
Common Murre	66.5	21.1	87.6	4	D	Atlantic Canada	Ronconi et al., 2022
Common Tern	27.5	4.7	32.2	2	D	Atlantic Canada	Ronconi et al., 2022
Double-crested Cormorant (*Phalacrocorax auritus*)	10.7*	5.73	16.43		O	Ontario, Canada	Stapanian et al., 2002

Species	Mean max (km)	Mean max SD (km)	Buffer Radii (km)	Sample size	Source	Study location	Reference
Glaucous Gull (*Larua hyperboreus*)	35*		35			Alaska, U.S.	Troy (unpublished)
Great Black-backed Gull	55.3	36.4	91.7	2	D	Atlantic Canada	Ronconi et al., 2022
Great Blue Heron (*Ardea Herodias*)	2.7**		2.7	63 ind.	O	Minnesota, U.S.	Custer & Galli, 2002
Great Cormorant (*Phalacrocorax carbo*)	25.6	8.3	33.9	4	D	Greenland; France; Netherlands; Spain	Woodward et al., 2024
Herring Gull	126.8	62.9	189.7	4	D	Atlantic Canada	Ronconi et al., 2022
Laughing Gull (*Leucophaeus atricilla*)	16.6*		16.6		D	New Jersey, U.S.	Dosch, 2003
Manx Shearwater	1,346.8	1018.7	2,365.5	6	D	UK; Ireland	Woodward et al., 2024
Northern Fulmar	542.3	657.9	1,200.2	16	D	Greenland; Norway; U.K.; U.S.	Woodward et al., 2024
Northern Gannet	330	261	591	3	D	Atlantic Canada	Ronconi et al., 2022
Razorbill	62.6	28.4	91	5	D	Atlantic Canada	Ronconi et al., 2022
Ring-billed Gull (*Larus delawarensis*)	10.8*		10.8	1,029 ind.	O	Montana, U.S.	Baird, 1976
Roseate Tern	19.1	6.9	26	2	D	Atlantic Canada	Ronconi et al., 2022
Thick-billed Murre	65.1		65.1	1	D	Atlantic Canada	Ronconi et al., 2022

Table Description: This table shows information on species' foraging range, based on a literature review completed by ECCC and provided to the Committee. The table was adapted from ECCC's submission to

the Committee, August 2024. Sample size represents the number of sites or colonies used to calculate the foraging metric. In some cases, only number of individuals (ind.) was known. Data sources were either classified as D (Direct) if data was collected using a reliable tracking method (GPS, VHF, PTT), or O (Observation) if data was collected using an indirect method such as surface or aerial survey. When mean maximum foraging ranges were not reported, mean foraging distance (*) or median foraging distance (**) was used to calculate the foraging radius.

Source: ECCC, 2024a.

Marine Bird Vulnerability Models

The Committee is aware of work being completed by ECCC and the Biodiversity Research Institute (BRI) to model collision and displacement vulnerability distribution for several marine birds in the Focus Area.

The Committee has seen confidential drafts of their work and preliminary results. The following provides a description of ongoing work (ECCC, 2024a).

ECCC, with input from BRI, developed offshore wind development vulnerability models for marine birds known to occur in the offshore environment of Canada's Atlantic Region. In this vulnerability model, species are classified using two exposure groups: marine birds and coastal/offshore migrants.

Vulnerability models have been developed for marine birds, which includes those species known to use marine habitats during their annual life history cycle. Seabirds, waterfowl, and some shorebirds are considered in the marine exposure group. The models factor in collision (flight height, activity budgets, avoidance rates) and displacement (habitat, avoidance rates), as well as population vulnerability (conservation status, survival rates). Metrics used to develop these models are based on previous risk modelling approaches (Garthe & Hüppop, 2004; Furness et al., 2013; Robinson Willmott et al., 2013; Adams et al. 2017; Kelsey et al., 2018) and incorporate updates relevant to the Atlantic region.

ECCC is currently developing models for the coastal/offshore migrant exposure group.

Table 7.3.3 summarizes some general characteristics of marine birds that could influence vulnerability.

Table 7.3.3. Marine Bird Characteristics Influencing Vulnerability to Offshore Wind Development

Species Group	Characteristics
Alcids Examples: Atlantic Puffin, Black Guillemot, Common Murre, Dovekie, Razorbill, and Thick-billed Murre	• Primarily diurnal and typically fly low across the ocean surface, < 20 m • Relatively high macro avoidance rate • Moderate to high habitat flexibility, wide prey, or habitat-specific ranges • Can be attracted to light
Aythyinae – Diving Ducks Examples: Greater Scaup (*Aythya marila*) and Lesser Scaup (*Aythya affinis*)	• Primarily nocturnal foragers • Flight height estimates vary considerably across the literature, with high uncertainty • High avoidance and moderate habitat flexibility

Species Group	Characteristics
	• Can be attracted to light
Gaviidae – Loons Examples: Common Loon (*Gavia immer*) and the Red-throated Loon	• Primarily diurnal • High documented macro avoidance rates • Minimal habitat flexibility • Can be attracted to light
Hydrobatidae – Storm-petrels Examples: Band-rumped Storm-petrels (*Hydrobates castro*), Leach's Storm-petrels, and Wilson's Storm-petrels	• Can have high nocturnal and diurnal flight activities • Low flight heights, with great maneuverability over the water's surface • Storm-petrels conduct chick provisioning and colony visits at night to avoid predation • Light attraction is a particular concern
Laridae – Gulls Examples: Little Gull (*Hydrocoloeus minutus*), Black-legged Kittiwake, Black-headed Gull (*Chroicocephalus ridibundus*), Bonaparte's Gull (*Chroicocephalus philadelphia*), Laughing Gull, Glaucous Gull, Great Black-backed Gull, Herring Gull, Iceland Gull (*Larus glaucoides*), Lesser Black-backed Gull (*Larus fuscus*), and Ring-billed Gull	• Relatively active throughout the day and night • Some gull species show high overlap of flight heights with the rotor swept zones of turbines • Most species show limited avoidance behaviour, however, can show attraction to turbines • Can be attracted to light
Merginae – Sea Ducks Examples: Barrow's Goldeneye (*Bucephala islandica*), Bufflehead (*Bucephala albeola*), Common Goldeneye (*Bucephala clangula*), Black Scoter, Surf Scoter, White-winged Scoter, Common Eider, King Eider (*Somateria spectabilis*), Common Merganser (*Mergus merganser*), Hooded Merganser (*Lophodytes cucullatus*), Red-breasted Merganser (*Mergus serrator*), Harlequin Duck (*Histrionicus histrionicus)*, and Long-tailed Duck	• Primarily diurnal, with some species showing more nocturnal activity than others • Merganser flight height shows overlap with rotor swept zones of turbines • High levels of macro avoidance across almost all species • Can be attracted to light

Species Group	Characteristics
Phaethontidae – Tropicbirds Example: White-tailed Tropicbird	• Limited literature on White-tailed Tropicbird behaviour overall • Good aerial maneuverability during courtship displays and predator evasions • Estimated to have a moderate macro avoidance rate • Flight activity relatively low but some records show flight heights within the rotor swept zone, primarily during foraging • Can be attracted to light
Phalacrocoracidae – Cormorants Examples: Double-crested Cormorant and Great Cormorant	• Primarily diurnal • Moderate maneuverability. • Double-crested Cormorant forages in marine and freshwater • Can be attracted to light
Podicipedidae – Grebes Examples: Horned Grebe (*Podiceps* auritus) and Red-necked Grebe (*Podiceps grisegena*)	• Nocturnal migrant, primarily forages and rests during daytime • May have good maneuverability, however, literature varies • Require specific resources and habitats for nesting and foraging • Can be attracted to light
Procellariidae – Petrels and Shearwaters Examples: Bermuda Petrel (*Pterodroma cahow*), Black-capped Petrel (*Pterodroma hasitata*), Desertas Petrel (*Pterodroma deserta*), Fea's Petrel (*Pterodroma feae*), Zino's Petrel (*Pterodroma madeira*), Audubon's Shearwater (*Puffinus iherminieri*), Cory's Shearwater, Great Shearwater, Manx Shearwater, Sooty Shearwater, and Northern Fulmar	• Data on the individual species often lacking • Flight height highly variable, dependent on wind conditions. Flight height closer to water surface during foraging. • Wide-ranging predators with demonstrated high macro avoidance. • Light attraction is a particular concern
Scolopacidae – Sandpipers, Snipes, and Relatives Examples: Red Phalarope (*Phalaropus fulicarius*), Red-necked Phalarope (*Phalaropus lobatus*), and Wilson's Phalarope (*Phalaropus tricolor*)	• Active both day and night, • Often fly close to the water's surface • Significant variability in prey and habitat preferences, with Wilson's Phalarope having greater flexibility due to its in-land range. • Can be attracted to light

Species Group	Characteristics
Stercorariidae – Jaegers and Skuas Examples: Long-tailed Jaeger, Parasitic Jaeger, and Pomarine Jaeger (*Stercorarius pomarinus*), and two skuas: Great Skua (*Stercorarius* skua) and South Polar Skua (*Stercorarius maccormicki*)	• Jaegers are highly active throughout the day. Limited roosting occurs throughout the day, and minimal hunting occurs throughout the night unless during rodent-rich breeding seasons. • Minimal macro avoidance rates and wide range of food availability. • Skuas are primarily diurnal with occasional nocturnal hunts and demonstrate a very high macro avoidance • Can be attracted to light
Sternidae – Terns Example: Arctic Tern, Black Tern, Caspian Tern, Common Tern, and Roseate Tern	• Active during the day with relatively similar nocturnal budgets • Flight height varied with high uncertainty • Moderate prey/habitat range due to their piscivorous diet • Can be attracted to light
Sulidae – Gannets and Boobies Example: Northern Gannet	• Foraging can occur day and night • Notable for their steep drops during plunge dives, reaching speeds over 100 km per hour and rises to heights of 100 m above sea level • Wide prey range but a limited habitat range • Can be attracted to light

Table Description: This table provides a high-level overview of some characteristics that could influence marine bird vulnerability to offshore wind development. This information was relayed to the Committee by ECCC (2024a) in confidential drafts of their work regarding marine bird vulnerability models.

Sources: Bradbury et al., 2014; Cramp, 1985; Cramp & Simmons, 1983; Cook et al., 2012; del Hoyo et al., 1992; Furness et al., 2013; Johnston et al., 2014; Krijgsveld et al., 2011; Palmer, 1976; Paton et al., 2010; Robinson Willmott et al., 2013; Wade et al., 2016; Winkler et al., 2020a; b; c; d; e; f; g.

7.3.2.1.2 Shorebirds and Coastal Waterbirds

Shorebirds, in the context of offshore wind development, refer to those avian species in the *Scolopacidae* family, that use coastal and marine edge habitat for feeding, breeding, and nesting. Shorebirds also interact with the offshore area during transoceanic migratory flights or when transiting between foraging, resting, and breeding habitats. Coastal waterbirds, such as gulls and herons, are generally found in the coastal zone only.

ECCC provided the Committee confidential mapping products that depict shorebird and coastal waterbird occurrence in the Focus Area and adjacent coastal areas (ECCC, 2023b). Maps showed shorebird coastal density based on ECCC internal data (ECCC, 2012; 2014; 2015d; 2023m) and supplementary data from eBird (eBird, n.d.). Spatial distribution of shorebirds in the Focus Area cannot be inferred from this information, however, ECCC advised that coastal hotspots could be areas of higher risk for offshore

wind energy development. Birds may interact with nearshore turbines while travelling between roosting locations, during stopovers, or when initiating migration.

For multiple shorebird species, coastal hotspots occur near Flat Bay Peninsula, Sandy Point, Stephenville Crossing, Western Brook Pond Beach, and St. Paul's Salt Marsh. Most species show peak abundance in the Focus Area between summer and early fall (July - October). Except for Purple Sandpiper (*Calidris maritima*), which shows moderate relative abundance over winter with peak abundance in April, most species have low abundance or are absent in winter months (ECCC, 2023l).

Through ECCC, the Shorebird Science and Conservation Collective also provided input to the Regional Assessment. Their report to the CWS (and provided to the Committee) is available on the Registry (ECCC, 2024a).[65] Their report was based on data from 74 organizations, collected from 2006 - 2023 (Shorebird Science and Conservation Collective, 2023a-h). Their analysis was scoped to an area of interest (AOI) that included both the Newfoundland and Labrador and Nova Scotia Regional Assessment Study Areas. The AOI is much broader than the Regional Assessment Focus Area. Overall, their submission included data and analysis of tag transmission locations and estimated tracklines (i.e., the most probable pathway connecting tag locations) for shorebirds in their database and tracked near the AOI. Data on all individuals with tracklines intersecting the AOI were provided (i.e., including for individuals tagged outside of the AOI but with a probable pathway across the AOI). The Shorebird Science and Conservation Collective cautioned that tracklines do not indicate actual flight paths. Tracklines can provide valuable information about the proportion of tracked individuals that cross an area but less accurate information about the position of the animals in the area.

In October 2024, ECCC submitted additional analysis by the Shorebird Science and Conservation Collective regarding *rufa* Red Knot (ECCC, 2024h).[66] The Shorebird Collective examined satellite tracking data from 79 *rufa* Red Knots to determine if they moved through the AOI in the preliminary offshore wind energy licencing areas near Nova Scotia and Newfoundland and Labrador. Data came from 7 organizations, collected from 2015 - 2024 (Shorebird Science and Conservation Collective, 2024).

Some key findings are summarized here and in Table 7.3.4 below. Unless otherwise specified, these findings are based on the October 2023 Shorebird Collective data.

- **Total number of individuals and tracks:** Between 2006 - 2023, 1,678 individuals of 21 species contributed to the Shorebird Collective. Of these, 41 individuals (8 species) were recorded in the AOI, and an additional 61 individuals (7 of the 8 species) have estimated movement paths across the AOI. These include American Golden-plover (*Pluvialis dominica*), American Woodcock

[65] This submission is available on the Registry under document reference number 275, ECCC and Shorebird Collective Movement Phase 1 & 2.
[66] This submission is available on the Registry page under document reference number 370, ECCC-CWS RufaREKNTracking Summary.

(*Scolopax minor*), Black-bellied Plover (*Pluvialis squatarola*), Hudsonian Godwit (*Limosa haemastica*), Lesser Yellowlegs, Pectoral Sandpiper (*Calidris melanotos*), Red Phalarope, and Whimbrel.

- **Proportion of relevant tracks intersecting the AOI:** Relative to the number of individuals tagged in common breeding and wintering areas (i.e., the shorebird collective sample size relevant to the area), a higher proportion of the following species had tracklines intersecting the AOI during fall migration (post-breeding): American Golden-plover, Hudsonian Godwit, Whimbrel and Black-bellied Plover. For other species a lower proportion intersected the AOI, or a very small number of individuals had tracklines in the AOI. Furthermore, in general, a higher proportion of tracklines from individuals breeding in the eastern Canadian Arctic crossed the AOI during post-breeding (fall) migration than individuals from populations further west. During spring migration (pre-breeding) tracking data are limited because tags were often deployed at Arctic breeding grounds and either collected locations for a short period or the tags stopped transmitting because of the tag falling off, malfunctioning, or from animal death.
- **Tags and Intersecting Tracklines in the Focus Area**: Based on the Committee's review of species-specific maps and summary information provided by the Shorebird Collective, the following species were recorded in or adjacent (along the coastline) to the Focus Area during fall migration: American Golden-plover, American Woodcock (during Spring migration only), Black-bellied Plover, and Whimberel. One Lesser Yellowleg trackline also occurs in the Focus Area. Red Phalarope were not recorded in the Focus Area. However, during the public commend period for this Report, ECCC advised that out of all shorebird species, Red Phalaropes and Red-neck Phalaropes are most like seabirds in habitat use and behaviour. As a result, these species are potentially most at risk in terms of collision and displacement. They indicated that phalaropes use upwelling zones to forage and are often found in the company of foraging whales around Brier Island. Follow-up research should be conducted to determine if there are similar upwelling zones used by these species in Newfoundland and Labrador (ECCC, 2024h).
- **Density of Tracked Shorebirds:** The Shorebird Collective summarized species richness and abundance tracked within 200 km of the AOI to show areas used by multiple tracked birds. Coastlines along the Gulf of Maine, Cape Cod, Massachusetts, and Mingan Archipelago, Quebec showed higher numbers of tracked individuals and species. One area of higher species richness occurred in the Focus Area near the south coast of the Island of Newfoundland.
- **Seasonal Timing of Movement through Atlantic Canada**: Post-breeding migration tag transmissions in the AOI generally occurred mid-July through October and peaked mid-August to mid-September. However, species have different migration phonologies.
- **Timing of Transmissions in Offshore AOI**: Most species cross the AOI at dusk or early evening, but some may cross during the day. The Shorebird Collective advised that smart curtailment strategies (such as shutting turbines off at night during peak migration) may be an affective strategy to reduce collision risk for shorebirds but may not be affective for all species.
- **Flight Altitude Information**: Data on flight heights is currently limited. The Shorebird Collective relayed information from tracking data in other regions:
    - Tracking data from shorebirds in other regions show that some shorebirds fly at the heights of offshore wind turbine blades (Schwemmer et al., 2023; Galtbalt et al., 2021), which tend to spin between 25 - 30 m above the water to 204 m on average (Musial et al., 2023). For example, a study on Eurasian Curlews (*Numenius arquata*) tracked with GPS-GSM data loggers in the

Baltic Sea (n = 51) found curlews flew at median heights of 60 m over sea (compared to 335 m over the mainland) during post-breeding (fall) migration (Schwemmer et al., 2023). During pre-breeding (spring) migration, median flight heights were 150 m over sea (576 m above land), thus indicating a collision risk with offshore turbine blades during both seasons. A separate study on Far Eastern Curlews (*N. madagascariensis*, n = 17) and Whimbrel (*N. phaeopus*, n = 9) tracked with GPS-GSM data loggers along the East Asia - Australasia Flyway reported similar patterns, with Curlews and Whimbrels flying lower over sea (median heights of 156 m and 133 m, respectively) compared to over the mainland (Galtbalt et al. 2021).

- Inconsistent with the previous two studies, Loring et al.'s (2020) Motus tracking study on the migratory movements and flight heights of 12 Western Hemisphere shorebird species (n = 594) in the U.S. Atlantic Outer Continental Shelf Region found modeled-estimated flight heights to vary between 28 - 2,940 m above sea level but generally occurred above the Rotor Swept Zone (RSZ, 250 m above sea level) with spring and fall flight heights averaging 914 m and 545 m, respectively. RSZ was higher during the fall with approximately 36% of the offshore flights occurring in the RSZ, compared to 24% in the spring (Loring et al., 2020).

- **Based on October 2024 Shorebird Collective data and analysis of *rufa* Red Knots**: 8 of the 79 tracked *rufa* Red Knots were recorded in the Atlantic Canada AOI. They were recorded during southbound (fall) migration only during the months of August and September in 2022 and 2023 with most individuals tracked during the second and third weeks of August. They were primarily recorded over water during the night between the hours of 18:00 - 01:00. One of the eight tracks (and recorded locations) intersected the Newfoundland and Labrador Regional Assessment Focus Area. This was near Cape Ray. It is unclear which wintering populations were recorded in the Focus Area (and AOI). However, six of the eight individuals were tracked to Northeastern South America the following fall before their tags stopped transmitting. On of these individuals continued south to Argentina, likely belonging to the SARA endangered Tierra del Fuego/Patagonia wintering population. Another individual was tagged in southern Brazil during April and could also be apart of this population.

Table 7.3.4. Post-Breeding (Fall) Migration – Proportion of Shorebirds with Tracklines Intersecting the AOI and Description of Tags in the Regional Assessment Focus Area

	Shorebird Collective Dataset Overall (n Individuals)	**Relevant Sample (n individuals)**	**Trackline intersected AOI (n individuals)**	**Locations Recorded in Focus Area***
American Golden Plover (*Pluvialis dominica*)				
Breeding Areas	Eastern Canadian Arctic	6	6 (100%)	One GPS location near Coast of GMNP.
	Western Canadian Arctic	6	4 (66%)	
	North Slope of Alaska	22	13 (60%)	
Total	59	34	23 (68%)	
American Woodcock				
Management Unit	Eastern Canada	46	10 (22%)	No locations recorded in Focus Area or estimated tracklines. One pre-breeding (spring) migration GPS location near Cape St. Mary's.
	Eastern U.S.	149	0 (0%)	
	Central Canada	8	0 (0%)	
	Central U.S.	7	0 (0%)	
Total	546	210	10 (5%)	
Black-bellied Plover				
Breeding Areas	Eastern Canadian Arctic	22	10 (45%)	Argos locations near St. Pierre and Miquelon and off the South Coast near Ramea (incl. final location).
	Western Canadian Arctic and North Slope of Alaska	10	0 (0%)	
	Western Alaska	9	0 (0%)	
Total	55	41	10 (24%)	
Hudsonian Godwit				
Breeding Areas	Near Churchill, Manitoba	1	1 (100%)	No locations recorded in Focus Area or estimated tracklines.
	Western Canadian Arctic	3	3 (100%)	
	Alaska	8	0 (0%)	

	Shorebird Collective Dataset Overall (n Individuals)	**Relevant Sample (n individuals)**	**Trackline intersected AOI (n individuals)**	**Locations Recorded in Focus Area***
Totals	42	12	4 (33%)	
Lesser Yellowlegs				
Breeding Areas	Eastern Canada	9	9 (100%)	No locations recorded in Focus Area. One estimated trackline along southwestern boundary of Focus Area.
	Hudson Bay Lowlands	6	2 (33%)	
	South-central Canadian Arctic	20	1 (5%)	
	Western Canadian Subarctic	11	0 (0%)	
	Central Alaska	12	0 (0%)	
	Southern Alaska	39	0 (0%)	
Total	107	97	12 (13%)	
Pectoral Sandpiper				
Breeding Areas	North Slope of Alaska	103	9 (9%)	Argos locations along the West Coast and going south off the Southwest Coast of the Island of Newfoundland.
Total	226	103	9 (9%)	
Red Phalarope				
Breeding Areas	Eastern Canadian Arctic	1	1 (100%)	No locations recorded in Focus Area or estimated tracklines.
Total	29	1	1 (100%)	
Whimbrel				
Breeding Areas	Hudson Bay Coast	11	4 (36%)	Combination of Argos and GPS locations near the coast of GMNP; offshore, north of the Bay of Islands; along the South Coast; and
	Western Canadian Arctic	11	11 (100%)	
	Alaska	29	0 (0%)	

	Shorebird Collective Dataset Overall (n Individuals)	**Relevant Sample (n individuals)**	**Trackline intersected AOI (n individuals)**	**Locations Recorded in Focus Area***
Additional Tagging Locations	Cape Cod, MA	5	0 (0%)	near Connaigre Peninsula and Burin Peninsula.
Total	66	56	15 (27%)	
rufa Red Knot				
Wintering Populations	Tierra del Fuego/Patagonia	unknown	unknown	One estimated trackline with several recorded locations near the Western boundary of the Focus Area, Cape Ray and Southwestern boundary of the Focus Area
	Northeastern South America	unknown	unknown	
	Southeastern USA/Gulf of Mexico/Caribbean	unknown	unknown	
Total	79	unknown	8	

Table Description: This table summarizes tracking data for shorebird's with tracklines intersecting the Newfoundland and Labrador and Nova Scotia Regional Assessment Study Areas. The table was adapted from ECCC, 2024a. Data comes from 74 organizations, collected from 2006 - 2023 (Shorebird Collective Data Version 2023-10-10). The Shorebird Science and Conservation Collective reported on the proportion of individuals with tracklines intersecting the Newfoundland and Labrador and Nova Scotia Regional Assessment Study Areas (AOI), relative to the number of individuals tagged in common breeding and wintering areas. The full report and table including results during pre-breeding (spring) migration is available on the Registry under document reference number 275. Data on *rufa* Red Knot is from 7 organizations, collected from 2015 - 2024 (Shorebird Collective Data Version 2024-09-24).

* Recorded locations are described based on Committee's visual assessment of maps provided. GPS data has minimal location error, typically between 10 - 15 m. Argos data has moderate location error, typically between 150 - 1,500 m.

Sources: ECCC, 2024a; h; Shorebird Science and Conservation Collective, 2023a-h; 2024.

Flight paths for American Golden Plover, American Woodcock, Black-bellied Plover, Whimbrel, and Lesser Yellowlegs may intersect the Focus Area. However, actual locations of flightpaths are unknown. Furthermore, findings are based on individual tracking data, which may not reflect population movement. Other limitations include small sample sizes and temporal gaps.

Current shorebird tracking studies provide evidence that multiple species use offshore environments during migratory periods (fall and spring). However, targeted tracking programs will be required to provide fine-scale conclusions regarding migratory routes and shorebird flyways in the region.

ECCC advised that, in the absence of offshore distribution or movement data for shorebirds, information on WHSRN Sites and Regionally Important Shorebird Sites can be used alongside other data sources and expert knowledge to assess areas where shorebirds may experience higher risks with respect to offshore wind energy development.

WHSRN Sites and Regionally Important Shorebird Sites are discussed below (see Section 7.3.2.2.2 of this Report).

7.3.2.1.3 Waterfowl

Waterfowl refers to those species in the Anatidae family (ducks, geese, swans), and are typically swimming game birds. They may inhabit fresh- and/or saltwater and spend most of their life on the water's surface. They may use portions of the Focus Area for breeding, nesting, foraging, migrating, or staging. Some, for example Common Eider, are colonial nesters within the Atlantic Region.

The Committee reviewed confidential species-specific maps provided by ECCC. These maps were based on ECCC internal data for Coastal Waterfowl Block Observations and Triennial Common Eider Survey Data (ECCC, 2018a; 2023h), the U.S. Geological Survey Gamebird Dataset (North American Bird Banding Program, 2023), and waterfowl habitat suitability modeling completed by Lamb et al. (2020). General descriptions of these maps and key findings follow.

Maps based on coastal waterfowl block observations showed relative importance of coastal blocks based on the proportion of individuals observed at each block.[67] Within the Focus Area, block observations were recorded along the Southwest Coast and South Coast of the Island of Newfoundland, near the Connaigre Peninsula, Burin Peninsula, and GMNP; they included observations of American Black Duck, Black Scoter, Common Eider,

[67] Relative importance was rated between 0 and 1 at intervals of 0.25. The maximum number of individuals across all years was considered. All blocks with observations in the Focus Area were rated 0-0.25.

Common Goldeneye, Common Merganser, and an unknown merganser species, Long-tailed Duck, Red-breasted Merganser, and an unknown loon species. All coastal blocks with waterfowl observations recorded in the Focus Area showed a low relative importance.

Maps based on triennial Common Eider survey data showed relative density of species. Maps were based on aerial survey data gathered from February to early March between 2003 - 2018, across Eastern Quebec and Atlantic Canada. Like findings from coastal waterfowl block observations, low densities of waterfowl were recorded in the Focus Area for most species. In general, observations were recorded along the South Coast of the Island of Newfoundland, surrounding the Burin Peninsula, in Fortune Bay, and surrounding Saint Pierre and Miquelon. Relatively high densities of White-winged Scoter were recorded near St. Pierre Miquelon. Other species observed in the Focus Area include Common Eider, Long-tailed Duck, Red-breasted Merganser, and Surf Scoter.

Importantly, while maps based on coastal waterfowl block observations and Common Eider survey data show low relative importance or relatively low density in the Focus Area, it should be noted that this information contradicts other assessments. For example, coastal area around the Burin Peninsula has been identified as a key wintering site for Common Eiders and Cape St. Mary's (adjacent to the Focus Area) is an important winter site for Harlequin Duck (see Section 7.3.2.2.2 of this Report) (Sea Duck Joint Venture, n.d.-b; Gutowsky, et al. 2022). ECCC advised that findings based on coastal waterfowl block observations and Common Eider survey data should be used alongside movement data (e.g., GPS, PTT, GLS) or at-sea surveys to understand potential areas waterfowl might be congregating, and the areas where waterfowl might transit or migrate within the RSZ of offshore wind turbines. ECCC provided the Committee with movement models for select waterfowl species (e.g., Common Eider, Long-tailed Duck, Red-throated Loon, Surf Scoter, and White-winged Scoter) which demonstrate use of the Focus Area.[68]

Maps based on the U.S. Geological Survey Gamebird dataset show relative densities of gamebird harvest around coastal areas in Atlantic Canada. This data also shows low densities of waterfowl in the Focus Area, but suggest the following species occur in the Focus Area: American Black Duck, Blue-winged Teal (*Spatula discors*), Canada Goose, Common Eider, Common Merganser, Green-winged Teal *(Anas crecca),* Lesser Scaup*,* Mallard (*Anas platyrhynchos*), and Ring-necked Duck (*Aythya collaris*). This dataset also shows hotspots for Common Murres near Fortune Bay and Wilson's Snipe (*Gallinago delicata*) off the southwest coast of the Island of Newfoundland.

Finally, maps based on data from Lamb et al. (2020), show portions of the Focus Area that are suitable habitat for waterfowl species. These areas were identified by modelling the average niche space (i.e., combination of preferred habitat characteristics) occupied by a

[68] Movement models developed by ECCC for marine birds, including waterfowl is discussed under Section 7.3.2.1.1 of this Report. The movement models provided are available on the Registry under document reference number 275, Marine Bird Movement.

species and considering an area's similarity to the average niche space.[69] ECCC provided the Committee with maps showing habitat suitability for each of Common Eider, Black Scoter, Surf Scoter, White-winged Scoter, and Long-tailed Duck during breeding season, fall (migration), winter, and spring (migration). Directed movement likely occurs between highly suitable areas within a season and between different seasonal habitats. Exposure to offshore wind development could be expected in those areas. Most portions of the Focus Area were not included in the assessment during most seasonal periods. Coverage included near St. George's Bay and around Port aux Port for winter habitat, and along the west coast through Port aux Choix for breeding habitat. Suitable winter habitat was identified for all five species in areas assessed. A small area along the coast, near GMNP, was identified as suitable breeding habitat for Long-tailed Duck. No suitable breeding habitat was identified for other species.[70]

ECCC also indicated, that in general, all species preferred shallow, nearshore habitats with high productivity (ECCC, 2023l).

7.3.2.1.4 Landbirds and Non-Avian Species

Landbirds predominately inhabit terrestrial areas. Any migratory landbird that breeds on the Island of Newfoundland must migrate using coastal and offshore routes. However, information about where and when these movements occur is limited. Non-avian species refer to bats and flying insects. Currently, there is very limited information on the occurrence of bats and flying insects in the Focus Area. For example, ECCC indicated that, to their knowledge there is no existing tracking data on bats or insects in the Canada Atlantic offshore region (ECCC, 2024a).

ECCC provided the Committee with maps showing Monarch Butterfly and Common and Swamp Milkweed (*Asclepias syriaca* and *Asclepias incarnata* respectively) observations (ECCC, 2023l). None overlap the Focus Area.

ECCC also provided the Committee with maps showing locations of bat observations in Atlantic Canada. Data were collected from published and private sources, including available published research, historical accounts, museum collections, and personal communications. Documented sightings of bats range from 1864 - 2023 and use various methods (ECCC, 2024a). Hoary Bat and Silver-haired Bat were observed in or adjacent to the Focus Area. Most observations were from the post-breeding migration period, in September, although this area of research is data limited. True et al. (2023), studied Eastern Red Bats along the U.S. east coast and similarly found over water flights peaked

[69] Lamb et al. (2020) derived habitat suitability models from individual tracking data (Argos PTT) deployed on sea ducks between 2002 and 2017. Only sedentary (non-transient) movements were used to develop the models. Habitat suitability was assessed only within areas used by tracked individuals; it was not assessed across the full range of these species.

[70] Confidential maps provided by ECCC classified areas assessed as < 0.25, 0.25 - 0.5, 0.5 - 0.75, and 0.75 - 1.0 where smaller values represent less deviation from the mean, and therefore more suitable habitat. The Committee identified potentially suitable habitat where areas were < 0.5.

late-August to early-September. ECCC cautioned this may not be directly comparable to this region (ECCC, 2024a). For example, Doucette et al. (2024) discovered migratory tree bats and myotis bats active in the Sable Island National Park Reserve from September 22 until December 12, in 2015/2016.

7.3.2.2 Important Areas and Population Trends for Sensitive Taxa

This section includes more information on some species that may occur in the Focus Area and that hold one or more key designation. It also highlights important areas for aerofauna (e.g., areas identified to support conservation efforts).

Highlighting specific taxa here does not mean other aerofauna should be overlooked. A fulsome assessment of aerofauna potentially impacted by a project should take place during project-level impact assessments.

7.3.2.2.1 Critical Habitat and Important Areas for Species at Risk

Table 7.3.5 lists aerofauna species at risk known to occur in the Study Area for the Regional Assessment of Offshore Wind Development in Newfoundland and Labrador or the Study Area for the Regional Assessment in Nova Scotia (ECCC, 2024a).

Table 7.3.5. Listed Species and Anticipated Updates Potentially Occurring Offshore Newfoundland and Labrador

Common Name	Scientific Name	Current SARA	Critical Habitat	Recent COSEWIC Updates	IUCN Status Updates	IUCN Trend	Marine Habitat Exposure	Marine Movement Exposure
Bank Swallow	*Riparia riparia*	TH	Partial ID				P	Y
Barn Swallow	*Hirundo rustica*	TH*	Recovery document in draft stage	SC			P	Y
Barrow's Goldeneye, Eastern Population	*Bucephala islandica*	SC					Y	Y
Bobolink	*Dolichonyx oryzivorus*	TH*	Partial ID	SC			N	Y
Buff-breasted Sandpiper	*Calidris subruficollis*	SC					N	Y
Chimney Swift	*Chaetura pelagica*	TH	Partial ID				N	P
Common Nighthawk	*Chordeiles minor*	SC					N	P
Eskimo Curlew	*Numenius borealis*	EN	Not Identified				N	U
Harlequin Duck, Eastern Population	*Histrionicus histrionicus*	SC					Y	Y
Horned Grebe, Magdalen Islands Population	*Podiceps auritus*	EN	Complete ID		VU	Decreasing	Y	P

Common Name	Scientific Name	Current SARA	Critical Habitat	Recent COSEWIC Updates	IUCN Status Updates	IUCN Trend	Marine Habitat Exposure	Marine Movement Exposure
Ivory Gull	*Pagophila eburnea*	EN	Partial ID				Y	Y
Olive-sided Flycatcher	*Contopus cooperi*	SC					N	P
Piping Plover, melodus subspecies	*Charadrius melodus melodus*	EN	Complete ID				N	Y
Red Crossbill, percna subspecies	*Loxia curvirostra percna*	TH	Not Identified				N	P
Red Knot, rufa subspecies, Tierra del Fuego/Patagonia wintering population	*Calidris canutus rufa*	EN	Partial ID				N	Y
Red Knot, rufa subspecies, Northeastern South America wintering population	*Calidris canutus rufa*			SC			N	Y
Red Knot, rufa subspecies, Southeastern U.S.A./ Gulf of Mexico/ Caribbean wintering population	*Calidris canutus rufa*			EN			N	Y

Common Name	Scientific Name	Current SARA	Critical Habitat	Recent COSEWIC Updates	IUCN Status Updates	IUCN Trend	Marine Habitat Exposure	Marine Movement Exposure
Red-necked Phalarope	*Phalaropus lobatus*	SC					Y	Y
Roseate Tern	*Sterna dougallii*	EN	Partial ID				Y	Y
Rusty Blackbird	*Euphagus carolinus*	SC					N	P
Savannah Sparrow, princeps subspecies	*Passerculus sandwichensis princeps*	SC					N	Y
Short-eared Owl	*Asio flammeus*	SC*		TH			N	P
Gray-cheeked Thrush (minimus subspecies)	*Catharus minimus minimus*			TH			N	P
Hudsonian Godwit	*Limosa haemastica*			TH	VU	Decreasing	N	Y
Leach's Storm-petrel	*Oceanodroma leucorhoa*			TH			Y	Y
Lesser Yellowlegs	*Tringa flavipes*			TH	VU	Decreasing	N	Y
American Tree Sparrow	*Spizella arborea*			High priority candidate for future assessment			N	P

Common Name	Scientific Name	Current SARA	Critical Habitat	Recent COSEWIC Updates	IUCN Status Updates	IUCN Trend	Marine Habitat Exposure	Marine Movement Exposure
Arctic Tern	*Sterna paradisaea*			High priority candidate for future assessment			Y	Y
Blackpoll Warbler	*Setophaga striata*			Low priority candidate for future assessment			N	Y
Common Tern	*Sterna hirundo*			Low priority candidate for future assessment			Y	Y
Horned Lark	*Eremophila alpestris*			High priority candidate for future assessment			N	P
Short-billed Dowitcher	*Limnodromus griseus*			Under assessment	VU	Decreasing	N	Y
Bermuda Petrel	*Pterodroma cahow*			Under assessment			Y	
Snowy Owl	*Bubo scandiacus*			Under re-assessment			Y	Y
Black Scoter	*Melanitta americana*				NT	Decreasing	Y	Y

Common Name	Scientific Name	Current SARA	Critical Habitat	Recent COSEWIC Updates	IUCN Status Updates	IUCN Trend	Marine Habitat Exposure	Marine Movement Exposure
Black-capped Petrel	*Pterodroma hasitata*				EN	Decreasing	Y	Y
Common Eider	*Somateria mollissima*				NT	Unknown	Y	Y
Common Grackle	*Quiscalus quiscula*				NT	Decreasing	N	P
Desertas Petrel	*Pterodroma deserta*				VU	Stable	Y	Y
Fea's Petrel	*Pterodroma feae*				NT	Unknown	Y	Y
Long-tailed Duck	*Clangula hyemalis*				VU	Decreasing	Y	Y
Semipalmated Sandpiper	*Calidris pusilla*				NT	Decreasing	N	Y
Sooty Shearwater	*Ardenna grisea*				NT	Decreasing	Y	Y
Zino's Petrel	*Pterodroma madeira*				EN	Stable	Y	Y
Northern Myotis	*Myotis septentrionalis*		Partial ID				N	Y

Common Name	Scientific Name	Current SARA	Critical Habitat	Recent COSEWIC Updates	IUCN Status Updates	IUCN Trend	Marine Habitat Exposure	Marine Movement Exposure
Eastern Red Bat	*Lasiurus borealis*			EN			Y	Y
Hoary Bat	*Lasiurus cinereus*			EN			Y	Y
Silver-haired Bat	*Lasionycteris noctivagans*			EN			P	Y

Table Description: This table identifies species listed under Schedule 1 of the SARA which may occur offshore Newfoundland and Labrador. Species which may become listed (e.g., recently assessed by Committee on the Status of Endangered Wildlife in Canada (COSEWIC)) and species with recent International Union for Conservation of Nature (IUCN) updates are also identified. COSEWIC was established under SARA as an independent body of experts responsible for identifying and assessing wildlife species considered to be at risk. This is the first step towards protecting wildlife species at risk. IUCN is a system for classifying species at high risk of global extinction.

Current SARA means current species at risk status. Categories include SC (special concern), TH (threatened), and EN (endangered). An asterisk (*) indicates the species is under consideration for status change.

COSEWIC categories include NAR (not at risk), SC (special concern), TH (threatened), and EN (endangered).

IUCN categories include LC (least concern), VU (vulnerable), NT (near threatened), and EN (endangered).

Under exposure columns, Y means yes, N means no, P means potentially yes, U means unlikely.

Blank cells indicate the information is not applicable for the species (e.g., the species is not listed under Schedule 1 of SARA, no recent COSEWIC updates for the species, etc.,).

Sources: ECCC, 2024a; h.

Based on current data, only Bank Swallow,[71] Bobolink, and Piping Plover have critical habitat in or adjacent to the Focus Area (ECCC, 2015a). [72]

Bank Swallow

Bank Swallows are aerial-foraging insectivores listed as threatened under SARA. They are common and widespread in Canada but have declined by over 90% since the early 1970s (ECCC, 2015b). Results from the Breeding Bird Survey also demonstrate persistent decrease in numbers (Smith and Edwards, 2020). Population declines are likely due to multiple stressors, including loss of breeding and foraging habitat through human management of aquatic habitat, loss of pastureland and reforestation of open habitats, destruction of active nests in aggregate pits, and changes in aerial insect populations on both the breeding and wintering grounds (COSEWIC, 2013a). Little is known about threats during migration and overwintering (COSEWIC, 2013a).

Offshore wind energy developments are unlikely to intersect Bank Swallow critical habitats directly, however, landfall of cables and associated transmission infrastructure could impact Bank Swallow critical habitat if not sited appropriately. Furthermore, Bank Swallows could interact with turbines while foraging or during migration. In other jurisdictions, unidentified swallows have been observed foraging around offshore wind turbines approximately 43 km offshore with estimated flight heights ranging from 23 m - 127 m above sea level (Robinson Willmott et al., 2023). Regarding migration, Bank Swallows are long-distance migrants. The Bank Swallow Connectivity Project (Motus) may have relevant information on Bank Swallow movement in the Focus Area. ECCC requested this information on behalf of the Committee, but it was not made available during this Regional Assessment.

Bobolink

Bobolink is listed as threatened under SARA and has been identified as a priority for conservation in several regions including the Boreal Softwood Shield Region, Atlantic Newfoundland and Labrador (CWS, 2013). Bobolink is a long-distance migrant songbird that inhabits grasslands and agricultural areas. Populations have decreased significantly across most of its range relative to 1970s levels (ECCC, 2015c). Declines are most likely caused by various changes to agricultural management and habitat fragmentation (COSEWIC, 2010c; Herkert, 1997; Murphy, 2003).

Piping Plover

Piping Plover are a small shorebird found only in North America. They are listed as endangered under Schedule 1 of SARA and are considered a priority for conservation in

[71] Critical Habitat for Bank Swallow only includes nesting and foraging habitats; other important habitats are not identified (e.g., roosting sites).

[72] Critical habitat is defined under SARA (2002) as habitat necessary for the survival or recovery of a wildlife species listed under Schedule 1 of the *SARA,* as identified in their species recovery document Critical habitat is specifically identified for species listed as Endangered or Threatened and species recovery documents are available on the Species at Risk Public Registry.

several regions including the Gulf of St. Lawrence (GSL) (Atlantic, Newfoundland and Labrador), Boreal Softwood Shield (Atlantic, Newfoundland and Labrador), NLS (Atlantic, Newfoundland and Labrador) (CWS, 2013). There are two subspecies of Piping Plover, split into 3 small populations (Atlantic, Prairie, and Great Lakes). Both subspecies have decreased moderately (greater than 25%, less than 50% decrease) relative to population levels in the 1970s, although the reliability of this assessment is considered medium (ECCC, 2015e). Furthermore, records from Piping Plover censuses since 1991 show variable counts with the most recent public census results (2016) showing an all-time low (ECCC, 2015e). Piping Plovers are sensitive because of small population sizes and low adult survival rates. Existing threats include predation, human disturbance (including localized disturbance), declines in habitat extent and quality, and loss of beach habitat on its wintering grounds (COSEWIC, 2013b; 2015b; Elliott-Smith & Haig, 2004; Gratto-Trevor & Abbott, 2011; Kirk, 2013; Roche et al., 2012). Changes to water levels (e.g., caused by climate change or human disturbance) can also decrease habitat suitability and lead to redistribution of breeding birds (COSEWIC, 2013b; Roche et al., 2012).

The Eastern subspecies of Piping Plover breeds in the GSL. More specifically, on the Magdalen Islands of Quebec and on the coasts of New Brunswick, Nova Scotia, Prince Edward Island, Newfoundland and Labrador, and the French Islands of St. Pierre and Miquelon. They are also found along the Atlantic coast beaches of the U.S. and overwinter along the Gulf Coast of the U.S. and Mexico, southern Atlantic U.S. coast, and the Caribbean, including the Bahamas and Cuba (ECCC, 2023l). ECCC provided the Committee confidential maps showing areas important for Piping Plover, based on their critical habitat, the Atlantic Canada Conservation Data Centre (ACCDC) database, and internal data on nesting records between 2017 - 2022 (ACCDC, 2023; ECCC, 2021; 2022c). The following areas in and adjacent to the Focus Area may be important for Piping Plover: GMNP; St. George's Bay; Port aux Port Peninsula; the southwest coast of the Island of Newfoundland; the south coast of the Island of Newfoundland, west of Ramea; the Connaigre Peninsula; and St. Pierre and Miquelon.

U.S. Atlantic Collision Risk Model

In 2022, BOEM published the report: Transparent modeling of collision risk for three federally listed bird species in relation to offshore wind energy development. This report outlines work to develop a model assessing exposure and collision risk of (U.S) federally protected birds from offshore wind energy development in the U.S. Atlantic, based on movement tracking data. The University of Rhode Island and Biodiversity Research Institute (BRI), with support from the U.S. Fish and Wildlife Service (USFWS) and Bureau of Ocean Energy Management (BOEM) developed (Adams et al., 2022):

- Collision risk models, movement models, and flight height distributions for the three initial case study species
- Fully annotated code for the above models and web application
- Open-source graphical web application (SCRAM) that implements a stochastic collision risk model with Motus data, with data for the three initial case study species hard-coded into the application
- User manual for SCRAM

Case study species included Piping Plover, Red Knot, and Roseate Tern.

Other Species at Risk

The Committee also reviewed confidential maps provided by ECCC depicting locations (other than critical habitat) potentially important to species at risk. Data provided includes:

- Potentially important areas for adult and juvenile Ipswich Sparrow (*Passerculus sandwichensis*) during fall migration.
- Observations of Piping Plover outside the breeding season (stopover and/or pre- or post-breeding areas) and breeding locations recorded between 2017 and 2022 (discussed above).
- Important areas for Roseate Tern.
- Locations of shorelines identified as Red Knot priority stopover sites.
- Migration areas for Lesser Yellowlegs travelling through Atlantic Canada during fall migration.
- Locations of bat observations including Myotis (*Myotis lucifugus* and *Myotis Septentrionalis*), Eastern Red Bat, Hoary Bat, and Silver-haired Bat.
- Locations of Monarch Butterfly observations obtained from the Atlantic Canada Conservation Data Centre (2023).

Based on these, important stopover areas for Red Knot and important areas for Piping Plover overlap the Focus Area. For some species at risk, available tracking data also shows recorded locations or estimated tracklines in the Focus Area (see Section 7.3.2.1.2 of this Report).

Red Knot is a long-distance migrant shorebird. Three subspecies occur in Canada, and the species *C. c. rufa* occurs in Atlantic Canada. This subspecies breeds in the central Arctic and migrates across the southeastern U.S., the northwest Gulf of Mexico, the northeast coast of Brazil, the Atlantic coasts of Argentina and Chile, and the Caribbean. COSEWIC has assessed *rufa* Red Knots as three units based on wintering populations: Tierra del Fuego/Patagonia; Northeastern South America; and Southeastern U.S./Gulf of Mexico/ Caribbean. The Tierra del Fuego/Patagonia wintering population is currently listed as Endangered. The other populations have been assessed as Special Concern and Endangered by COSEWIC and are under consideration for addition to Schedule 1. It is unclear which populations occur in the Focus Area, but currently available tracking data suggests the Tierra del Fuego/Patagonia wintering population passes through the area (see Section 7.3.2.1.2 of this Report).

The global Red Knot population is declining, and the *rufa* subspecies has shown a large decrease (greater than 50% decrease) in population size since 1982, when regular aerial surveys for the subspecies on the wintering grounds in Tierra del Fuego and Patagonia began (ECCC, 2015f). Improper fueling prior to migration has been shown to decrease migratory performance, reproductive success, and survival in Red Knot (Baker et al., 2004; Duijns et al., 2017). Threats like human disturbance, habitat degradation, and erosion of food resources at key staging sites can, therefore, have an adverse effect on Red Knot (Duijns et al., 2017). Climate change is another significant threat to this species, because Red Knot are long-lived with low reproduction rates. This makes it difficult to

adapt to accelerated climate change at their breeding grounds (e.g., drying of tundra ponds, shrub encroachment asynchrony of insect emergence and chick hatching, changes in predation pressure and extreme weather events) (Callaghan et al., 2005; Martin & Wiebe, 2004; Meltofte et al., 2007; Smol & Douglas, 2007; Stow et al., 2004; Tape & Racine, 2006; Tulp & Schekkerman, 2006; 2008). Other existing threats include decline in shellfish populations and hunting Red Knot at key wintering and staging sites (COSEWIC, 2007b; ECCC, 2017a). Red Knot has been identified as a regional conservation priority in many regions including for GSL Region (Atlantic, NL) and NLS (CWS, 2013).

Red Knot occurs in Atlantic Canada during spring and fall migration, with the highest concentrations occurring in late summer and early fall (ECCC, 2023l). ECCC identified coastline adjacent to the Focus Area, particularly around St. George's Bay and GMNP, as important stopover sites, based on Atlantic Canada Shorebird Survey data collected since 1974, including unpublished data (ECCC, 2012; 2023l). In maps provided, ECCC included a 10 km buffer around priority stopover sites. They indicated that this buffer is a conservative estimate of the distance required for Red Knot to reach flight altitudes higher than anticipated heights of turbine rotor swept zones (20 - 300 m). They also indicated other important stopover sites may be identified through ongoing research (ECCC, 2023l). Stopover sites are used for refuelling and resting during migration and high-quality stopover sites are critical for migratory shorebirds.

As above (see U.S. Atlantic Collision Risk Model), BOEM is modelling collision risk with offshore wind energy development for Red Knot in the U.S. Atlantic (Adams et al., 2022).

Additionally, recorded locations of Lesser Yellowlegs and observations of bats did not overlap exactly with the Focus Area, as data on these species are limited. However, their presence adjacent to the Focus Area indicates potential for overlap with offshore wind energy development areas (ECCC, 2023l).

Northern Gannet

Northern Gannet may also be of concern in the Focus Area. In recent years, a severe outbreak of highly pathogenic avian influenza (HPAI) caused significant mortality amongst several eastern Canada wild birds. Avery-Gomm et al. (2024), released the first comprehensive assessment of resulting bird mortality in eastern Canada during the spring and summer 2022 breeding season. They estimate mortalities were greatest amongst Northern Gannet (25,699 individuals), American Common Eiders (1,894 individuals), and Common Murres (8,133 individuals); followed by gulls, cormorants, Atlantic Puffins, Black-legged Kittiwakes, Razorbills, and terns. Prior to the HPAI outbreak, breeding populations of Northern Gannet at the 5 largest colonies increased dramatically since 1970 and were considered stable or increasing from 2010 - 2020 (d'Entremont et al., 2022).

In addition to mortality estimates presented by Avery-Gomm et al. 2024, population declines up to 30% were observed at some Northern Gannet colonies (Lane et al. 2024).

The entire breeding North American population and 13% of the global Northern Gannet population occurs in Canada (Mowbray, 2020). Northern Gannet breed in dense colonies,

at 3 colonies in Quebec and 3 colonies in Newfoundland and Labrador (Funk Islands, Baccalieu Island, and Cape St. Mary's). Cape St. Mary's is the largest colony in Newfoundland and Labrador and is in proximity to the Focus Area. Figure 7.3.9 (under Section 7.3.2.1.1 of this Report, Marine Birds) shows Northern Gannet colonies and predicted foraging distribution based on Ronconi et al. (2022). In addition to the area surrounding Cape St. Mary's, higher densities of Northern Gannet could be expected in the Focus Area off the Connaigre Peninsula in fall and, during spring and summer months off the south coast of the Island of Newfoundland and along the west coast of the Island towards the northern and northwestern boundaries of the Focus Area. These observations are based on confidential maps provided by ECCC (see discussion on marine birds above). Publicly available data and visuals showing density and distribution estimates for individual marine bird species can be accessed through the Open Science and Data Platform (ECCC, 2023b). Information on fine-scale use and movement patterns of Northern Gannet during migration and winter is also available and can be visualised using the Northeast Ocean Data Explorer Tool (Northeast Ocean Data Portal, 2023; Spiegel et al., 2017). Northern Gannet movement utilization distribution models are discussed above under Section 7.3.2.1.1 of this Report.

7.3.2.2.2 Areas Important for Aerofauna

Figure 7.3.20 shows some areas important for aerofauna near the Focus Area. Areas important to aerofauna and near the Focus Area include:

- Aerofauna critical habitat, important stopover sites for Red Knot and important areas for Piping Plover (see Section 7.3.2.2.1 of this Report).
- Important bird and biodiversity areas.
- Bird colonies (see Section 7.3.2.1.1 of this Report).
- Sea duck key habitat sites.
- Important shorebird sites.
- Lawn Bay Ecological Reserve and Cape St. Mary's.
- Migratory Bird Sanctuaries.

Figure 7.3.20. Areas Important for Aerofauna in and Adjacent to the Regional Assessment Focus Area

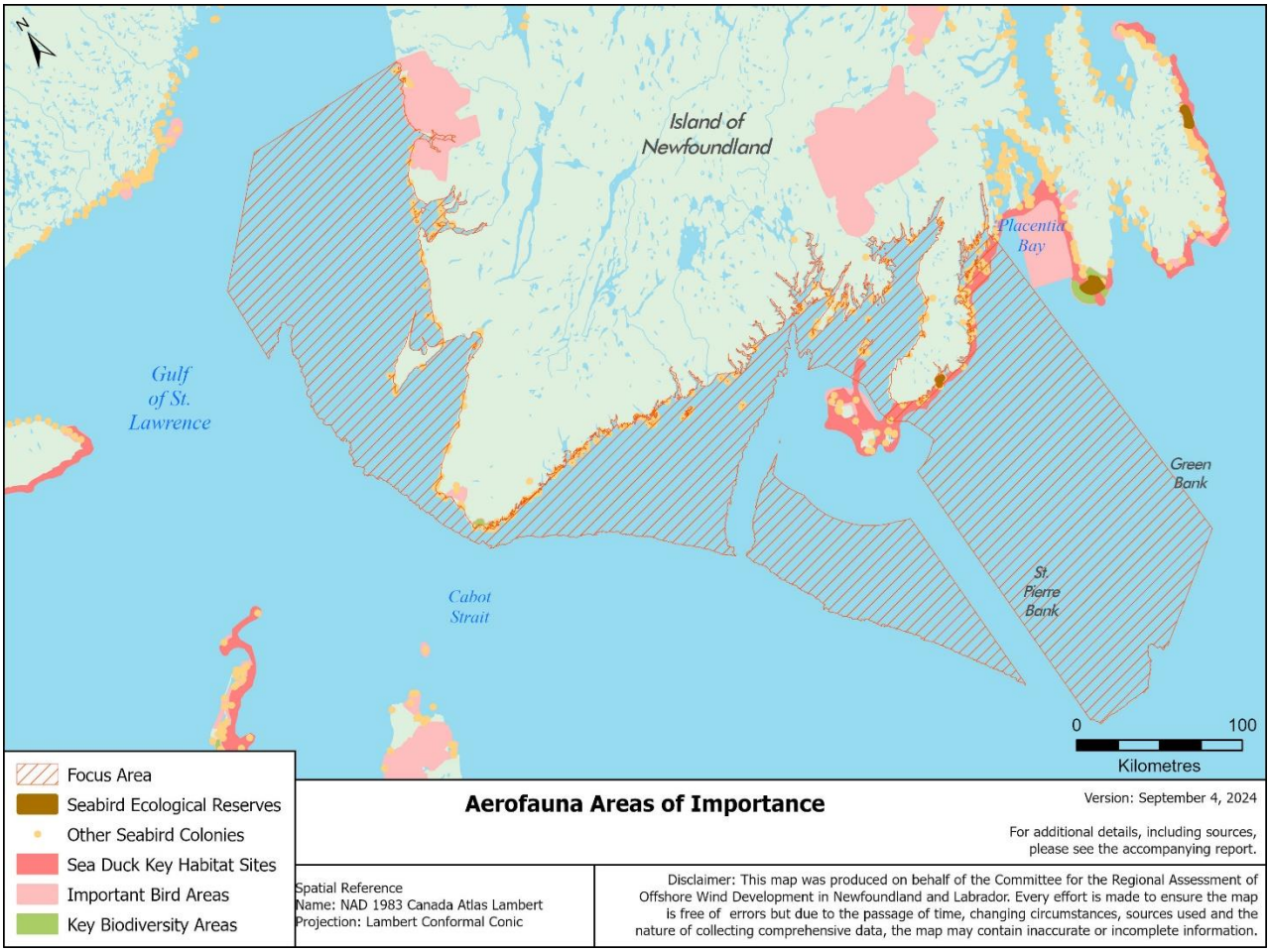


Figure Description: This map shows some of the areas important for Aerofauna adjacent to the Focus Area.

Data Sources: ECCC, 2016a; FFA, 2020; IAAC, 2023a; IBA Canada, 2024; KBAs Canada, 2024a; NRCan, 2023; Sea Duck Joint Venture, n.d.

Important Bird Areas and Key Biodiversity Areas: The Important Bird Area (IBA) Canada Program is an international conservation initiative coordinated by BirdLife International, in partnership with Bird Studies Canada and Nature Canada. The goal of the IBA program is to designate areas throughout the country that are important habitat to bird species (IBA Canada, n.d.-b). The identification process for IBAs is criteria-based, and criteria are based on the presence of species at risk, species with restricted range, habitats holding representative species assemblages, or a congregation of a significant proportion of a species' population during one or more season. To date, the program has identified approximately 600 different areas as having worldwide, continental, or national significance to bird populations (Moore & Couturier, 2011). Of these, 80 are located partially or wholly in NWAs or MBSs and all are included in science-based initiatives to identify, conserve and monitor a network of sites that provide essential habitat (IBA Canada, n.d.-c).

The KBA system, is an international system to identify areas important for maintaining biodiversity nationally ang globally. In 2019, the KBA Canada program began. IBAs are being (or have been) assessed against KBA criteria. Qualifying IBAs are being transitioned to the broader KBA system. IBAs are still being maintained globally, and the criteria being kept up to date, so if a site qualifies to become an IBA but not a KBA, they will still be stored in the IBA database (KBA Canada, 2024b).

There are thirteen IBAs within or adjacent to the Focus Area, listed in the table below. Cape St. Mary's and Grand Bay West to Cheeseman Provincial Park are KBAs (KBA Canada, 2022; 2023).

Table 7.3.6. Important Bird Areas (IBAs) Located within or Adjacent to the Focus Area

Important Bird Area	Area within or adjacent to the Focus Area (km^2)	IBA Criteria	Conservation Status	Species
Cape St. Mary's (IBA NF001, KBA NL001)*	329.39	Globally Significant: Congregatory Species	IBA Conservation Plan written/being written	Black-headed Gull Black-legged Kittiwake Dovekie Harlequin Duck Manx Sherwater Northern Gannet Piping Plover

Important Bird Area	Area within or adjacent to the Focus Area (km^2)	IBA Criteria	Conservation Status	Species
				Razorbill
Bay du Nord Wilderness Reserve and Middle Ridge Wildlife Reserve (NF018)	3,804.04	Nationally Significant: Restricted Range Species	Wildlife Reserve	Rock Ptarmigan (*Lagopus muta*) Willow Ptamigan (*Lagopus lagopus*) Canada Goose Amercian Black Duck Green-winged Teal Common Goldeneye Common Merganser Harlequin Duck
Placentia Bay (NF028)	1,398.05	Globally Significant: Congregatory Species	N/A	Dovekie Manx Sherwater Red Crossbill (*Loxia curvirostra*)
Corbin Island (NF030)	4.17	Globally Significant: Congregatory Species, Colonial Waterbirds/Seabird Concentrations	IBA Conservation Plan written/being written	Herring Gull Leach's Storm-petrel
Middle Lawn Island (NF031)	4	Globally Significant: Congregatory Species, Colonial Waterbird/Seabird Concentrations	IBA Conservation Plan written/being written	Manx Shearwater Leach's Storm-petrel Herring Gull Greater Black-backed Gull (*Larus marinus*) Black Guillemot
Green Island (NF032)	5.61	Globally Significant: Congregatory Species, Colonial Waterbird/Seabird Concentrations	IBA Conservation Plan written/being written, Migratory Bird Sanctuary (federal)	Leach's Storm-petrel Herring Gull Common Terns Arctic Terns Black Guillemots (*Cepphus grylle*) Manx Shearwaters
Miquelon Island (Northeast Coast) (NF034)	346.76	Globally Significant: Congregatory Species	IBA Conservation Plan written/being written	Piping Plover Red-necked Grebe

Important Bird Area	Area within or adjacent to the Focus Area (km^2)	IBA Criteria	Conservation Status	Species
Grand Colombier Island (NF036)	7.19	Globally Significant: Congregatory Species, Colonial Waterbirds/Seabird Concentrations	IBA Conservation Plan written/being written	Leach's Sotrm Petrel Atlantic Puffin Black-legged Kittiwake Herring Gull Great Cormorant Great Black-backed Gull Razorbills Manx Sherwaters Northern Fulmars
Big Barasway (NF037)	10.40	Nationally Significant: Threatened Species	Ecological Reserve (provincial)	Piping Plover
Grand Bay West to Cheeseman Provincial Park (IBA NF038, KBA NL038)*	40.33	Nationally Significant: Threatened Species	Provincial Park (including Marine)	Black-headed Gull Piping Plover
Codroy Valley (NF040)	35.46	Nationally Significant: Restricted Range Species	N/A	Piping Plover Red Crossbill Ovenbird (*Seiurus aurocapilla*) Red-throated Hummingbird (*Archilochus colubris*) Gray Catbird (*Dumetella carolinensis*) Red-eyed Vireo (*Vereo olivaceus*) Rose-breasted Grosbeak (*Pheucticus ludovicianus*) Bobolink Warbler species (Magnolia (*Setophaga magnolia*), Black-throated Green (*Setophaga virens*), Bay-breasted (*Setophaga castanea*), Cape May (*Setophaga* tigrine) and Blackburnian (*Setophaga fusca*))

Important Bird Area	Area within or adjacent to the Focus Area (km^2)	IBA Criteria	Conservation Status	Species
Codroy Valley Estuary (NF041)	13.56	Continentally Significant: Congregatory Species	N/A	Piping Plover Canada Goose Wood Duck (*Aix sponsa*) Green-winged Teal American Black Duck Northern Pintail (*Anas acuta*) Gadwall (*Mareca strepera*) Lesser and Greater Scaup Common and Red-breasted Merganser Eurasian Wigeon Duck (*Mareca Penelope*) Tufted Duck (*Aythya fuligula*) Northern Shoveler (*Spatula clypeata*) American Qigeon (*Mareca americana*) Blue-winged Teal
Gros Morne National Park (NF045)	1,865.12	Nationally Significant: Restricted Range Species	National Park	Black-headed Gull Dovekie Great Black-backed Gull Iceland Gull Piping Plover Rock Ptarmigan Red Crossbill Ovenbird Harlequin Duck

Table Description: Details on IBAs located adjacent to the Focus Area.
* IBAs that qualify as KBAs.

Source: IBA Canada, 2024.

Sea Duck Key Habitat Sites are important areas for sea ducks across North America. They include habitats most critical to sea ducks during at least one season (particularly migration and breeding seasons). Designation of Sea Duck Habitat sites is intended to heighten awareness about these important habitats and aid in prioritizing habitats for conservation and protection efforts (Sea Duck Joint Venture, n.d.). Most sites occur outside of the Focus Area, with some along the coast of the Island of Newfoundland. Part of the Saint Pierre and Miquelon to Cape St. Mary's Sea Duck Key Habitat Site occurs within the Focus Area southwest of Bird Island and is of significant importance for Common Eider and Harlequin Duck during winter.

Important Shorebird Sites relate to the Western Hemisphere Shorebird Reserve Network (WHSRN) sites.[73] WHSRN sites are nominated and proved important for shorebirds in the Western Hemisphere on a regional, international, or hemispheric scale. Designation depends on peak species counts and/or percentage of biogeographic populations using the site annually. Important shorebird sites are regionally important but not yet nominated for WHSRN status or do not qualify for nomination. In their November 2023 submission, ECCC indicated that shorebird sites are assumed to be connected and could imply movements between sites. They recommended that in the absence of offshore distribution or movement data for shorebirds, this information can be used alongside other data sources and expert knowledge to assess areas where shorebirds may experience higher risks with respect to offshore wind energy development.

Ecological reserves are protected under the provincial *Wilderness and Ecological Reserves Act* (WER Act) (1980). Disturbing and destroying animals in ecological reserves is prohibited, as are various development activities (e.g., forestry, mining, agriculture etc.,) (*Wilderness and Ecological Reserve Act*, 1980). For some reserves, nearby vessel activity is also restricted during bird breeding seasons (DOECC, n.d.-c). The Committee is not aware of any specific requirements or guidance related to the development of offshore wind energy in proximity to ecological reserves. Nonetheless, these areas are important for the conservation of multiple species, including birds. The Lawn Bay Ecological Reserve was established to protect the only known colony of Manx Shearwater in North America. It also provides habitat for a significant colony of Leach's Storm-petrels, smaller numbers of Great Black-backed Gulls, Herring Gull, Black Guillemots, Black-legged Kittiwakes, Common Murres and occasionally, Arctic and Common Terns (DOECC, n.d.-c). Cape St. Mary's is one of Newfoundland's largest breeding bird colonies. As above, Cape St. Mary's hosts a significant population of Northern Gannet. It is also an important breeding habitat for species such as Common Murre, Black-legged Kittiwake, Thick-billed Murre, and Herring Gull (Canadian Parks and Wilderness Society, n.d.). Northern Gannet and Herring Gull can forage significant distances that could overlap with the Focus Area. Oil pollution from ocean going vessels in Placentia Bay is an ongoing threat to the colony (Canadian Parks and Wilderness Society, n.d.).

[73] Currently, no WHSRN sites occur within the Focus Area.

Migratory Bird Sanctuaries (MBS) are listed under the Schedule in the Migratory Bird Sanctuary Regulations (2019). The primary purpose of MBSs is the protection of migratory birds from killing, harm and harassment during a critical part of their life cycle, such as breeding, nesting, moulting, or staging and stopover during their migration (ECCC, 2017c). Shepherd Island MBS, Île aux Canes MBS and Terra Nova MBS are in Newfoundland and Labrador, and several MBSs are located along the coast of Quebec. During the public comment period for the Draft Report, ECCC advised that although these are not in the Focus Area, birds traveling to these sites may migrate through the Focus Area and could be adversely affected by offshore wind development.

7.3.2.2.3 Migration Paths

Aerofauna may interact with offshore wind development during migration or other movement offshore. As above (see Section 7.3.2.1 of this Report), ECCC completed an extensive review of movement data in the Atlantic Canada offshore region and created movement models for several species across different seasons. ECCC also used this data to plot migration paths and corridors. Figures 7.3.21 and 7.3.22 show estimated migration corridors in fall and spring. These estimates only begin to develop our understanding of aerofauna movement in the Atlantic offshore region. Estimates are based on existing tracking data and do not account for all species known to migrate through the region. For example, ECCC advised that "some species of shorebirds breed in the Arctic and enter the study area only during the fall migration. Those species can be under-represented, as tracking data is scarce due to the logistical difficulties of deploying tracking devices in the breeding or wintering areas" (ECCC, 2024a). Furthermore, the existing movement data has notable gaps (e.g. limited number of individuals tracked). For the species used in this analysis, some migration paths overlap the Focus Area in fall, especially to the west of the Island of Newfoundland.

ECCC indicated that, to their knowledge, there are no existing tracking studies that describe the behaviour of bats or invertebrates in the Atlantic Canada offshore region. offshore. Due to the size and weight of recording devices, these products are limited to individuals that are sufficiently large to carry the device and does not include these taxa or small-bodied birds such as shorebirds (ECCC, 2024a).

Figure 7.3.21. Estimated Avifauna Fall Migration Corridors

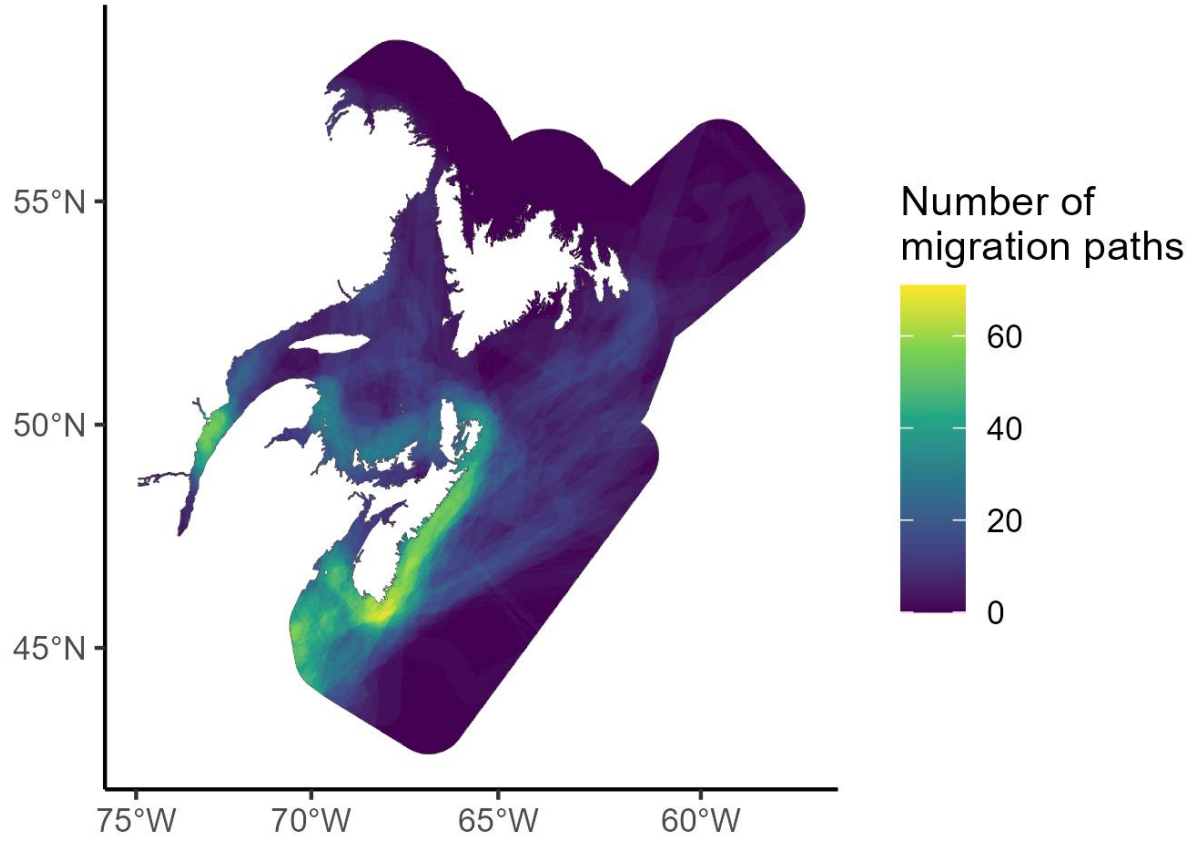


Figure Description: This map was developed by ECCC and provided to the Committee to show estimated migration corridors for avifauna. Where existing tracking data overlapped a species' fall migration period, an individual's migration path was plotted. Migration paths were plotted as the Euclidian distance between recorded locations, and a buffer corresponding to the average error of all track locations was applied. All buffered migration paths were summed in a single map to estimate migration corridors for each species in fall. Species migration paths were summed to develop the map shown here. This map is based on tracking data for: American Black Duck, Common Eider, Great Shearwater, Herring Gull, Lesser Yellowlegs, Long-tailed Duck, Long-tailed Jaeger, Northern Gannet, Parasitic Jaeger, Ring-throated Loon, Sooty Shearwater, Surf Scoter, Whimbrel. Migration corridor maps for each of these species is available on the Registry. These do not include all species that migrate through the Atlantic Canada offshore region.

Data Source: ECCC, 2024a.

Figure 7.3.22. Estimated Avifauna Spring Migration Corridors

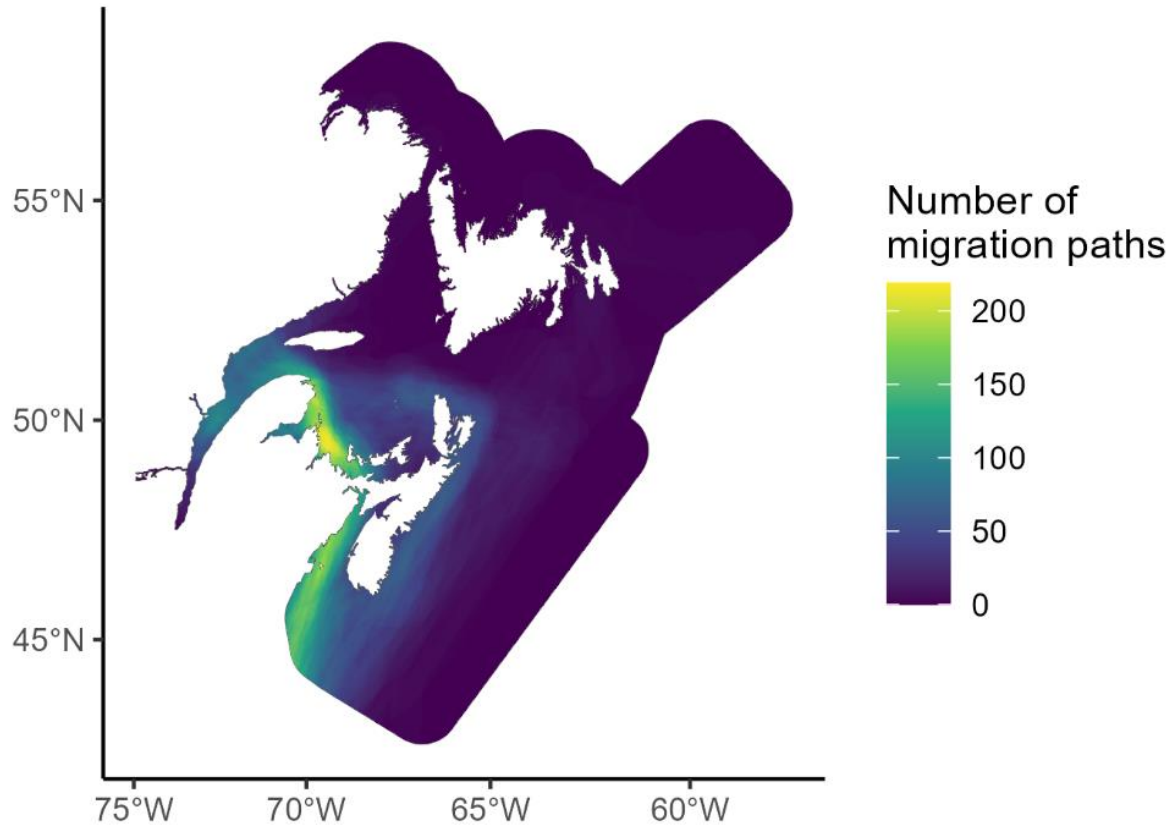


Figure Description: This map was developed by ECCC and provided to the Committee to show estimated migration corridors for avifauna. Where existing tracking data overlapped a species' spring migration period, an individual's migration path was plotted. Migration paths were plotted as the Euclidian distance between recorded locations, and a buffer corresponding to the average error of all track locations was applied. All buffered migration paths were summed in a single map to estimate migration corridors for each species in spring. Species migration paths were summed to develop the map shown here. This map is based on tracking data for: American Black Duck, Black Soter, Great Black-backed Gull, Glaucous Gull, Herring Gull, Long-tailed Duck, Northern Gannet, Pectoral Sandpiper, Red-throated Loon, Surf Scoter, and White-winged Scoter. Migration corridor maps for each of these species is available on the Registry. These do not include all species that migrate through the Atlantic Canada offshore region.

Data Source: ECCC, 2024a.

7.3.3 Potential Effects of Planned Offshore Wind Activities

This chapter explores the potential positive and adverse effects of offshore wind farms on aerofauna.

As a part of this Regional Assessment, ECCC provided the Committee with sector-based Pathways of Effects (PoE) models for offshore wind development and aerofauna (ECCC, 2024a). These show how different activities associated with each phase of offshore wind development could result in impacts to aerofauna. Models are presented at the end of this section.

Overall, common stressors associated with offshore wind development that could affect aerofauna include artificial lighting, artificial structures, noise, and habitat loss and fragmentation; and the introduction of invasive species, and/or physical or chemical hazards due to accidents. These lead to effects that can be grouped broadly under mortality, change in individual fitness, and change in habitat.[74] Effects are complex and interact with one another. ECCC identified two measurable endpoints:

- Changes to aerofauna habitat availability and distribution, including quality, quantity, and connectivity.
- Changes to aerofauna species survival and reproduction.

The discussion that follows includes an overview of commentary provided by ECCC on the PoEs, and additional findings from the Committee's review of offshore wind development in other jurisdictions. The discussion is organized by stressors and broad effects likely experienced by aerofauna.

7.3.3.1 Artificial Lighting

Table 7.3.7 summarizes sources of artificial light during different stages of offshore wind development. Once development and operations are completed, decommissioning can remove some or all sources of artificial lighting and remove attraction and avoidance effects (ECCC, 2024a). Partial decommissioning would leave some parts of the turbine on site and lighting may be required for navigational safety. Lighting would also be associated with monitoring vessels.

[74] As per Hannah et al. (2020): Mortality means death of an organism or group of organisms. It can be immediate or delayed and can occur because of change in individual fitness. Changes in individual fitness are non-lethal changes to physiological conditions that affect the ability of an organism to grow, survive to reproductive age and/or produce or rear offspring. These include behavioural effects, changes to health and reproduction and injury. Change in habitat includes habitat loss and change in habitat quality.

Table 7.3.7. Sources of Artificial Lighting During Offshore Wind Development

Project Phase	Stressor Sources
Pre-construction	• Lighting on vessels used for transportation of personnel • Monitoring equipment to conduct site surveys and related assessments
Construction	• Lighting on vessels, aircraft, and equipment needed to complete construction sub-activities • Additional site lighting needed to complete work
Operation	• Aviation lighting fixed on platforms and turbines • Lighting on vessels and aircraft during routine maintenance • Additional site lighting needed to complete work during routine maintenance
Decommissioning	• Lighting on vessels, aircraft, and equipment • Additional site lighting needed to complete work

Table Description: This table summarizes sources of artificial lighting that could impact aerofauna during different phases of offshore wind development. See Section 4 of this Report for an overview of offshore wind development phases and activities.

Source: ECCC, 2024a

7.3.3.1.1 Behavioural Changes and Changes in Habitat Quality

Artificial lighting can elicit behavioural changes in aerofauna (e.g., attraction or avoidance) and can subsequently increase collision risk or otherwise decrease fitness (Deakin et al., 2022; Gjerdrum et al., 2021; Hüppop et al., 2006; Marques et al., 2014; Montevecchi, 2006; personal communication, R. Thomas, July 22, 2024; Voigt et al., 2018). Effects related to collision are under Section 7.3.3.2.2 of this Report.

Regarding fitness, artificial lighting has been linked to instances of stranding, disorientation or displacement from usual movement pathways. For example, ECCC presented the Committee with evidence from offshore oil and gas platforms suggesting birds may circle aimlessly around artificial light sources until exhaustion (Hüppop et al., 2006; Ronconi et al., 2015). Other research at lighthouses, oil platforms, and ships also shows lighting during inclement weather can disorient and/or attract birds (Hill et al. 2014; Hüppop et al. 2016). These effects can increase energy cost, which may decrease fitness or leave individuals more susceptible to threats (Deakin et al., 2022; Gjerdrum et al., 2021; Hüppop et al., 2006; Marques et al., 2014; Montevecchi, 2006).

Displacement from movement pathways can occur due to attraction or avoidance responses (or through other effect pathways) and can affect fitness. For example, aerofauna sometimes avoid vessels and equipment used during pre-construction activities in response to artificial lighting (Syposz et al., 2021). Using alternate movement pathways means the connectivity between habitat locations is altered. This can further increase energy costs, if individuals are flying longer distances or for longer periods of time and can decrease fitness. ECCC relayed to the Committee:

> Though the mechanisms are less clear [compared to other effects of artificial lighting], migratory stopovers of nocturnal migrating birds are influenced by artificial lighting (McLaren et al., 2018). Nocturnal migrating birds can potentially become lost at sea or more susceptible to predation due to increases in energetic cost, and migration can be short-stopped, forcing a longer migration or altering paths (R. Thomas, personal communication, July 22, 2024, from ECCC, 2024a).

Finally, artificial lighting may change foraging habitat quality. This can occur through various mechanisms. Because of displacement, individuals could encounter different habitats of different quality. Habitat enhancement could also be observed at wind farms, where aerofauna prey species may be attracted to light (C. Gjerdrum, personal communication, July 16, 2024; Lieske et al., 2020a).

Several factors may influence an individual's behavioural response to artificial lighting and/or the extent of the response. For example, species and individual characteristics (e.g., species type, age etc.), project characteristics (e.g., type of lighting, project location etc.,), and environmental conditions (e.g., weather, visibility, etc.,) are all important to consider (Deakin et al., 2022; Gjerdrum et al., 2021; Hüppop et al., 2006; 2016; Montevecchi, 2006; Rebke et al., 2019; Rodríguez & Rodríguez, 2009; Voigt et al., 2018). Studies tend to show petrels (e.g., Leach's Storm-petrel, Cory's Shearwater), Herring Gull, nocturnal migrating landbirds, and migratory bats may be more vulnerable to light attraction (Gjerdrum et al., 2021; Hüppop et al., 2006; 2016; Montevecchi, 2006; Rebke et al., 2019; Rodríguez & Rodríguez, 2009; Voigt et al., 2018).

In 2020, NatureScot published an information note summarizing the effect of aviation obstruction lighting on birds at wind turbines (and other similar structures), and recommended mitigation measures. In their note, they report flashing red lights reduce attraction and subsequent kills significantly. White lights appear to be better than red lights, and towers with no lighting are least attractive. They recommend minimizing artificial light exposure by using flashing light and avoiding the use of continuous lighting. They also recommend reduced flash durations combined with increased intervals between flashes are recommended (Cook et al., 2011; Evans et al., 2007; Gartman et al., 2016; Gehring et al., 2009; Kerlinger et al., 2010). Additionally, impacts of artificial lighting can be reduced through minimizing permanent lighting by turning off all unnecessary lighting when not in use.

7.3.3.2 Artificial Structures

Artificial structures are another stressor eliciting effects. Table 7.3.8 summarizes artificial structures associated with different stages of offshore wind development. These can result in several interacting effects including behavioural responses (attraction or avoidance), injury or mortality due to collisions and habitat change. Vessels are included in this discussion as these can attract aerofauna to roosting perching opportunities. Effects related to these structures maybe different from those caused by offshore wind turbines as these move and are intermittently present.

During decommissioning, the removal of wind turbines and other platforms, should begin to decrease attraction responses, lowering collision mortality or injury over the long-term (Hall et al., 2022). Effects should continue to decrease after decommissioning is completed because of lower vessel presence. In the case of partial removal of turbines, foundation transition pieces and marking buoys can offer roosting or perching opportunities for aerofauna (Harwood et al., 2017). Partial removal of artificial structures can also result in habitat enhancement through the artificial reef effect.

Table 7.3.8. Artificial Structures Associated with Different Stages of Offshore Wind Development

Project Phase	Stressor Sources
Pre-construction	• Vessels or equipment used in monitoring
Construction	• Specialized vessels equipped with cranes and jacks for site preparation • Large, specialized vessels for turbine, foundation, and scour protection installation, potentially including vessels with cranes and jack-ups
Operation	• Site-specific numbers of wind turbines • Equipment such as cranes and vessels for lifting and transportation of components, equipment, and personnel for routine maintenance
Decommissioning	• Large, specialized vessels for turbine, foundation, and scour protection decommissioning, potentially including vessels with cranes and jack-ups

Table Description: This table summarizes artificial structures that could impact aerofauna during different phases of offshore wind development. See Section 4 of this Report for an overview of offshore wind development phases and activities.

Source: ECCC, 2024a

7.3.3.2.1 Behavioural Responses

Attraction due to artificial light is discussed above. Attraction could also result from the introduction of artificial structures. Vessels and equipment associated with various stages of offshore wind development can create roosting or perching opportunities and attract aerofauna, especially seabirds and bats (Ahlén et al., 2009; Dierschke et al., 2016; Solick & Newman, 2021). Turbines can also attract aerofauna due to increased perching opportunities and increased prey availability (see Section 7.3.3.2.3 and 7.3.3.3 of this Report). Attraction due to these structures can have sub-effects and consequence like those described for artificial lighting (see Section 7.3.3.1 of this Report) (e.g., heightened collisions risk, increased incidents of stranding, higher energy expenditure, decreased fitness).

Artificial structures also cause an avoidance response in some aerofauna. Consequences are discussed under habitat loss below. Avoidance of offshore wind turbines can occur at multiple spatial scales (Cook et al., 2018). Physical avoidance can include last-second maneuvering to avoid collisions (micro avoidance), redistribution of birds within a

windfarm due to turbines (meso avoidance), and/or redistribution of birds outside the perimeter of wind farms (macro avoidance) (Cook et al., 2018; May, 2015; SEER, 2022b; Skov et al., 2018. According to Skov et al. (2018), offshore wind projects have generally reported seabirds engage in micro-avoidance behaviours at a rate greater than 95%. Bats may also alter their flight patterns or avoid areas with significant pressure fluctuations (e.g., caused by turbine blade movement), potentially leading to changes in their overall behavior, commuting routes, and foraging strategies (Minderman et al., 2017).

Some aerofauna may also adjust their migration timing to avoid high-risk periods near wind farms (i.e., high winds, moonless nights, etc.) (Nemes et al., 2023; Pulido, 2007). This can result in asynchrony between migratory patterns, critical resources, and breeding conditions. Extended movement times because of elongated journeys can also have the same result (Nemes et al., 2023; Pulido, 2007).

7.3.3.2.2 Physical Injury or Mortality Due to Collisions

This discussion predominantly focuses on collisions with offshore wind project components. Offshore wind turbines can directly cause injury or mortality. Indirectly, lower body condition (due to injury) may also lead to mortality by affecting the ability to fly to other habitat areas to forage or recover (ECCC, 2024a). The presence of wind farms and the associated mortality risks (i.e., collisions) can also lead to increased disturbance and stress among bird populations (Larsen & Guillemette, 2007).

Collisions between birds and wind turbine blades have been documented at both onshore and offshore wind farms (Adams et al., 2017; Marques et al., 2014). Offshore wind turbines, because of their height or location, can pose a risk to avian species during movement or migration (Hüppop et al., 2006). Individuals may collide with the supporting structure, the blades (stationary or rotating), or be swept up in the wake of the rotor blades (Fox et al., 2006; Hüppop et al., 2006; 2016). Furthermore, rotor speed has been shown to influence bird collision risk (Drewitt & Langston, 2006).

Methods commonly used at land-based farms, such as carcass searches are not feasible at offshore wind sites, limiting post-construction monitoring at offshore wind farms to incidental observations and remote collision detection monitoring technologies. This may lead to under-reporting collision rates (Drewitt & Langston, 2006; SEER, 2022b). At the same time, some studies have been conducted to assess the extent of direct mortality from collisions at offshore wind farms. (Bailey et al., 2014; Croll et al., 2022; Galparsoro et al., 2022; Lane et al., 2020). These studies provide valuable insights into the magnitude of the problem and help identify high-risk areas and seasons.

Key findings from research on bird-turbine collisions and collisions with other offshore structure suggest several influencing factors.[75] For example, project location and design (Drewitt & Langston, 2006; Everaert & Stienen, 2006; Hill et al., 2014; Kerlinger & Curry, 2002; Petterson, 2005), species type and abundance (AWWI, 2020; Degraer et al., 2021; Erickson et al., 2014; Everaert & Stienen, 2006; Goodale et al., 2019; Hill et al., 2014; Hüppop et al., 2016; SEER, 2022b; Watson, 2022), individual characteristics (e.g., age, health, behaviour such as foraging, breeding and migration) (Hill et al., 2014; Hüppop et al., 2016), and weather conditions (Robinson Willmott et al., 2013) could influence collision rate. While a wide range of bird species can be affected, certain groups are more vulnerable to collisions. Studies have shown that large raptors, such as eagles and hawks, and species that are known to frequent offshore areas, including seabirds and waterfowl, are at a higher risk (Watson, 2022; Goodale et al, 2019). Movement pathways of migratory birds that intersect wind farms during their seasonal migrations are also at risk (Degraer et al., 2021).

In addition to above water components, the presence of subsea infrastructure (foundations, cables, substations, and converter stations) could pose collision risks, although this effect is not as well documented. Diving birds (sea ducks, alcids, loons, gannets, cormorants, and terns) are known to sustain injury when plunge-diving into obstructions such as boat decks or fish holds when foraging (Mowbray, 2020). They may similarly risk collision with underwater mooring systems. While this risk is expected to be low as many marine birds favor shallow water for foraging, many dive in deeper waters in pursuit of their prey, and thus would be vulnerable to collisions with underwater infrastructure. Murres, for example, regularly dive to depths exceeding 100 m (Elliott et al., 2007) and many shearwaters are observed foraging in deep waters

For bats, wind turbines are now considered one of the leading causes of bat mortality worldwide (O'Shea et al., 2016). Bats, while adapted to maneuver through intricate landscapes using echolocation, are vulnerable to collisions with turbines at offshore wind farms (Thaxter et al., 2017a). As bats venture out over marine areas to feed on insect prey or move to offshore roosting sites, they face the risk of colliding with large wind turbines (True et al., 2023). This is often linked back to the limited ability of bats to detect currently used turbines (Lawson et al., 2020). Bat collision risk at onshore windfarms in North America is well documented (AWWI, 2018; Arnett et al., 2008; Cryan & Barclay, 2009; Hayes et al., 2019; Martin, Arnett, et al., 2017; Pettit & O'Keefe, 2017) Fatality estimates due to collisions at onshore wind farms in the U.S. range from 4 - 7 bats per MW per year, up to 50 bats per MW per year at windfarms located along forested ridgelines in the southeastern U.S. (AWWI, 2020). At North American onshore windfarms, collision

[75] Bird collision risk at offshore wind development sites may not be comparable to collision risk at other structures such as lighthouses, oil platforms, and ships due to differences in lighting and structural features. Research shows, among other factors, lighting, masts, and guywires of these structures contributed to collision risk and these are different than features associated with offshore wind development (Hill et al., 2014).

mortality has affected migratory tree-roosting bats, with long-distance migrant fatalities (e.g., Hoary bat, Eastern Red bat, Silver-haired bats) most recorded (AWWI, 2020; Kunz et al., 2007). More collisions at onshore wind farms have been recorded during high activity periods, and between mid-July and mid-October in North America (Arnett et al., 2008; Cryan et al., 2014; True et al., 2021). Low wind speeds (e.g., less than 5 meters per second) have also been shown to increase bat collisions (Cryan et al., 2014).

Although bats are less commonly observed offshore compared to onshore locations (Guest et al., 2022; Pelletier et al., 2013; Stantec Consulting Limited, 2016b),[76] records from other offshore structures (e.g., lighthouses) and acoustic and telemetry surveys, show that several bat species may migrate offshore and use offshore structures as stopover sites (Dowling et al., 2017; Pelletier et al., 2013; Stantec Consulting Limited, 2016a; b). Furthermore, bats have been recorded as occurring up to 130 km off the Atlantic Coast in the U.S. (Stantec Consulting Limited, 2016b), and bats have been observed at offshore wind farms in Europe during seasonal migration (Guest et al., 2022; Rydell et al., 2010). Any migratory bat species found on the Island of Newfoundland will require offshore movements.

Acoustic monitoring surveys have indicated that long-distance migratory bat species occur more frequently offshore than other species of bats, and their activity is increased offshore during migratory periods and periods with low wind speeds, like patterns observed at onshore locations (Stantec Consulting Limited, 2016b).

Direct collisions can result in serious trauma, lacerations, and broken bones (Grodsky et al., 2011). Most bats likely die from their injuries, but delayed lethal effects from nonlethal contact is currently not known (Grodsky et al., 2011).

Several factors contribute to the high collision risk for bats:

- Bats are attracted to insects congregating around turbines but fail to detect and avoid the fast-moving blades (Guest et al., 2022).
- Turbines may be mistaken as potential roosting or mating sites where bats can rest or congregate (Cryan, 2008; Cryan & Barclay, 2009).
- Turbine rotation speed can cause doppler shifts in echolocation pulses, pushing them outside the detectable range of bats, magnifying detection challenges (Long et al., 2010).
- The relatively small size of bats and their propensity to fly at altitudes matching wind turbine rotor zones amplify the collision risk (Arnett et al., 2011; Cryan & Brown, 2007).

7.3.3.2.3 Habitat Alteration

Several studies have found offshore wind farms serve as artificial reefs (CSA Ocean Sciences Inc., 2021; DFO, 2004b; ICF, 2020; Whitehouse et al., 2011). Artificial reefs alter ocean ecosystems and structures by creating new habitats for various organisms (e.g., flora and fauna, suspension feeders, hard substrate associated fish) and increasing food

[76] See Section 7.3.6 of this Report, Data Gaps and Limitations.

availability for higher trophic levels (Degraer et al., 2020). This can enhance habits or negatively alter habitats for aerofauna depending on the particular changes in ecosystem structure.

Artificial reefs can create rich foraging grounds. Seabirds, such as gulls, terns, and cormorants, may have improved foraging success because of the increased availability of fish near these structures (Dierschke et al. 2016; Vanermen et al., 2014). Furthermore, the complex structure of artificial reefs supports a diverse marine ecosystem (Paxton et al., 2020). This diversity in prey species can be advantageous for birds that exhibit dietary preferences, ensuring a broader range of food sources and contributing to the overall health and nutritional balance of bird populations (Wilson et al., 2010). It can also attract a greater abundance and diversity of bird species, fostering a healthier ecosystem (Dierschke et al., 2016).

At the same time, newly created habitats may also attract non-native or invasive species. The introduction or spread of non-native and invasive species can proliferate disease, cause disruptions to food-web dynamics, and threaten the biodiversity of an ecosystem (Degraer et al., 2020). Changes to the species composition of an area by non-native and invasive species can eliminate essential food sources for predators or disrupt existing predator/prey relationships (Watson et al., 2024).

Birds and bats may otherwise benefit from increased prey availability. The increased presence of wind turbines in the marine environment may attract insects around the structures, drawn to the lights and altered wind conditions (Jansson et al., 2020; Long et al., 2011; SEER 2022b). This congregation of insects could provide an additional and potentially enhanced food source for bats, supporting their foraging activities (de Jong et al., 2021; Foo et al., 2017; Rydell & Wickman, 2015). Finally, certain species may find elevated structures associated with wind turbines suitable for roosting or nesting (Dierschke et al., 2016; Lewis, 2023). Several studies attribute wind farm attraction to increased perching opportunity (Dierschke et al., 2016; Hill et al., 2014; NatureScot, 2020). Cormorants and falcons have been observed perching on offshore wind turbine fixed foundations in Europe and the U.S. (Hill et al., 2014; Stantec Consulting Limited, 2020), and cormorant and gull species have been observed roosting on turbines, with a preference for locations along the perimeter of wind farms (Kahlert et al., 2004; SEER, 2022b). Furthermore, gull and tern abundance has been observed to increase post-construction at an offshore wind farm in the U.K. (Petersen, 2005). It is unclear if this attraction was related to roosting opportunities on above-water infrastructure, new food sources from the creation of artificial reefs, or if they were attracted by vessel activity (Petersen, 2005). In their feedback on the Draft Report, ECCC advised that attraction to offshore wind infrastructure for the purposes of roosting or nesting increases collision risk. If birds are nesting within a wind energy development area their exposure to impacts will be elevated as they make repeated foraging trips to and from the nest.

Habitat enhancement may also have negative consequences by causing attraction, and subsequently, increased collision risk.

7.3.3.3 Habitat Loss

Offshore wind development may cause direct and/or effective habitat loss. Direct habitat loss refers to instances where habitat is removed or transformed. Effective (or functional) habitat loss refers to displacement caused by disturbance and/or changes in habitat quality, like prey abundance. Table 7.3.9 summarizes sources of aerofauna habitat loss during different phases of offshore wind development.

Table 7.3.9. Potential Causes of Habitat Loss During Different Stages of Offshore Wind Development

Project Phase	Stressor Sources
Construction	• Ice-breaking, pile driving and excavation activities during site preparation. • Increased human disturbance. • Installation of turbines and scour protection lower prey availability for marine birds. • Increased vessel presence.
Operation	• Avoidance response to turbines. • Movement barriers. • Increased human disturbance and vessel presence during routine maintenance.
Decommissioning	• Increased human disturbance and vessel presence during decommissioning activities. • Effective habitat loss due to full removal of wind turbines and reintroduction of commercial fisheries.

Table Description: This table summarizes potential causes of aerofauna habitat loss during different phases of offshore wind development. See Section 4 of this Report for an overview of offshore wind development phases and activities.

Source: ECCC, 2024a

7.3.3.3.2 Construction and Vessel Use

Activities during construction can cause displacement of species that tend to be more vulnerable to disturbance (e.g., sea ducks) (Hemery et al., 2024) and may affect foraging habitat quality by lowering prey abundance (Perrow et al., 2011).[77] Ice-breaking specifically, can cause direct habitat loss for species that rely on sea ice or polynyas, for foraging during breeding and/or migration (Mallory et al., 2019; Stirling, 1997).

Vessel use, during both construction and other stages of offshore wind development, also affects habitat quality. Waves caused by vessels may have adverse and/or positive effects. For example, nest destruction related to vessel wake has been document in freshwater systems (Allen et al., 2008). Wave induced mixing could also dislodge benthic prey and enhance foraging habitat for birds (Gabel et al., 2017). Furthermore, species using habitat in proximity to vessels may experience temporary habitat loss (Dehnhard et al., 2019; Leemans & Collier, 2022; Schwemmer et al., 2011) or engage in escape behaviours (Dehnhard et al., 2019; Jarrett et al., 2018; Larsen & Laubek, 2005; Mendel et al., 2019; Schwemmer et al., 2011). Both effects reduce fitness. Alcids, Sea Ducks, Loons and Terns may be highly sensitive or vulnerable to disturbance by vessels (Dehnhard et al., 2019; Goodship & Furness, 2022; Jarrett et al., 2018; Larsen & Laubek, 2005; Mendel et al., 2019; Ronconi & Clair, 2002).

7.3.3.3.3 Displacement and Fragmentation During Operation

During operation, both adaptation to ongoing activity and avoidance of affected areas or displacement has been noted in birds (Reid et al., 2022b; Skov et al., 2018). Displacement could be permanent or temporary (Dierschke et al., 2016; Drewitt & Langston, 2006; Fox et al., 2006; Williams et al., 2024). For example, Dierschke et al., (2016) found avoidance during the first year of operation at some wind farms in Europe followed by an eventual increase in species' abundance (this increase was assumed to result from increased prey availability around underwater structures). The occurrence and degree of displacement could also vary based on several factors. Regarding species type, for example, studies in the U.K. show species observed in lower numbers at offshore farms post-construction included scoters, loons, gannets, and alcid species. Some species were displaced up to 2 - 4 km from the offshore wind farm boundary (Dierschke et al., 2016; Kahlert et al., 2004; Petersen, 2005; Petersen et al., 2006). An advisory group member with offshore wind farm experience in other jurisdictions indicated that in Europe, loons (known as divers, in the U.K.) are one of the principal concerns with respect to displacement. Species-specific behaviour influences the extent of the effect and can often be related to vessel-related stressors during maintenance activities (Dierschke et al., 2016; Furness et al., 2013).

Displacement also occurs with bats. Loud and disruptive noises associated with offshore wind development can lead to temporary displacement as bats seek to avoid the

[77] Displacement occurs when habitats frequently used by birds (e.g., for transiting, resting, roosting, or foraging) are less frequently used or abandoned.

disturbance (Ellerbrok et al., 2023; Renterghem et al., 2014; Schaub et al., 2008). Wind turbine structures can also impact previously undisturbed areas that served as important habitat for bats and disrupt activities such as foraging (Bach & Rahmel, 2004; Barre et al., 2018; Millon et al., 2018). Bats often forage over water surfaces to capture insects, utilizing these areas as a crucial part of their feeding ecology (Ahlen et al., 2009; Russo & Jones, 2003).

Sjollema et al. (2014), evaluated the movement of bats along the mid-Atlantic coast to determine the potential impacts of offshore wind development. Bats frequently utilized areas within 20 km of the shoreline, and it was concluded that wind farms located farther than 26 km from shore would have minimal impact on bat movements. It was also concluded that offshore wind development closer than 26 km could have the same impact on bat mortality as onshore wind farms. Lagerveld & Mostert (2023), found similar offshore movements for a bat species in the Netherlands within a 25 km distance of the coastline. It was again noted that offshore wind development within that range could pose a threat to bats and their movement. Similar work done by Stantec Consulting Limited (2016a), found that bat presence offshore is widespread, but seasonal in nature and that potential impacts on movement could possibly be mitigated by featherings of turbines. Feathering is a curtailment measure that involves adjusting the turbine blade angle so that they no longer produce force that spins the rotor.

During operation, avoidance responses to turbines can also cause barriers to movement (ECCC, 2024a). Habitat fragmentation occurs when large, continuous areas of suitable habitat are divided into smaller, isolated patches, often due to human activities such as infrastructure development or land-use changes. Offshore wind farms are often located along coastlines and in areas frequently used by migratory birds (Masden et al., 2009), and their presence can act as physical barriers or create areas of increased risk during migration (Drewitt & Langston, 2006; Fox et al., 2006; Fox & Petersen, 2019; Gauld et al., 2022). Avoidance has been observed at small or larger scales ranging from within 10 m of turbines, to 1.5 - 3.0 km (Skov et al., 2018), and as far as 4 km (Petersen et al., 2006). ECCC (2024a) relayed some species avoid offshore wind energy development areas entirely (macro avoidance) due to disturbance caused by the turbines, as recorded by studies at operational developments (e.g. Garthe et al., 2023; Vanermen et al., 2015). Wind farms can similarly fragment natural bat habitats (Cryan, 2011; Roscioni et al., 2014). Bats may face challenges navigating through the turbine infrastructure, leading to isolated pockets of habitat that can affect their ability to find food, roost, and engage in essential behaviors (Barre et al., 2018).

7.3.3.3.4 Decommissioning

Finally, decommissioning can again alter habitats. It is assumed that habitat initially disrupted by turbine installation could become productive foraging habitat for marine birds over time (Dierschke et al., 2016; Smyth et al., 2015). Full removal of structures will cause direct loss for benthic marine species and can alter prey abundance aerofauna (Hall et al., 2022; Topham et al., 2019). Reintroducing commercial fisheries into decommissioned areas could similarly contribute to effective habitat loss (Fowler et al., 2020).

7.3.3.3.5 Consequences of Habitat Loss for Avifauna

Habitat loss has several interrelated consequences for birds. As with displacement from movement pathways caused by attraction, habitat loss, and fragmentation have adverse energy costs. Habitat loss may limit access to essential resources such as feeding areas, suitable nesting sites, and stopover locations during migration (Drewitt & Langston, 2006; Exo et al., 2003; Fox et al., 2006; Garthe et al., 2023; Marjakangas et al., 2023; Masden et al., 2009).

Impacts on avian foraging is a primary concern regarding offshore wind farms (Furness et al., 2013). Marine birds in particular, rely heavily on specific feeding areas, and studies have consistently demonstrated offshore wind farms can lead to displacement from these areas (Garthe et al., 2023; Peschko, Mendel, et al., 2020; Peschko, Mercker, et al., 2020). The need to avoid areas with ongoing disturbance, such as regular ship traffic or continuous turbine operation, forces birds to adjust their foraging patterns affecting their access to prey and overall foraging efficiency (Perrow et al., 2011; Petersen et al., 2011; Velando & Munilla, 2011). Birds may have to fly longer distances to find suitable foraging areas and expend more energy searching for food (Leopold et al., 2013; Pettersson, 2005). Birds may also use areas with lower prey availability or with less suitable prey in terms of size and type, also reducing foraging efficiency (Langston & Pullan, 2003). Less efficient foraging can further cause nutritional stress (Reid et al., 2022b) or can even lead to starvation due to compounding energetic cost and shift to less optimal foraging habitat preventing effective foraging (Garthe et al., 2023 from ECCC, 2024a).

Habitat loss can also result in resource scarcity and increased competition. Continuous disturbance may compel aerofauna to abandon traditional habitats altogether reducing available nesting, breeding, and foraging locations (Marques et al., 2021). Such habitat displacement can disrupt normal behavior and lead to resource scarcity, affecting survival and reproduction (Petersen et al., 2006). Furthermore, displaced birds having to use alternative foraging may encounter increased intra-species competition, potentially leading to reduced access to food resources (Humphreys et al., 2015; Leopold et al., 2013; Pettersson, 2005).

Finally, habitat loss and fragmentation can affect reproductive success and genetic diversity. For example, during sensitive periods disturbance could result in nest abandonment as well as reduced hatching and fledgling success (Mulholland et al., 2018; Peschko, Mendel, et al., 2020; Peschko, Mercker, et al., 2020). These could potentially lower population growth rates for affected species (Mulholland et al., 2018). Long-term disturbances can even lead to population declines over time (Peterson et al., 2006). Habitat fragmentation can further hinder genetic exchange by disrupting ecological connectivity among populations (Bishop et al., 2017; Marjakangas et al., 2023). Genetic barriers reduce population diversity and adaptability. In their August 2024 submission to the Committee, ECCC indicated this can hinder reproduction by causing extinction and loss of genetic diversity (Cristofari et al., 2019).

7.3.3.3.6 Habitat Loss in Insects

Less is known about the effects of offshore wind development on insects when compared to birds and bats. For insects, installation of wind turbines (along with the access roads and associated infrastructure used during construction) can create physical barriers that disrupt natural movement and dispersal pathways (Voigt, 2021). It can also lead to the direct loss or degradation of habitat areas, reducing the available resources and suitable living spaces for insect and butterfly populations (Latham et al., 2017). Edge effects are another concern. Fragmentation can create new habitat edges, where the remaining habitat patches border disturbed or developed areas. These edges can expose insect and butterfly populations to different environmental conditions, such as changes in temperature, humidity, and wind patterns, potentially affecting their survival and behavior (Latham et al., 2017; Voigt, 2021). Finally, habitat fragmentation can reduce gene flow and population connectivity (Marcantonio et al., 2023). Smaller, isolated populations within fragmented habitats may also be more vulnerable to environmental disturbances, such as extreme weather events, disease outbreaks, or changes in food availability, increasing the risk of local extinctions (Neve et al., 2008; Vandergast et al., 2007).

7.3.3.4 Noise

At least some activities during each phase of offshore wind development increase noise levels and human activities (Table 7.3.10). Noise changes the quality of aerofauna habitat and can cause displacement, increase stress, or disrupt auditory cues.

Table 7.3.10. Potential Sources of Noise During Different Stages of Offshore Wind Development

Project Phase	Stressor Sources
Pre-Construction	• Baseline monitoring equipment, such as drones, transportation vessels, and aircraft.
Construction	• Marine vessels and equipment needed for site preparation introduce frequent noise from drilling and excavation. • Noise disturbance caused by installing wind turbines, foundations, and scour protection.
Operation	• Equipment, vessels, or aircraft that may be required for offshore wind energy development maintenance.
Decommissioning	• Aircraft, vessel and equipment use during infrastructure removal.

Table Description: This table summarizes sources of noise that could impact aerofauna during different phases of offshore wind development. See Section 4 of this Report for an overview of offshore wind development phases and activities.

Source: ECCC, 2024a.

ECCC relayed to the Committee that seabirds, particularly Red-breasted Merganser, can be displaced from foraging habitat by vessel noise (Jarrett et al., 2018). Breeding seabirds respond to aircraft noise at various volumes, ranging from head turning to flying away (Brown, 1990). Adverse effects associated with displacement are discussed above. (see Section 7.3.3.3 of this Report, Habitat Loss).

Regarding stress, several studies link noise to increased stress in avifauna (Bech-Hansen et al., 2019; Breuner, 2011; Platteeuw et al., 2017; Society for Endocrinology, 2009). Stress can have health impacts, reduce immune system function, lower overall fitness, and may impact the ability of birds to thrive and reproduce successfully (Breuner, 2011; Society for Endocrinology 2009). Stress can also disrupt normal behavioural patterns, such as breeding, foraging, and migration, potentially affecting reproductive success and survival (Larsen & Guillemette, 2007).

Lastly, some studies show that noise from passing aircraft or equipment use can potentially impact communication or predator detection and breeding success, especially in environments where ambient noise levels are typically much quieter and temporal exposure is extended (Iasiello & Colombelli-Négrel, 2023; Ortega, 2012; Smith et al., 2023).

7.3.3.4.1 Impacts of Noise and Barotrauma in Bats

The presence of continuous low-frequency noise and infrasound from wind turbines may interfere with bats' echolocation capabilities (Bunkley & Barber, 2015), disrupt communication (Smotherman et al., 2021), and/or induce physiological stress in bat populations (Korine et al., 2023). The noise generated by wind turbines primarily arises from the aerodynamic interactions between the rotor blades and the surrounding air (Howe et al., 2007). As the blades cut through the air, they create turbulence, leading to the production of audible and inaudible low-frequency sounds (Cryan & Barclay, 2009). Infrasound, which is below the threshold of human hearing, may still be detectable by bats, given their heightened sensitivity to sound (Surlykke & Kalko, 2008).

The negative consequences of noise pollution on bats in the context of offshore wind farms include:

- Difficulties hunting, navigating, and avoiding obstacles due to disrupted echolocation (Allen et al., 2021; Bunkley et al., 2015; Long et al., 2010; 2011).
- Impacts to social behavior and breeding success due to communication disturbance.
- Stress responses, which can manifest as altered reproductive patterns, changes in feeding behavior, and overall compromised health (Frick et al., 2020).
- Barotrauma is another physiological change experienced by bats due to turbine movement. Movement of blades can lead to rapid changes in air pressure in the surrounding environment (El Mouhsine et al., 2018). This phenomenon poses a potential risk of barotrauma to bats, as their sensitive inner ears may be adversely affected by these pressure fluctuations. Effects include diminished physiological well-being, injury and discomfort (Baerwald et al., 2008; Rollins et al., 2012). Sublethal barotrauma-induced damage to the inner ears may impair bats' echolocation abilities, crucial for navigating and locating prey (Guest & Hein, 2023; Grodsky et al., 2011). This

impairment could reduce their foraging efficiency and increase the risk of collisions with turbine blades.

7.3.3.4.2 Potential Impacts of Underwater Noise on Diving Birds

Underwater noise of sufficiently high amplitude could cause physical damage to birds and/or could cause behavioural change. Specifically, bird species who dive in pursuit of prey or for benthic feeding opportunities may be exposed to anthropogenic noise underwater.

While aquatic bird hearing ability and sensitivity to underwater noise is not well understood, species-specific studies show that at least some diving birds consistently respond to underwater noise in an experimental setting (Crowell, 2014; Hansen et al., 2016; 2017; Sørensen et al., 2020). For example, Long-tailed Duck responds reliably to high-intensity stimuli (>117 dB re 1µPa) from 0.5 - 2.9 kHz (Crowell, 2014). Common Murre and Great Cormorant also consistently respond to underwater noise (Hansen et al., 2016). In their 2017 study, Hansen et al., suggests a hearing threshold for cormorant Lp, rms 70 - 75 dB re 1µPa for tones at tested frequencies of 1 - 4 kH. They further suggest this is comparable to seals and small odontocetes and could indicate use of auditory cues for foraging and/or orientation (Hansen et al., 2017).

Somewhat related, Crowell et al., (2015) and Mooney et al., (2019) measured in-air auditory threshold in various diving duck species, Red-throated Loon, gannet, and puffin. Hearing was tested at tone bursts between frequencies of 0.5 - 6 kHz. All species showed greatest hearing sensitivity between 1 - 3 kHz and a sharp reduction in sensitivity at > 3 - 4 kHz (Crowell et al., 2015; Mooney et al., 2019). The Red-throated Loon and Northern Gannet exhibited the highest sound sensitivity thresholds while the lowest thresholds belonged to the duck species, specifically the Lesser Scaup and Ruddy Duck (*Oxyura jamaicensis*) (Crowell et al., 2015).

Few studies investigate the effects of seismic surveys, and particularly the use of airguns. One study shows that African Penguins (*Spheniscus demersus*) exhibit strong avoidance from their preferred foraging habitat during seismic surveys within 100 km of their colonies and return to normal behaviour after survey operations are complete (Pichegru et al., 2017). Conversely, Stemp (1985) reported seabird abundance in Hudson Strait (Atlantic seaboard of Canada) during seismic surveys involving explosions (year 1 and 2) and airguns (year 3). In both cases they found only normal variation in abundance, likely linked to weather. They reported few cases of mortality for birds in close proximity to explosive changes (Stemp, 1985, as cited in Brown et al., 2020). Studies on underwater explosions (very high-amplitude, low frequency) also show acute trauma and even mortality in diving birds within close proximity (Cooper, 1982; Danil & St Leger, 2011; Stemp, 1985; Yelverton et al., 1973). Mortality or other negative effects on seabirds have not been reported during extensive seismic operations in the North Sea and elsewhere (Brown et al., 2020).

Echo and sonar emit sound at a higher frequency than the documented hearing range of diving birds (Brown et al., 2020), although as above, there is limited research available on diving bird hearing ability.

In their submission to the Committee, ECCC (2024a) also indicated:

> Underwater noise from maintenance activities may cause displacement and elicit behavioural responses from aerofauna. Depending on the frequency of the noise, seabirds may elicit various responses to underwater noise (Hansen et al., 2020; Mooney et al., 2019). Potential effects could be similar to other types of disturbance from [offshore wind] energy development maintenance and operation, such as displacement from habitat and reduced foraging area. However, noise disturbance may decrease body condition by evoking physiological effects such as increasing heart rate, changing hormone levels, and weight loss (Ortega, 2012)... Indirect effects of underwater noise may [also] alter prey availability for piscivorous birds (Perrow et al., 2011).

7.3.3.5 Indirect Effects of Planned Offshore Wind Activities

In reviewing the effects on aerofauna, indirect effects to other components should also be considered. These are summarized in Table 7.3.11 below.

Table 7.3.11. Potential Indirect Effects Caused by or Affecting Aerofauna

Component	Indirect Effects	Section
Marine Fish and Fish Habitat	Impacts to prey-predator interactions, behaviours, distribution, abundance, health, and ecosystem.	7.4
Fisheries	Impacts to commercial fishing economy through changes to prey-predator interactions, behaviours, distribution, abundance, health, and ecosystem of commercial species. Impacts on gamebird harvesting.	7.7
Communities and Economies	Impacts to tourism economy and location as well as recreation locations and opportunities for bird watching.	7.13
Physical and Cultural Heritage	Impacts to culturally important species for Indigenous groups and communities.	7.11

Table Description: This table summarizes the potential indirect effects to other components (i.e. Fish and fish habitat, Fisheries and Other Ocean Uses etc.) if aerofauna are affected by offshore wind development.

Source: ECCC, 2024a.

Pathways of Effects Models

As above, ECCC provided the Committee with PoE models outlining the potential effects of offshore wind development on aerofauna. A PoE model is a tool used to describe the cause-and-effect relationship of federally designated projects. ECCC is currently developing national guidance for modeling pathways of effect. The models presented here were developed based on approaches used by DFO for commercial shipping and in collaboration with the national PoE task team (Government of Canada, 2012). ECCC's full submission is available on the Registry under document reference number 275.

The following limitations should be considered when reviewing these pathways. No cause-effect pathway should be prioritized over another based on the PoE. (ECCC-CWS-ATL, August 15, 2024):

- These are simplified, conceptual models that do not consider cumulative effects.
- Models outline effects, not impacts. An impact implies magnitude and significance, while an effect does not (Boehlert & Gill, 2010).
- PoEs are generic sector-based pathways and do not consider site- and species- specific variable.

Figure 7.3.23. Generic Pathway of Effects Diagram

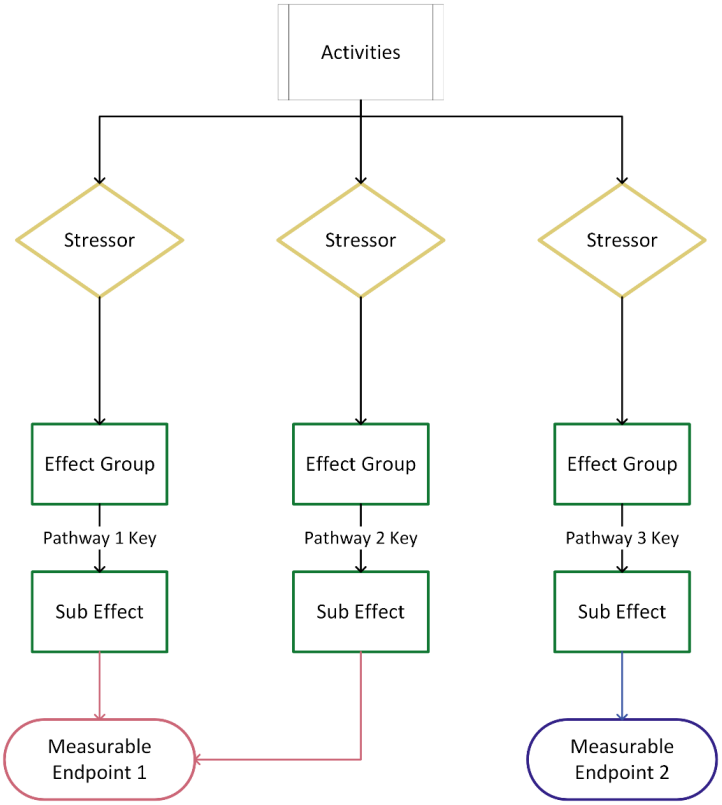


Figure Description: Adopted from ECCC submission to the Committee, August 15, 2024. This diagram may help readers interpret the models below. Model components were defined as follow.

- Activities and sub-activities are human-induced undertakings that may result in impacts to the environment (Government of Canada, 2012).
- Stressors are any natural or anthropogenic variable (a chemical, physical or biological entity) that causes a quantifiable change (increase or decrease) in a biological response or measurable endpoint(s) (Government of Canada, 2012; Orr et al., 2020; U.S. EPA, 1998).
- Effects are any change that the project may cause in the environment (CEAA, 2009).
- Impacts are a measurable change to an ecosystem component/function (e.g., loss of spawning habitat) as a result of human-induced pressures. An impact can be positive or negative (Boehlert & Gill, 2010; Government of Canada, 2012).
- Measurable endpoints are environmental state indicators used to measure and track changes over time with respect to the objective (Government of Canada, 2012) and/or an explicit expression of the environmental value that is to be protected, operationally defined by an ecological entity and its attributes (U.S. EPA, 1998).
- Pathways are lines used to represent a cause-effect relationship between an activity, a stressor, and an effect (DFO, 2006a).

Figure 7.3.24. Potential Effects of Pre-Construction Site Surveys on Aerofauna

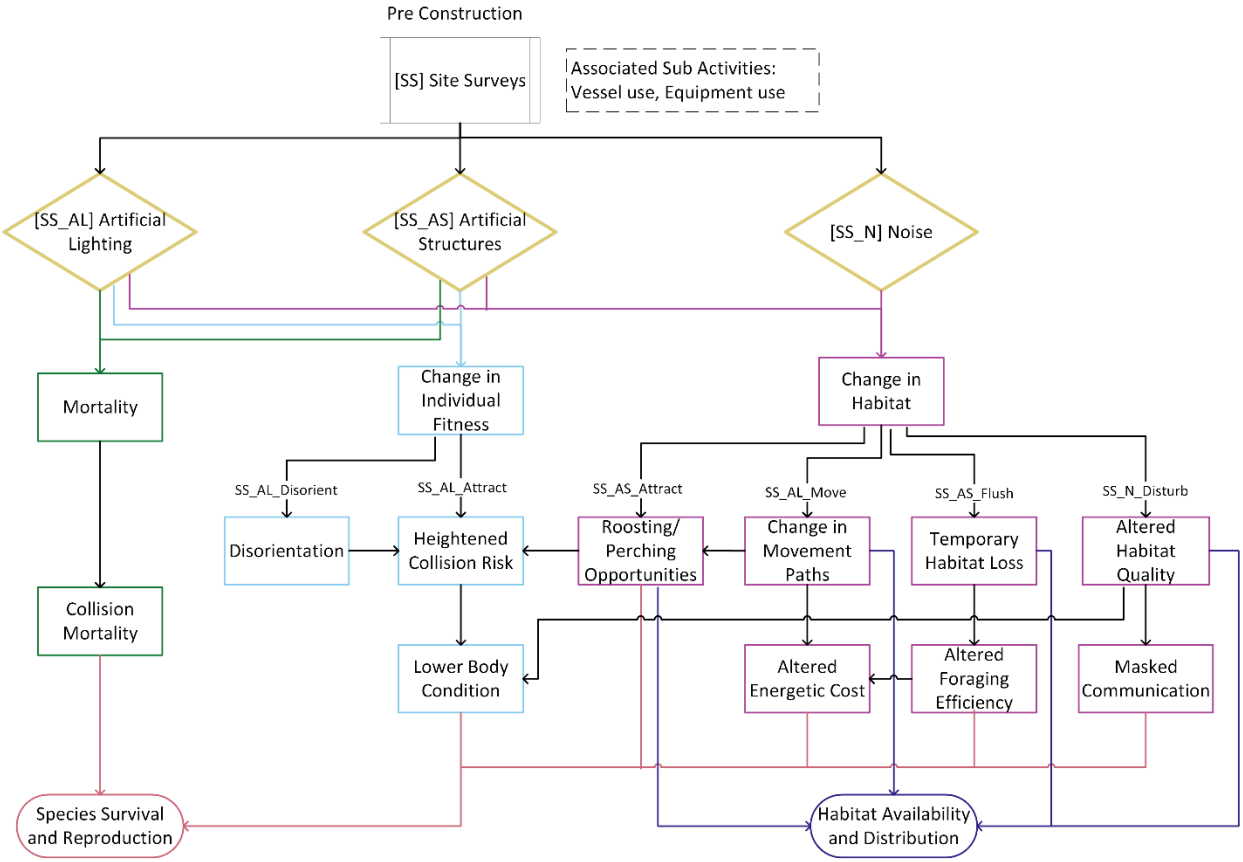


Figure Description: Model adopted from ECCC submission to the Committee, August 15, 2024. This model shows how site preparation during the pre-construction phase of offshore wind development can result in effects to aerofauna.

Figure 7.3.25. Potential Effects of Site Preparation During Construction on Aerofauna

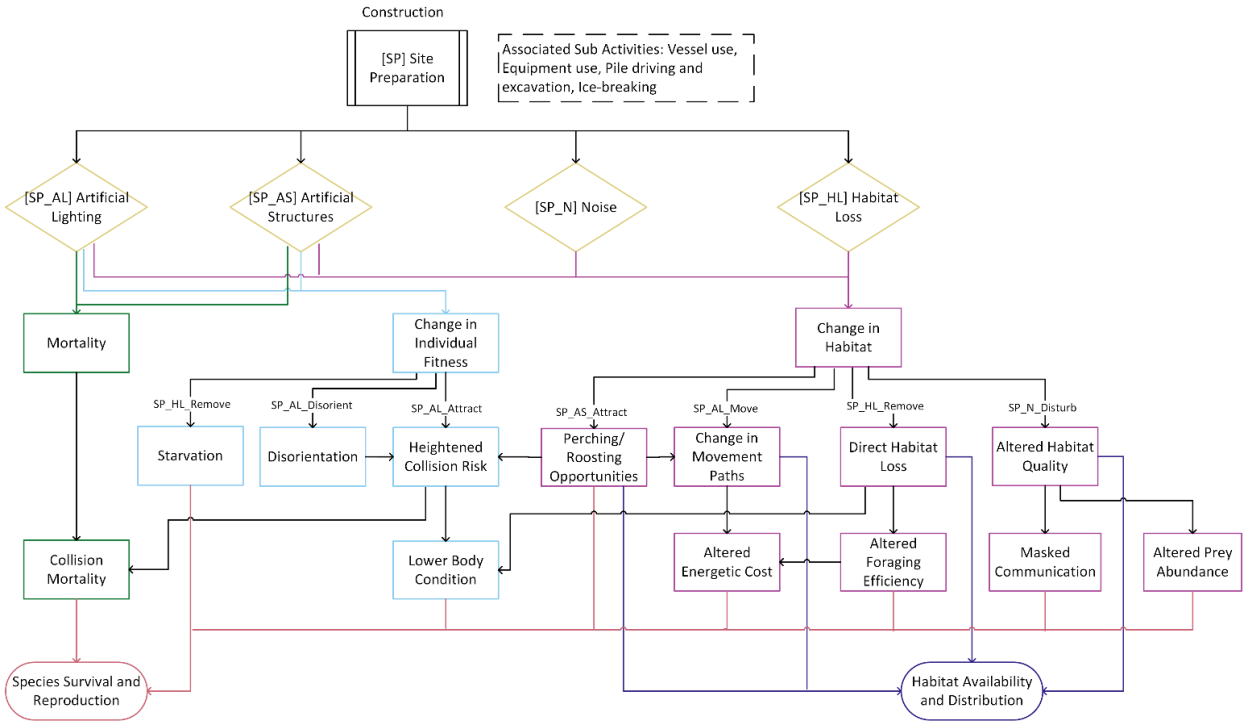


Figure Description: Model adopted from ECCC submission to the Committee, August 15, 2024. This model shows how site preparation during the construction phase of offshore wind development can result in effects to aerofauna.

Figure 7.3.26. Potential Effects of Infrastructure Installation During Construction on Aerofauna

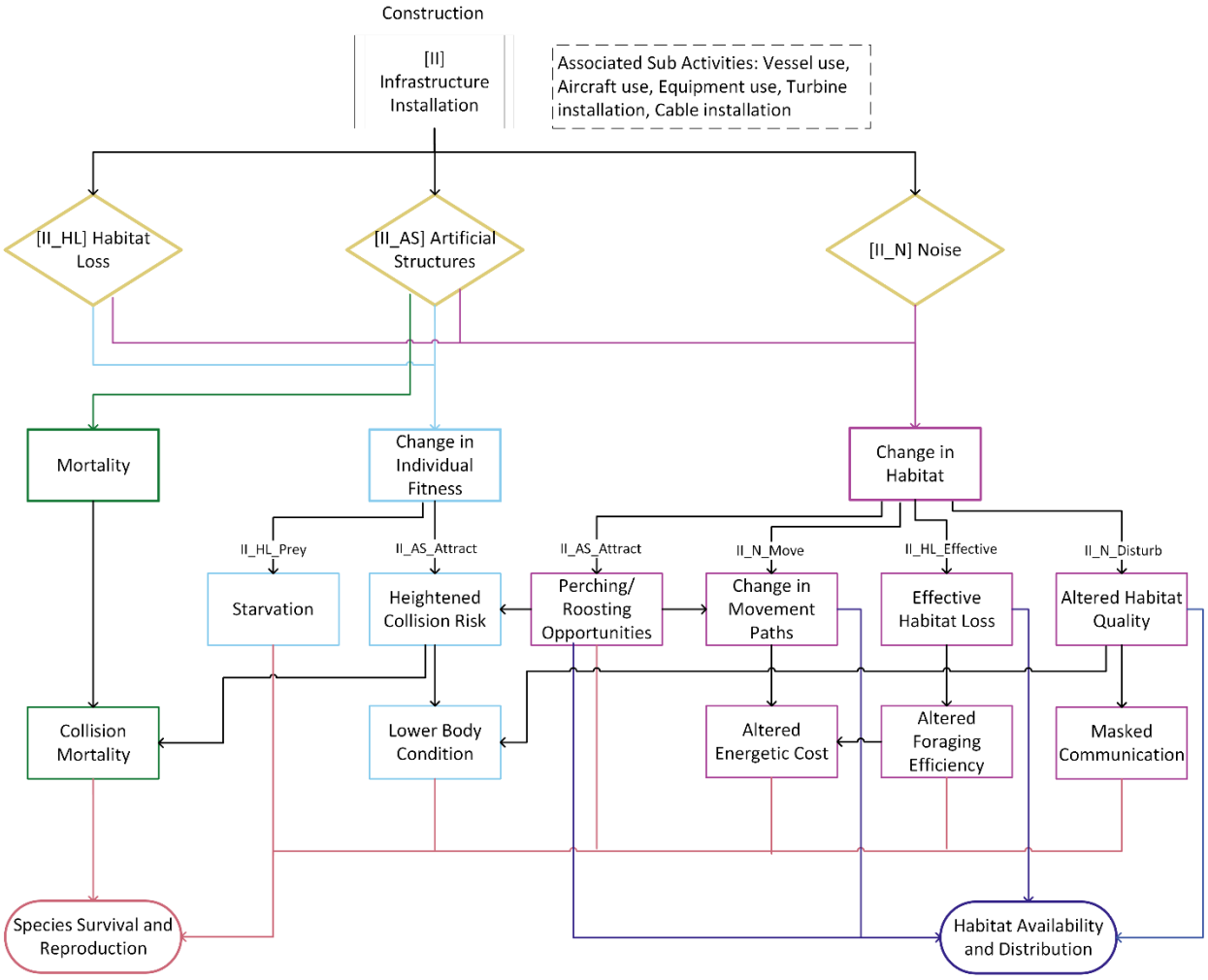


Figure Description: Model adopted from ECCC submission to the Committee, August 15, 2024. This model shows how infrastructure installation during the construction phase of offshore wind development can result in effects to aerofauna.

Figure 7.3.27. Potential Effects of Electricity Generation During Operations on Aerofauna

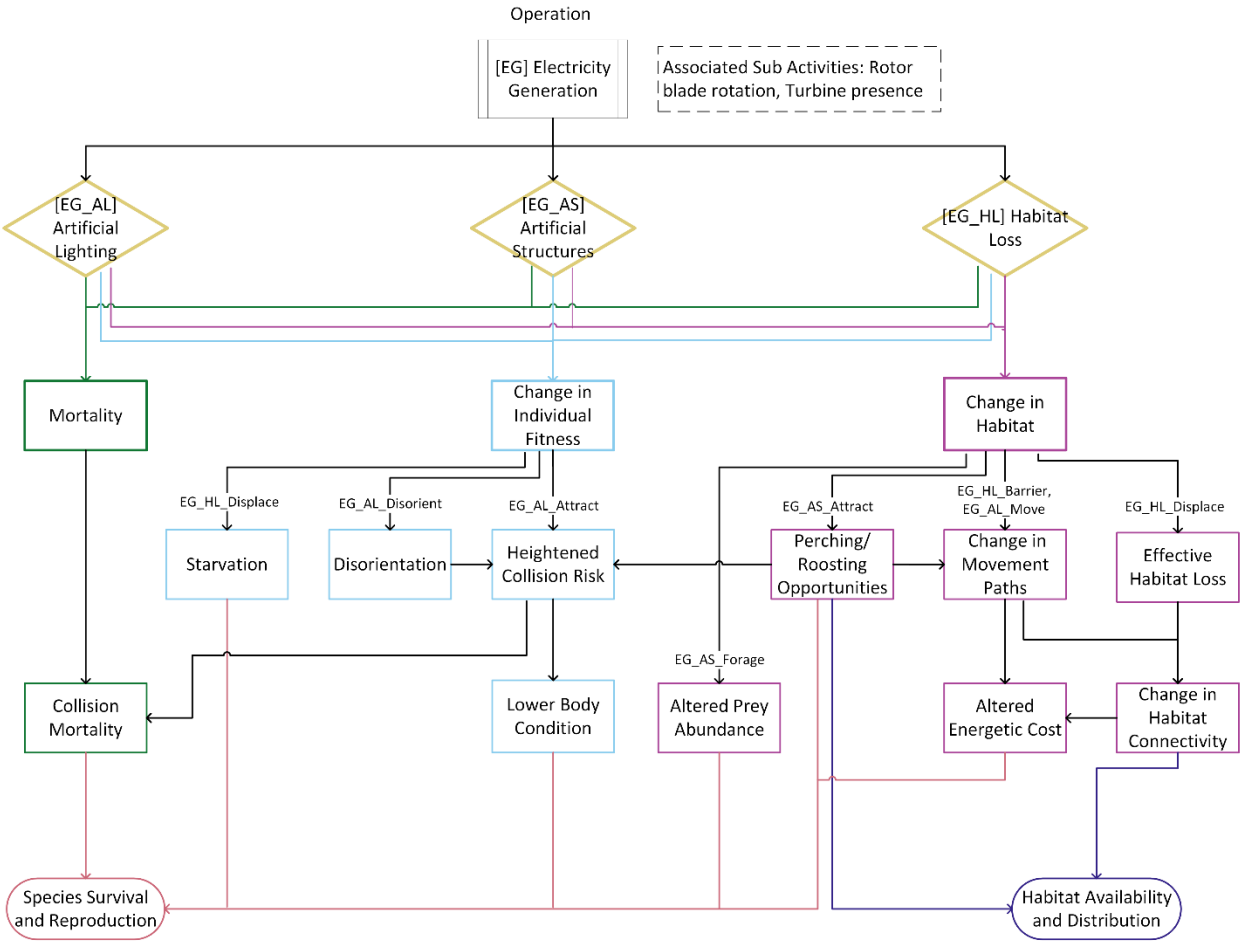


Figure Description: Model adopted from ECCC submission to the Committee, August 15, 2024. This model shows how electricity generation during the operations phase of offshore wind development can result in effects to aerofauna.

Figure 7.3.28. Potential Effects of Routine Maintenance During Operations on Aerofauna

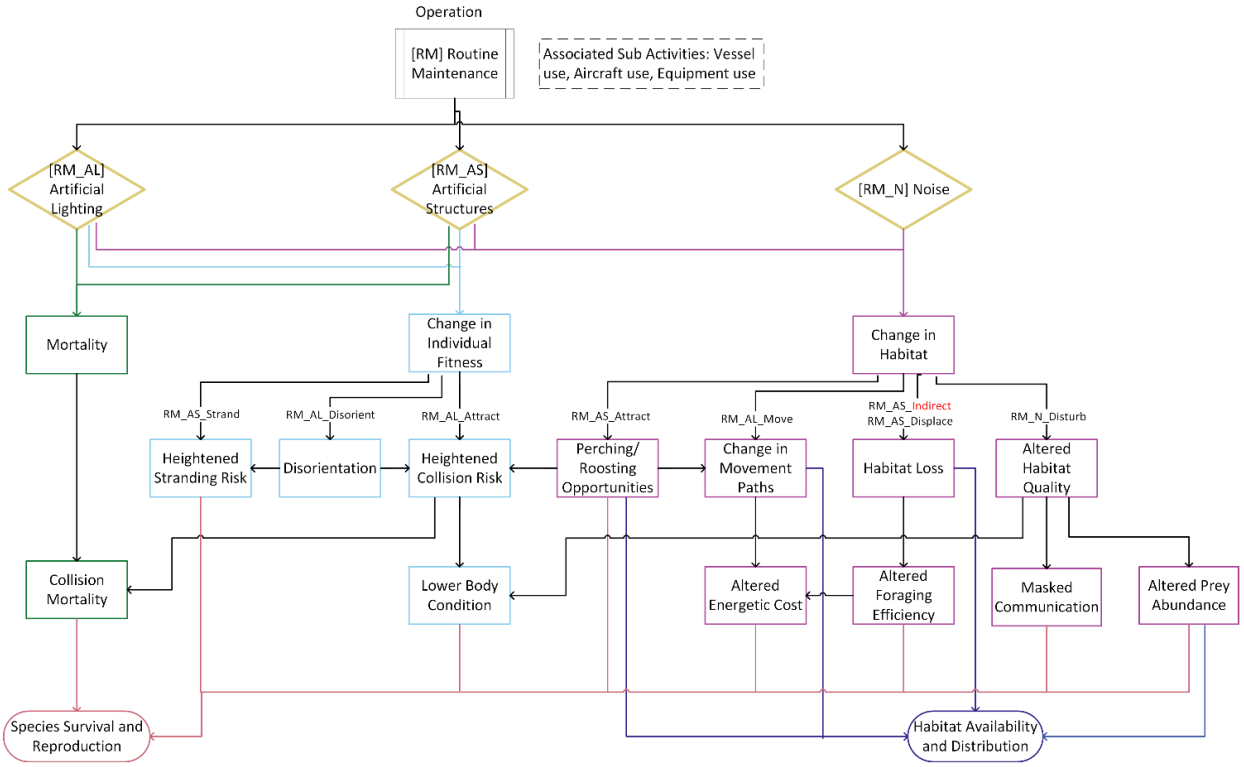


Figure Description: Model adopted from ECCC submission to the Committee, August 15, 2024. This model shows how routine maintenance during the operations phase of offshore wind development can result in effects to aerofauna.

Figure 7.3.29. Potential Effects of Full Removal During Decommissioning on Aerofauna

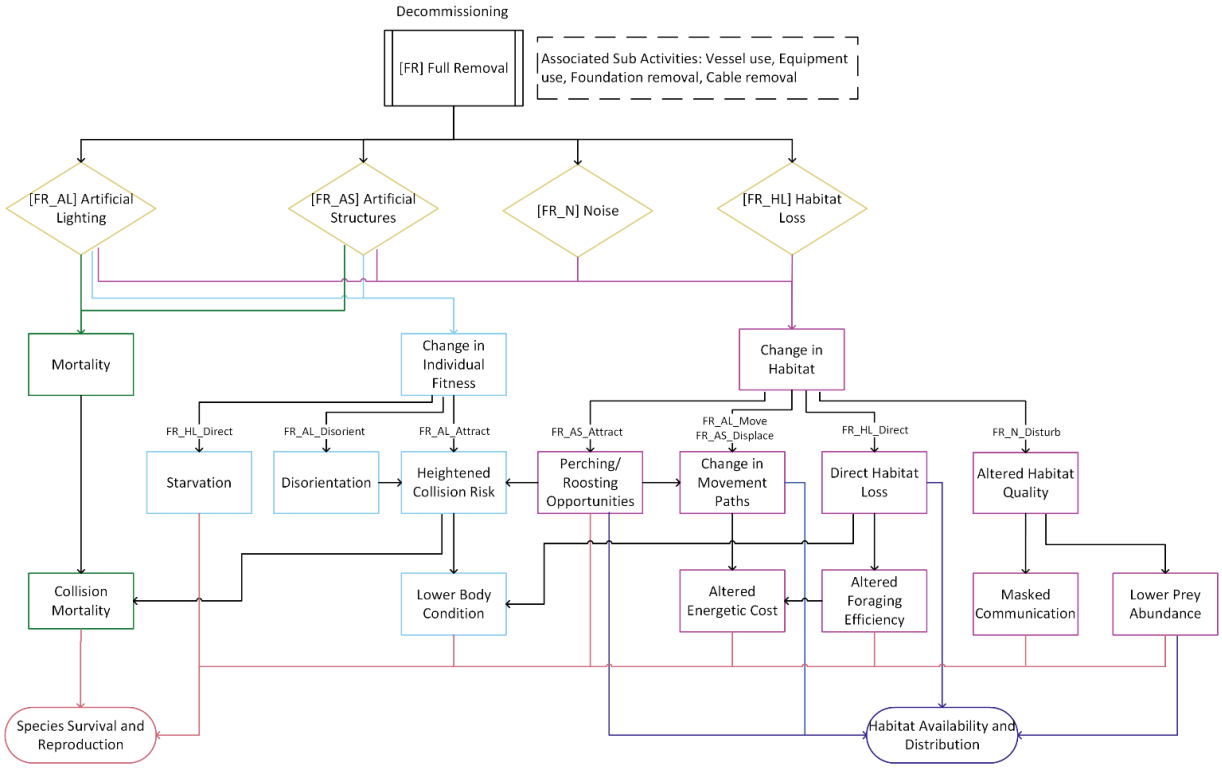


Figure Description: Model adopted from ECCC submission to the Committee, August 15, 2024. This model shows how full turbine removal during the decommissioning phase of offshore wind development can result in effects to aerofauna.

Figure 7.3.30. Potential Effects of Partial Removal During Decommissioning on Aerofauna

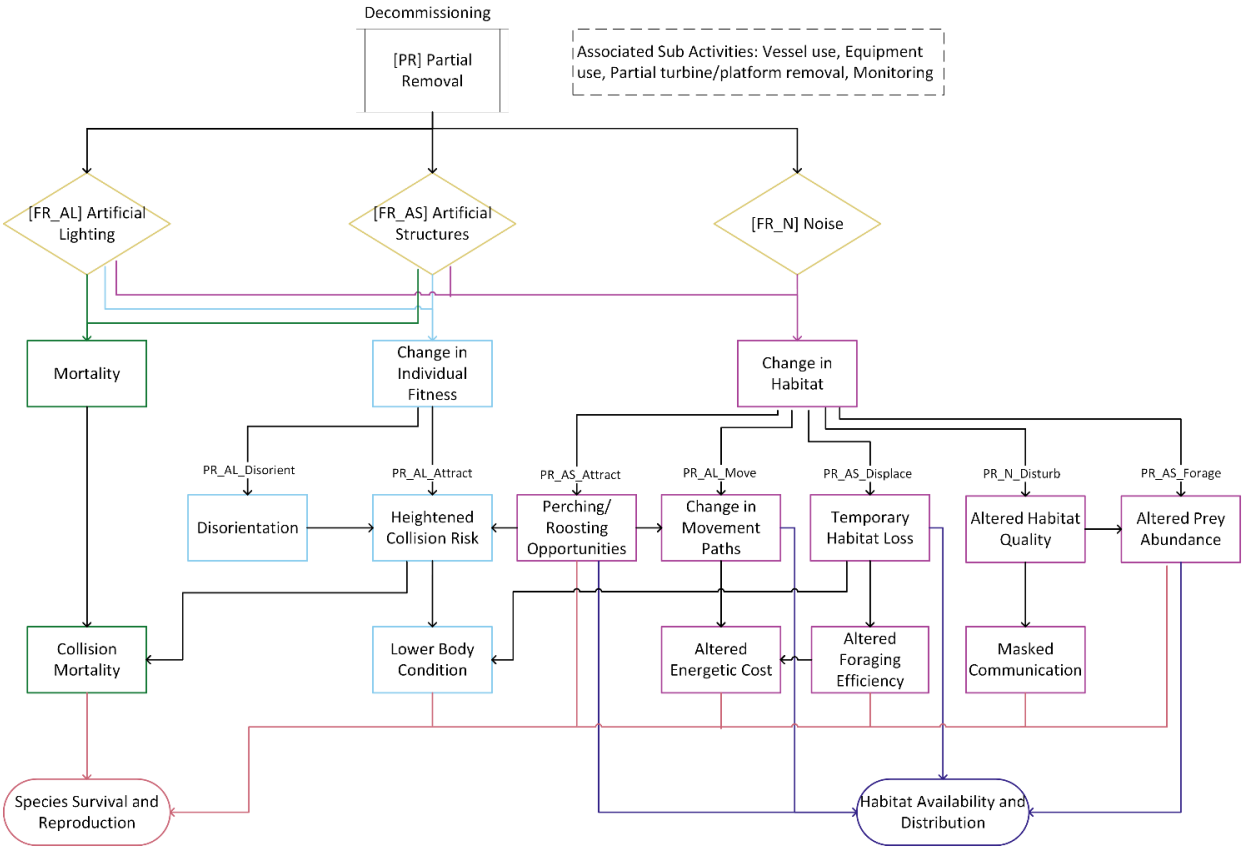


Figure Description: Model adopted from ECCC submission to the Committee, August 15, 2024. This model shows how partial turbine removal during the decommissioning phase of offshore wind development can result in effects to aerofauna.

Figure 7.3.31. Effects of Accidents During Any Development Stage on Aerofauna

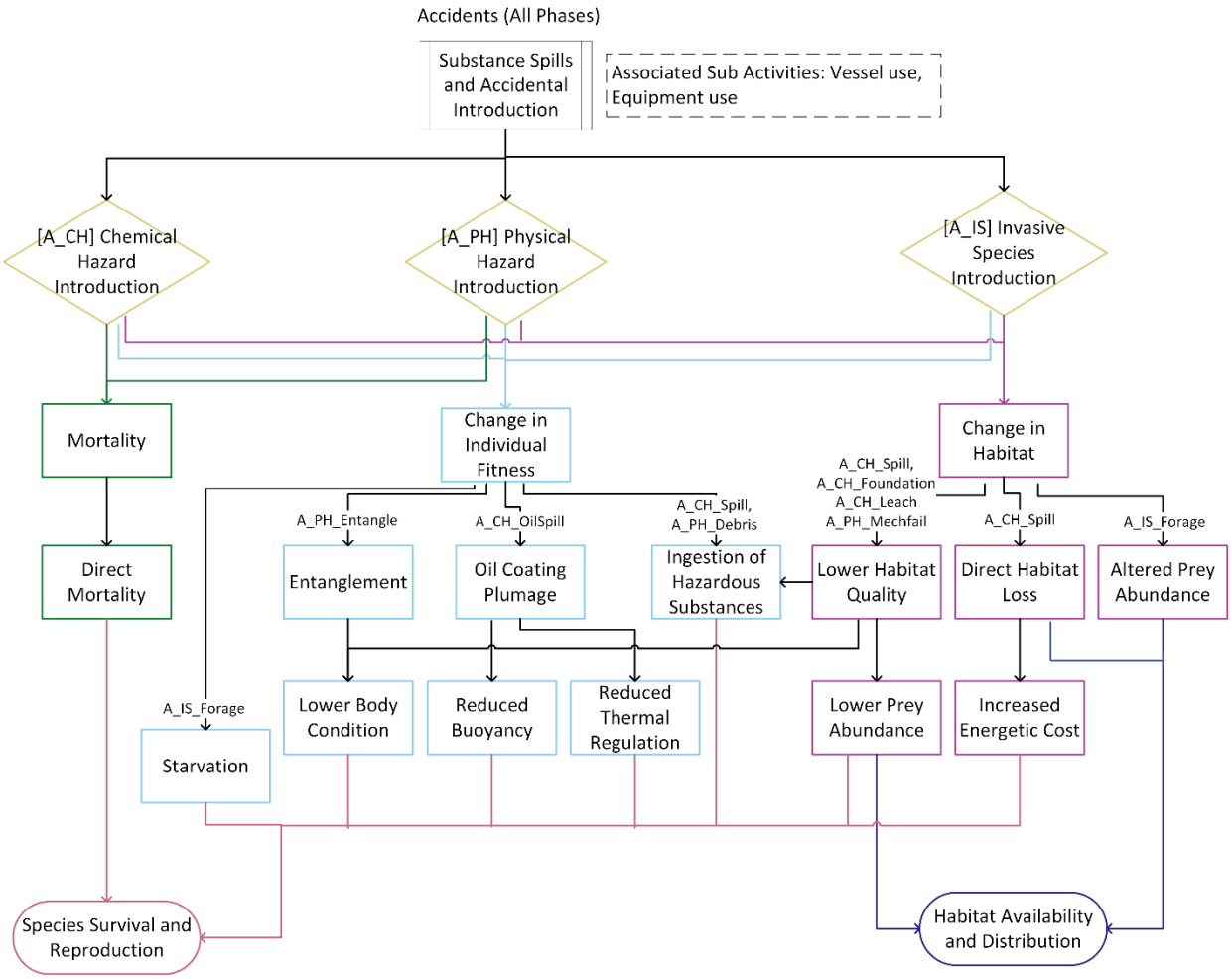


Figure Description: Model adopted from ECCC submission to the Committee, August 15, 2024. This model shows how the accidental introduction of invasive species, hazardous chemicals or physical hazards during offshore wind development can result in effects to aerofauna.

7.3.4 Mitigation and Other Measures

Table 7.3.12 outlines some common measures used to mitigate adverse effects (or enhance positive effects) of offshore wind development on aerofauna in other jurisdictions.

Importantly, many minimization measures (e.g., deterrents, lighting systems, feathering etc.,) intended to reduce impacts of offshore wind development are untested or unverified. ECCC and the Biodiversity Research Institute (BRI) are currently developing an offshore wind energy mitigations database and associated manuscript, which was submitted for peer review in August 2024.[78] BRI and ECCC identified 212 mitigation approaches from 233 source documents. They found no evidence of efficacy for 86 % of the mitigation approaches reviewed. Approaches were either not tested to assess whether they were effective at mitigating anthropogenic impacts to aerofauna (59 %) or did not indicate evidence of efficacy (64% of those tested). Researchers noted the most tested and effective measures included measures related to lighting for birds (e.g., reducing artificial light, avoiding white light, avoiding continuous light), and alteration of turbine operations for bats (e.g., curtailment and feathering of turbine blades).

Furthermore, ECCC advised that on-site restoration to mitigate impacts on aerofauna are not currently available in offshore environments. On-site restoration should be considered for any residual impacts resulting from offshore wind development in terrestrial environments only (e.g., cable landfall, laydown areas etc.) (ECCC, 2024a).

Appropriate siting should be the primary mitigation measure used to reduce impacts to aerofauna. Important local habitats and movement pathways, which are vital for their survival, should be avoided.

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[78] A pre-print version is publicly available at: Gulka, J., Knapp, S., Soccorsi, A., Avery-Gomm, S., Knaga, P., & Williams, K.A. 2024, August 22. Strategies for Mitigating Impacts to Aerofauna from Offshore Wind Energy Development: Available Evidence and Data Gaps. bioRxiv. https://www.biorxiv.org/content/10.1101/2024.08.20.608845v1

Table 7.3.12. Measures Commonly used to Mitigate and/or Enhance Effects of Offshore Wind Development on Aerofauna

Mitigation Measure	Description

Optimize Project Siting, Layout and Design	• Avoid and/or apply buffers zones around sensitive areas like:
	  ○ Areas with high bird activity, such as IBAs, breeding colonies, and major migration corridors to reduce risk of collisions, displacement, and habitat loss.
	  ○ Coastal areas with significant bat roosting or breeding colonies and known bat migration routes and flyways.
	  ○ Areas with known insect and butterfly migration routes; high-density or sensitive/rare populations of insects and butterflies; or areas with high-quality, continuous habitats for insects and butterflies.
	• Use comprehensive data on bird distribution, abundance, and movement patterns to inform site selection and turbine layout.
	• Reduce barrier effect and risk of collision for migrating birds by aligning turbine rows parallel to predominate migration routes and by incorporating gaps or corridors within turbine arrays that can provide safe passage and maintain habitat connectivity.
	• Establish buffer zones or habitat corridors and stepping-stone habitats to facilitate the movement and dispersal of insects and butterflies between fragmented habitat patches and to provide refuge areas for insect populations, reducing their exposure to noise and vibration disturbances.
	• Optimize the size, layout, and configuration of wind turbines to minimize the disruption of local wind patterns and microhabitats, which may adversely impact butterflies and insects.
	• Modify standard infrastructure such that the minimum air gap between blade tip and sea surface minimizes seabird interaction.
	• Use robust turbine blade component materials to reduce breakdown and abrasion into sea.

Manage Construction Timing, Noise, Lighting and Level of Disturbance	• Minimize interference with migrating bird movement and risk of nest abandonment or failure by timing constructions activities to avoid critical periods and planning a flexible schedule that can be adapted for local conditions and bird activity patterns. • Schedule construction activities to avoid periods of peak bat activity, such as migration seasons or critical life stages like breeding and pupping. • Limit the extent and duration of construction activities, particularly in areas with high bird activity, to reduce overall disturbance footprint. • Implement noise reductions measures like using quieter equipment or installing temporary noise barriers.

Mitigation Measure	Description
	• Minimize the use of artificial lighting during construction and use motion sensor and directional lighting to reduce light pollution and avoid disorientation of birds and bats. • Protect and buffer important bat habitats, such as coastal caves or foraging areas, from construction impacts. • Employ dedicated bird monitoring and deterrent measures during construction can help identify and mitigate potential conflicts in real-time. • Remove debris from floating lines and cables to reduce likelihood of megafauna entanglement.
Habitat Restoration and Creation	• Help mitigate impacts of habitat loss and fragmentation by restoring and enhancing habitats affected by construction activities. • Offset impacts by creating artificial nesting structures or restoring coastal habitats or native vegetation corridors to provide alternative breeding, foraging and roosting areas for displaced birds and bats. • Involve local communities, conservation organizations, and stakeholders in habitat restoration and creation efforts to foster collaboration and ensure long-term sustainability. • Implement habitat management plans to maintain or enhance suitable roosting, foraging, and commuting habitats for bats near wind farm sites. • Implementing habitat restoration and enhancement measures, such as creating buffer zones, planting native vegetation, and promoting diverse microhabitats, to provide suitable conditions for insect and butterfly populations. • Minimize use of anti-fouling paint on subtidal surfaces to encourage species' colonization on the structures.

Alter Turbine Lighting Schemes and Increase Turbine Visibility/Detection	• Increase visibility and reduce risk of collisions:
	  ○ Reduce risk of bird collisions by using techniques like painting blades with contrasting colours, using UV-reflective coatings and lighting systems to enhance turbine visibility, particularly during low-light conditions or poor weather.
	  ○ Apply coatings or materials to enhance acoustic reflectivity of turbine surfaces for improved bat echolocation and install aviation lighting systems with ultraviolet or blue light components to increase bat visibility of turbines.
	  ○ Incorporate features such as alternate colour or alternate lighting systems to enhance visibility for butterflies and insects.
	• Reduce bird attraction and disorientation by using intermittent or pulsating lights instead of continuously burning lights and bird-friendly light spectra, such as lights with longer wavelengths (e.g., red or amber). Reduced flash durations combined with increased intervals between flashes are recommended.

Mitigation Measure	Description
	• Minimize unnecessary light exposure and associated risks to birds by integrating radar-assisted lighting systems (activate turbine lighting only when aircrafts are detected in the vicinity). Timers or passive infrared devices are also commonly used to reduce excess lighting. • Consider and accommodate the specific visual capabilities and behaviors of bird species present in the area when selecting lighting design, intensity, and spectral characteristics. • Reduce impacts to butterflies and insects by implementing measures to minimize unnecessary light emissions, such as using shielded and downward-facing lights, adjusting light intensity and wavelength, and employing motion sensors or timers to reduce light exposure during periods of low activity. • Implementing measures such as temporary shutdowns or dimming of lights during peak migration periods or times of high insect activity.
Use Deterrent Technologies and Curtail Turbines During High-Risk Periods	• Discourage birds from entering high-risk areas near turbines by deploying acoustic deterrent systems (e.g., broadcast bird distress calls or predator vocalizations) and/or visual deterrents (e.g., reflectors, streamers, laser systems). • Deploy unmanned aerial vehicles or trained raptors to scare away birds, particularly during migration periods. • Deter bats by integrating ultrasonic broadcast systems into turbine nacelles or deploying standalone units within wind farm arrays and emitting high-frequency acoustic deterrent signals audible and discomforting to bats. Position strategically for targeted deterrence. • Reduce collision risk by temporarily shutting down or feathering turbine blades during periods of high bird activity or migration. • Selectively curtail turbines at lower wind speeds when bats are more active to reduce collision risk and increase cut-in wind speed thresholds for turbine blade rotation during periods of high bat activity. • Curtail or feather turbine blades (adjust blade pitch to minimize rotation) during periods of peak bat activity, such as migration or foraging times. • Adjust turbine operations, such as reducing rotor speeds or temporarily shutting down turbines during critical mating periods or times of high insect activity. • Optimize curtailment schedules based on local bird migration patterns, breeding season and weather conditions to maximize bird protection while minimizing energy losses and consider advanced monitoring systems (e.g., radar or camera-based detection) to identify approaching bird flocks and trigger curtailment protocols in real-time.

Mitigation Measure	Description
	• Use automated shutdown systems using camera or radar technology automatic detection and tracking/ daylight and/or thermal imaging. • Implement operational minimization based on real-time monitoring data or predetermined seasonal bat migration/foraging patterns. • Use multiple deterrent technologies and adapt them to species and behaviours and hearing capabilities to enhance effectiveness.
Implement Technologies and Techniques to Mitigate Electromagnetic Interference, Noise and Vibration	• Reduce adverse impacts to butterflies and insects by: ◦ Implementing shielding techniques and proper grounding of wind farm infrastructure to minimize the emission of electromagnetic fields. ◦ Implementing noise-reduction technologies, such as aerodynamic blade designs, noise-insulating materials, and strategic turbine placement, to minimize the propagation of noise and vibrations. • Use of bubble curtains (e.g. big bubble curtains, double curtains) for noise abatement for piling noise.

Table Description: This table outlines some common measures used to mitigate adverse effects (or enhance positive effects) of offshore wind development on aerofauna in other jurisdictions.

Sources: Adams et al., 2019; Agudelo et al., 2021; Akhtar et al., 2024; Arnett & May, 2016; Arnett et al., 2011; 2013; 2016; AWWI, 2018; Bailey et al., 2014; Barnes et al., 2018; Barré et al., 2023; Bart, 2005; Behr et al., 2017; Bennett & Hale, 2014; Bennun et al., 2021; Blackwell, 2002; Bright et al., 2008; Byom et al., 2020; Courbis et al., 2023; Cresci et al., 2024; Croll et al., 2022; Cuthrell, 2023; Dai et al., 2015; Deshmukh et al., 2019; Dorey et al., 2019; Drewitt & Langston, 2006; Edwards-Jones et al., 2024; European Commission, 2020; Evans et al., 2007; Fox et al., 2006; Furness et al., 2013; Garcia-Rosa & Tande, 2023; Gartman et al., 2016; Gaston et al., 2012; Gehring et al., 2009; Gili et al., 2024; Gilmour et al., 2020; 2021; Goodale et al., 2019; Goodship & Furness, 2022; Gorresen et al., 2015a; b; Hadipour et al., 2017; Heer et al., 2013; Hayes et al., 2019; Hilty et al., 2020; Hüppop et al., 2006; Huzzen, 2019; IBA Canada, 2024; International Finance Corporation, 2023; Juretzek et al., 2021; Kerllinger et al., 2010; Latham et al., 2017; Lehnert et al., 2014; Lewis, 2023; Levitt et al., 2022; Lloret et al., 2022; Long et al., 2011; Longcore et al., 2008; Lüdeke, 2017; Marques et al., 2014; Martin, 2022; Martin & Banks, 2023; Martin, Arnett, et al., 2017; Masden et al., 2009; Månsson et al., 2022; May et al., 2015; 2017; NatureScot, 2020; 2021; Nicholls et al., 2022; NRG Systems, 2020; Ontario Ministry of Natural Resources, 2011; Oregon State University, 2019; Pardo et al., 2023; Pearce-Higgins et al., 2012; Poot et al., 2008; Rabie et al., 2022; Reid et al., 2022b; Rodrigues et al., 2015; Rogers, 2020; Rosa & Tande, 2023; Rowse et al., 2016; Roy & Traiteur, 2010; Schirmacher et al., 2018; SEER, 2022b; Smallwood & Bell, 2020; Solick & Newman, 2021; Sordello et al., 2020; Spyridonidou & Vagiona 2020; Squires et al., 2021; Stone et al., 2012; Thess & Lengsfeld, 2022; Tomé et al., 2017; van Erp et al., 2021; Vagiona & Kamilakis, 2018; Voigt, 2021; Voigt et al., 2012; 2024; Wang & Smith, 2015; Weaver et al., 2020; Wieringa et al., 2021; Wilson & Elliott, 2009; Young et al., 2003.

ECCC provided expert advice on mitigation measures to address impacts of offshore wind development on aerofauna in response to Committee information requests. The full submission is available on the Registry under document reference number 275 Cumulative Effects and Mitigation. They recommended several measures to avoid impacts based on

site selection, project design, and scheduling; physical and operational controls to minimize impacts; examples of compensation measures; and general measures like ensuring that all project staff, contractors, and sub-contractors receive education and training related to federal regulations, permits, and policies. It is strongly recommended that this submission be reviewed by project proponents. Its contents, alongside this Report should require consideration in future impact assessments.

7.3.5 Engagement Outcomes

Over the course of the Regional Assessment the Committee received the following feedback related to aerofauna:

- Several participants raised concerns about migration routes. For example:
  - Participants of the Indigenous Knowledge Advisory Group asked whether migration routes were considered in the constraints analysis to identify initial offshore wind energy licencing areas during February 2024 meetings.
  - During November 2023 engagement sessions the Committee heard the whole west coast is known as a corridor for migratory birds. Impacts there need to be considered.
  - In September 2024, Flat Bay Band Inc. submitted a letter to the Committee including concerns about the impacts of offshore wind farms on migratory bird and bat populations. These species may collide with the turbines, leading to fatalities, which could have cascading effects on the ecosystem.
- During June engagement sessions at Stephenville the Committee heard concerns about impacts to migratory animals such as birds. Participants indicated that Red Island which is off the western tip of the Port aux Port peninsula, is the only island in the region and an important stop for many species on their journey.
- During November 2023 engagement sessions the Committee heard that it should consider the effect of on land components of offshore wind development (e.g., converter stations, powerlines, and cables) could have on bats and migratory flyways.
- During June 2024 engagement in Stephenville, a participant indicated the importance of considering aerofauna species-by-species, within each area because species travel at different heights and for varying distances for foraging and migration. They also raised concerns about infrasound that may affect sea life and aerofauna.
- During June 2024 engagement a participant indicated that bird mortalities related to oil and gas are easier to identify and that it's more difficult to hold offshore wind projects accountable for bird mortalities.
- During June 2024 engagement participants raised concerns about impacts to birds and bats. They asked whether wind generated by offshore wind development would affect birds and bats. They indicated puffin populations are attracted to lights and get disoriented, and they noted concerns about migratory routes and birds flying offshore because of their attraction to lights.
- During June 2024 engagement a participant noted examples of offshore wind farms in Norway where vertical shafts are being used to help minimize impacts to aerofauna.
- QFN recommended the offshore wind licencing areas avoid critical habitat for seabirds. In their submission dated August 23, 2024, a member of Port au Port Indian Band similarly indicated they

are concerned for the impact of offshore wind development to all species at risk such as (but not limited to) Blue Whales (*Balaenoptera musculus*), wolffish, eagles, and Piping Plover.

- In their submission dated August 23, 2024, a member of Port au Port Indian Band indicated that offshore wind turbines could be devastating to marine habitats; bird, bat, and insect population; gannets; ducks; forging birds; and nesting areas. Another member raised concerns that offshore wind turbine development activities, such as construction or operation, may generate excessive noise and light pollution (at distances as great as 80 km), which can disturb local wildlife populations and disrupt their natural behaviors, including (but not limited to) Blue Whales, wolffish, eagles and Piping Plover.
- In their submission dated August 23, 2024, a member of Port au Port Indian Band suggested the Committee review the YouTube channel 'NLGhostwolf' to observe videos of the marine life and aerofauna of the peninsula (Humpback Whale Madness, Humpback whales feeding on Capelin near Stephenville, Vlog#3 Whale Watching on Newfoundland's scenic west coast and more).

During June 2024 engagement sessions the Committee also heard more place-specific feedback and concerns about impacts to aerofauna. For example:

- In Burgeo participants indicated seeing a lot of change in recent years (e.g., seeing Canada Geese for the first time, increase in cormorants (also referred to as shags), seeing shags in places they hadn't before, and that tern harvests and gannet abundance have decreased significantly.
- In Burgeo participants noted ongoing monitoring work in the area, such as the Coastal Communities Conservation Opportunities Initiative, Murre and Tern monitoring – Coastal Stewardship Agreement, Birds Canada monitoring, and public bird monitoring programs. They also indicated that Sandbanks Provincial Park has an inventory of birds, butterflies and insects seen over the years.
- Participants in Port aux Basques shared some of the species they had observed in the area. They indicated that:
    - Canada Geese are in the Codroy Valley and that the Grand Codroy River is one of their stops as they migrate.
    - Black Guillemots used to be common in the area but now are mostly gone.
    - Turrs and murres are present. Harvesters never fail to get their quota.
    - Geese, gulls, terns, and bats are in the area. Birds like terns and murres will be migrating in wintertime and will be impacted.
    - Great Blue Herons (*Ardea* Herodias) have been seen in the river.
    - Flocks of gannets near Cape Ray, always lots of gannets in this area.
- In Fortune participants indicated seeing Common Murre (locally known as turr) fly through Fortune Bay and seeing pelican in the offshore areas. Participants also noted stewardship programs in the area to track birds.
- In Marystown participants indicated observations of various species. Mother Carey's Chicks (Storm-petrels) breed off Green Island and that these species travel far distances overnight. Green Island is also one of the largest nesting areas for puffins and guillemots and puffins are in Burin. Puffins are close to shore but in the wintertime, they go offshore and live in the ocean. They also indicated that Lawn Island Ecological Reserve is an important bird area. Shearwaters occur there

and are ocean-going birds so a buffer around the ecological reserve wouldn't necessarily protect them. Finally, participants recalled GPS banding in the '80s and indicated the biggest problem with Newfoundland is they'll do a first-year study, and they don't come back. The funding runs out.

- In Harbour Breton participants discussed observations in recent years including seeing more landbirds offshore, seeing turrs offshore, and observing bird attraction to lights. They also noted community work and citizen science to study bird colonies and other species in the area.

7.3.6 Data Gaps and Limitations

ECCC provided the Committee with advice on knowledge gaps related to assessing the impact of offshore wind development on aerofauna. Their advice included input from the Canadian Wildlife Service (ECCC), Science and Technology Branch (ECCC), waterfowl researchers (ECCC), BRI, and the Shorebird Collective. Some knowledge gaps and suggested follow-up were also adopted from other jurisdictions with existing offshore wind development.

The gaps identified relate to information on existing conditions; offshore wind development impacts and mitigation measures; and cumulative effects. Some gaps relate to specific taxa, areas or seasons while others are more broadly applicable.

Regarding existing conditions, identified gaps focus on:

- Needing information on species-specific altitude and fine scale movement for all marine birds during all seasons to effectively estimate collision risk.
- Needing more tracking data for colonial and coastal seabirds around breeding colonies to estimate mean and maximum foraging ranges and population densities that could overlap with offshore wind development areas and needing Information on foraging ranges for landbirds and bats.
- Needing more data on movement during migration such as:
    - Spring and fall tracking data on seabirds, waterfowl and shorebirds, to identify migration routes.
    - Information on northbound migration for shorebirds and
    - Information on migration routes for landbirds and bats.
- Needing more information on at sea density and distribution for certain seabirds, especially during overwintering, to estimate species specific impacts of offshore wind development and cumulative effects.
- Needing more species targeted monitoring programs and surveys to identify and avoid key habitat sites in the offshore environment for certain waterfowl and certain inland and coastal waterbirds. Information on overwintering grounds is particularly scarce.
- Needing more coastal surveys and targeted species monitoring to understand species-specific relative abundance and densities of waterfowl and certain shorebirds and gamebirds.
- Needing information on spatial and temporal distribution of migrating bats, including altitudinal data, to estimate baseline conditions before development and to estimate collision risk.
- Needing information on interannual variability in at-sea distribution for all aerofauna to generate accurate species- and population- specific density and distribution estimates over time.
- Lacking data in specific geographic areas.

Regarding effects and mitigation, identified gaps focus on:

- Understanding species-specific behaviour of seabirds around offshore wind development infrastructure and related maintenance vessels and behaviour of bats around offshore wind development infrastructure (i.e., are they attracted to or displaced).
- Understanding aerofauna behavioural responses to light sources associated with offshore wind development, including variation during different times of year.
- Understanding impacts of underwater and above water noise on aerofauna.
- Programs to assess aerofauna mortalities linked to offshore wind development collisions, and to monitor key colonies for species most vulnerable to offshore wind energy development (survival, reproductive success, etc.,).
- Effects of decommissioning including partial decommissioning and repowering.
- Prey dynamics and interacting effects on Terns (i.e., what happens if forage fish near colonies are moving?)
- Mitigation effectiveness.
- Identifying available compensatory mitigation options.

Regarding cumulative effects to aerofauna, identified gaps focus on:

- Identifying the best approach to assessing cumulative effects of offshore wind development on aerofauna and completing cumulative effects analyses.
- Effectively identifying sources of cumulative effects for migrating populations.
- Supporting assessment methods with applicable data layers and models.
- Implementing ecosystem-based management approaches.

In many (but not all) cases, some work is underway to address these gaps, or existing programs and research could be leveraged and expanded to address gaps. As some examples ECCC has several ongoing partnerships with different institutions and organizations undertaking specific research (e.g., ongoing work by Cornell will provide insight on using weather radar data to monitor large scale biomass movements through the airspace); and programs like ECSAS, existing coastal surveys and the Atlantic See bats at See Program could be expanded upon.

A need for increased collaboration and data management across different departments, jurisdictions, and stakeholders is also an important consideration. For example, a framework or process for easier and more consistent sharing of research efforts and coordination between US researchers and Canadian research could help address gaps. In one of their suggestions, ECCC notes “Given that the Bureau of Ocean Energy Management (BOEM) and the US Fish and Wildlife Service (FWS) are conducting similar efforts, a Canadian approach should assess and adapt US findings for Atlantic Canada, avoiding duplication of efforts while ensuring a regionally appropriate strategy” (ECCC, 2024a).

Tables 7.3.13, 7.3.14, and 7.3.15 summarize more details from ECCC's submission. including specific gaps, suggested follow up, ongoing work and risks of not addressing gaps.[79]

Not addressing these knowledge gaps could limit the ability to assess (before projects), monitor and evaluate (during and post projects) the potential impacts of offshore wind development on aerofauna. For example, specific impacts could be under- or over-estimated due to incomplete or inaccurate baselines or a limited understanding of components' responses to specific effects. These gaps could also lead to ineffective mitigation measures including ineffective project siting, and harm to aerofauna, and/or applying some mitigation measures that may not be needed given more data. As articulated throughout this Report, this Regional Assessment should be viewed as a starting point. Data and information gaps should be addressed, then the Committee's findings should be revisited.

[79] The full submission is available on the Registry under document reference number 275, Aerofauna Knowledge Gaps and Recommended Research.

Table 7.3.13. Knowledge Gaps Related to Aerofauna Existing Conditions

Gap	Gap Details and Suggested Follow Up	Risks
Altitude and fine scale movement data	• Species specific data on flight height, speed and maneuverability when interacting with areas that may overlap with offshore wind energy developments. • Gap applies to all marine birds and all seasons. • Suggestions for follow up include biomass monitoring or tracking programs with devices equipped with accelerometers; requiring tags for small aerofauna that can provide flight height data and other behavioural information (e.g., miniaturized tags with biometric pressure sensors); exploring us of ATLAS system to enable studies to monitor fine-scale movements of smaller birds/bats within development areas once infrastructure is in place. • Ongoing work by Cornell (end date March 2025) will provide insight on using weather radar data to monitor large scale biomass movements through the airspace.	• Skewed collision risk estimates.

At-sea density and distribution for certain seabirds and seasons	• At-sea density and distribution for:
	  ○ Black Guillemot during winter;
	  ○ Bonaparte's Gull Spring and fall migration;
	  ○ Common and Red-throated Loons during overwintering;
	  ○ Razorbill during overwintering;
	  ○ Shearwaters during overwintering;
	  ○ Sotrm-petrels during overwintering; and
	  ○ Skuas during winter and spring migration.
	• Suggestions for follow up include continuation and expansion of ECSAS and species targeted surveys.
	• ECCC is analysing historic tag deployments; deploying new tags in 2024 - 2025; and working to develop predictive models for Shearwaters.
		• Not possible to estimate species-specific impacts or cumulative effects.

Gap	Gap Details and Suggested Follow Up	Risks
Foraging range for colonial and coastal Seabirds	• Maximum and mean maximum foraging ranges from breeding colonies into the offshore environment and stage-specific (incubating vs. chick-rearing) foraging estimates. • Gap applies to all colonial and coastal seabirds during breeding season. • Suggestions for follow up include species targeted tracking programs prioritizing species and/or colonies adjacent to anticipated offshore wind energy development areas.	• Underestimating population densities and foraging ranges that can overlap with offshore wind energy developments.
Foraging ranges and migratory routes for Roseate Tern	• Offshore habitat uses during the breeding season around colonies and migratory routes. • Suggestions for follow up include species targeted tracking programs. • ECCC is conducting a pilot project on Common Tern intended to lead to future telemetry work on Roseate Tern.	• Increased impacts on a species at risk, currently considered "Endangered". • Lack of protection while moving during critical periods in the offshore.
Baseline data on bat migration	• Spatial and temporal distribution of migrating bats and altitudinal data • Gap applies to all seasons. Species of most interest include Silver-haired Bat, Eastern Red Bat, and Hoary Bat • Suggestions for follow up include acoustic surveys through the Atlantic See bats at Sea Program (ships of opportunity, transects, and coastal stationary surveys)	• Potential to not understand baseline before development. • Skewed collision risk estimates.
Relative abundance and coastal density for waterfowl and for certain shorebirds and gamebirds	• Species-specific relative abundance and densities of waterfowl during breeding season, outside of breeding season, and during migrations. • Habitat use and movement between sites in spring, summer and fall for Red Knot, Buff-breasted Sandpiper (*Calidris subruficollis*), and Lesser Yellowlegs. • Species-specific relative abundance and densities and extent of range expansion for Woodcock during all seasons. • Suggestions for follow up include coastal surveys and species targeted monitoring.	• Inability to identify potential overlap with offshore wind energy.

Gap	Gap Details and Suggested Follow Up	Risks
	• For Common Eider, there are existing data sources for regional, year-round tracking and winter aerial surveys. Of high importance is identification of key winter sites and post-breeding moult sites. Some of this work is being done by ECCC through analysis of winter aerial surveys and with Ducks Unlimited to model telemetry data.	
Key Habitat Sites for certain waterfowl and certain inland and coastal waterbirds	• Key habitat sites in the offshore environment for Harlequin Duck and Barrow's Goldeneye year-round, and, particularly, overwintering sites. • Identification of overwintering grounds including use of offshore environment for Horned Grebe in Atlantic Canada. Gap applies to spring migration and winter. • Suggestions for follow up include species targeted monitoring programs and surveys for the identified waterfowl and species targeted tracking programs for Horned Grebe. • For Harlequin Duck, ECCC has large database of historic surveys and has conducted new surveys in 2023/2024. The province of Nova Scotia also has an active survey program. • For Barrow's Goldeneye, comprehensive surveys are current to 2010. Eastern Habitat Joint Venture may provide an opportunity for winter surveys.	• Potential for development within key overwintering habitats • For Horned Grebe critical habitat currently only includes nesting and foraging habitat on the Magdalen Islands. Not identifying key overwintering habitats could mean a lack of protection during non-breeding season.
Northbound migration for shorebirds	• Identification of movement corridors and routes, and identification of coastal areas where birds might be staging before migration. • Suggestions for follow up include integrating data from multiple sources (Motus, tracking programs, and ACSS) and continuing species targeted tracking programs to quantify the areas and times of movements for all shorebirds through the region. • Several recommendations for collection of tracking data, including: ○ Studies should include resident populations that breed within the region and populations breeding in the Arctic.	• Potential to not characterize risk to shorebirds from site-based assessments and cumulative effects to shorebirds within the region.

Gap	Gap Details and Suggested Follow Up	Risks
	○ Number of species with tags should be expanded, while ensuring the relevant breeding populations are targeted. ○ Tags should be chosen in consideration of spatial and temporal resolution, and altitudinal data should be a priority. Tags should be programmed to collect more locations (when possible); locations at different times of day; Argos data if only a few GPS locations can be collected; fine-scale GPS if examining altitude/exposure to turbines. ○ Specific tag technologies are preferred. For larger seabirds (e.g., gannets) tracking with combination of agentometers, accelerometers, and GPS can be used to map 3D movements and would be useful to better understand collision risk. For small songbirds and bats, the priority should be combining new x-band (not weather) radar technology with acoustic monitoring. Recommended technologies include for tag types (sunbird, ornitela), tracking systems (ATLAS), and monitoring technology (FaunaScan MR2). ○ Consider tag deployment locations: Tagging across populations is helpful to determine relative exposure to lease areas. Tagging near lease areas may bias estimates of exposure. Tagging is currently biased to southbound migration periods.	
Foraging ranges and migration routes for landbirds and bats	• Identification of migration routes for landbirds and bats to and from Newfoundland and Labrador including timing. • Target seasons include summer, spring and fall. • Suggestions for follow up include MOTUS tagging programs and tower network expansion in Newfoundland and Labrador.	• Potential for development within key migratory routes leading to increased displacement or collision risk.
Spring/fall tracking data on seabirds, waterfowl and shorebirds	• Tracking data on key species during migratory periods to capture spring and fall routes. • Gap applies to multiple seabirds, waterfowl and shorebirds.	• Potential for development within key migratory routes leading to increased

Gap	Gap Details and Suggested Follow Up	Risks
	• Suggestions for follow up include species targeted tracking programs and ECSAS targeting breeding and non-breeding seasons to encompass non-breeders and young pre-breeders. • Preliminary results from Black-legged Gull tracking from Nunatsiavut show they overwinter in the Gulf of St. Lawrence and migrate through the Strait of Belle Isle, potentially passing through Regional Assessment areas in late fall and spring. This species is harvested (eggs and individuals) by Inuit in Labrador and could be at risk to offshore wind energy development during migration. • Additional Northern Gannet tracking is anticipated from the Motevecchi lab at Memorial University. • Partnership between ECCC and the SEATRACK program is ongoing and providing migration data for Leach's Storm-petrel, Herring Gull, Black-legged Kittiwake, and Atlantic Puffin from Witless Bay, Newfoundland and Labrador.	displacement or collision risk.
Tern Migration	• Post-breeding (and after failed breeding) movements by terns. • Suggestions for follow up include multiple years of tagging mixed tern species to understand post-breeding/post-failure movements and southward migration. • Ongoing collaboration with Audubon and others in the Gulf of Maine Seabird Working Group.	• Key overlaps (areas) could be missed due to lack of data. Terns could be harmed.
Understanding plasticity for all aerofauna	• How much interannual variability in at-sea distribution is there for a given aerofauna species or population? How can this be represented in distribution models, monitoring and mitigation plans and cumulative effects assessment? • Gap applies to all aerofauna and all seasons. • Suggestions for follow up include that all baseline research should be conducted over multiple years to account for variation; project monitoring and mitigation plans should allow for adaptive management based on results; research similar to the Environmental Studies Research Fund for offshore oil and gas for offshore wind energy; and gaining a better understanding of prey species.	• Limited ability to generate accurate species/population-specific density and distribution estimates over time. • Limited ability to assess effects of stationary threats like turbines and the

Gap	Gap Details and Suggested Follow Up	Risks

	• Related to prey species, recommendations include:
	  ○ Better understanding of prey species and potential impacts that could result from changes to prey availability.
	  ○ Baseline surveys of prey species, understanding prey distributions, and particularly spawning areas for prey fishes, to help inform siting of wind farms and timing of construction activities.
	• There will be data coming from tagged waterfowl (puddle ducks and geese) and American Woodcock in the coming years that can contribute to distribution data for these species.
		future suitability of protected areas (e.g., MPAs)

Lack of colony data at south coast of Newfoundland and Saint Pierre - Miquelon	• Location and population density of Common Eider in southern Newfoundland. • Breeding location, population density, and distribution of colonial nesting birds at Saint Pierre-Miquelon. • Suggestions for follow up include to maintain monitoring of historic and current colonies in southern Newfoundland; Collaboration with St. Pierre -Miquelon/French government; Possibility to use Lotek tags that are geo-referenced and automatically initiate a specific duty cycle once at a pre-specified latitude or longitude to avoid gaps in critical locations.	• Underestimating population densities and foraging ranges that can overlap with offshore wind energy developments.
Incomparable data	• Identify/develop modelling techniques that enable multiple spatiotemporal data sources to predict a single best-estimate distribution model, including a method to express uncertainty due to lack of data • Examples of sources include ECSAS, tracking, aerial surveys, Motus, etc. • Suggestions for follow up include requiring a method to express to non-technical stakeholders the difference between "no birds predicted/observed", and "no birds". This could be a more quantitative assessment of data gaps (i.e., mapping exercise with data by species, known colony locations and sizes, and the proposed development areas).	• Potential to mis-classify risk due to presentation of incomparable data products or data gaps.

Table Description: Summary of ECCC's submission to the Committee regarding knowledge gaps related to assessing the impact of offshore wind development on aerofauna. Their advice included input from the Canadian Wildlife Service (ECCC), Science and Technology Branch (ECCC),

waterfowl researchers (ECCC), BRI, and the Shorebird Collective. The full submission is available on the Registry under document reference number 275, Aerofauna Knowledge Gaps and Recommended Research

Table 7.3.14. Knowledge Gaps Related to Effects of Offshore Wind Development on Aerofauna and Mitigation Measures

Gap	Gap Details and Suggested Follow Up	Risks
Behavioural effects of offshore wind infrastructure on bats	• Understand if and how bats are attracted to offshore infrastructure. • Suggestions for follow up include Before-After-Gradient (BAG) studies on bat densities before and after development to understand impacts to bats and whether infrastructure is an attractant.	• Potential to not detect changes in movements and survival of migrating bats.
Species specific behaviour of seabirds around offshore wind infrastructure and maintenance vessels	• Species-specific behaviour around offshore wind infrastructure and associated maintenance vessels (attraction or displacement?). • Suggestions for follow up include comparing pre- and post- offshore wind development seabird locations relative to turbines; monitoring and reporting species sightings around vessels during maintenance activities, including avoidance and attraction behaviour. • Recommended methods for studying seabird locations include using high-resolution aerial imagery with surveys at different times across the breeding season.	• Underestimation of collision or displacement risk experienced by aerofauna taxa due to maintenance vessels. • Inability to accurately anticipate risk of displacement as additional installations are proposed. • Inability to understand potential drivers of changes in survival and reproductive success at colonies, if applicable.

Impacts of noise	• Impact of noise (both underwater and above) including chronic stress, displacement from colonies and foraging grounds.
	• Suggestions for follow up include:
	  ○ Research: Monitoring of noise levels and nest abandonment.
	  ○ Adaptive management: Restrictions during sensitive times near colonies.
		• Inability to accurately anticipate risk of displacement, particularly from colonies or foraging grounds.

Gap	Gap Details and Suggested Follow Up	Risks
Behavioural Response to Light	• More study of behavioural responses to artificial light sources in offshore wind energy developments including variation during different times of year (e.g., there could be petrel strikes during fledging periods, but not during the remainder of the year). • Suggestions for follow up include monitoring offshore wind energy development lighting sources for evidence of attraction, reporting strandings or collision (whenever possible) on lit infrastructure; monitoring during construction and maintenance (with potential stop-work collision limits in place) is equally important as monitoring during operation.	• Underestimation of collision or displacement risk experienced by aerofauna taxa.
Linking mortality to collisions with offshore wind infrastructure	• Lack of historical beached bird survey data and active programs in some areas. • Suggestions for follow up include investigating the feasibility of a region wide beached bird survey program that focuses on assessing mortality associated with future offshore wind energy developments.	• Not being able to understand changing distribution or detect mortality events associated with collision
Effects of decommissioning including partial decommissioning and repowering	• Impacts due to decommissioning remain unknown as few offshore wind energy developments have been decommissioned. Often assumed that these are similar to construction, but this does not account for partial decommissioning or repowering. • Suggestions for follow up include monitoring and mitigation effectiveness assessment during decommissioning/repowering phases that enable comparison across all development phases.	• Underestimation of potential displacement of aerofauna from important habitats such as colonies, foraging areas, and stop over sites.

Gap	Gap Details and Suggested Follow Up	Risks
Prey Dynamics and Interacting Effects on Terns	• Information on Forage fish dynamics and movements near key colonies. • Suggestions for follow up include forage fish surveys near key colonies (pre-breeding through chick fledging); understanding and protecting key spawning areas for forage fish that are prey for seabirds; assessing forage fish abundance and composition in an area prior to development and throughout operations. • Ongoing ECCC project collecting new Greater Shearwater telemetry data and developing distribution models with existing and new data.	
Compensatory Mitigation	• What available and effective compensatory mitigation options exist for migratory aerofauna in Atlantic Canada that are vulnerable to offshore wind energy developments? • Suggestions for follow up include to identify priority species for mitigation, review potential compensatory methods, and develop appropriate metrics based on scientific literature. This work should build on ongoing mitigation reviews and explore frameworks like mitigation banks or in-lieu fee programs. Given that the Bureau of Ocean Energy Management (BOEM) and the US Fish and Wildlife Service (FWS) are conducting similar efforts, a Canadian approach should assess and adapt US findings for Atlantic Canada, avoiding duplication of efforts while ensuring a regionally appropriate strategy. BOEM and FWS discussions are still primarily internal, therefore timing of ECCC involvement remains unknown.	• If available and effective methods are not identified it may not be possible for proponents to achieve no net loss of proposed projects.
Mitigation Effectiveness	• What are the actionable measures that can reduce risk of offshore wind energy developments on migratory aerofauna? • Suggestions for follow up include to assess mitigation effectiveness at all phases of offshore wind development.	• Inability to assess mitigation effectiveness and enact adaptive management in response to monitoring results.

Table Description: Summary of ECCC's submission to the Committee regarding knowledge gaps related to assessing the impact of offshore wind development on aerofauna. Their advice included input from the Canadian Wildlife Service (ECCC), Science and Technology Branch (ECCC),

waterfowl researchers (ECCC), BRI, and the Shorebird Collective. The full submission is available on the Registry under document reference number 275, Aerofauna Knowledge Gaps and Recommended Research.

Table 7.3.15. Knowledge Gaps Related to Cumulative Effects of Offshore Wind Development on Aerofauna

Gap	Gap Details and Suggested Follow Up	Risk
Approach	• What is the best approach for assessing the cumulative effects of offshore wind developments, other human activities and natural processes on aerofauna? • Suggestions for follow up include to conduct a comprehensive review of Cumulative Effects Analysis approaches from other jurisdictions with mature offshore wind development industries. Synthesize the best practices and propose an analytical strategy for assessing the cumulative effects of offshore wind development and other pressures on aerofauna. • This work is being advanced through current work between ECCC-STB and the Biodiversity Research Institute.	• During various phases of offshore wind development industry development (i.e., site selection) decision makers (e.g., Canada's Offshore Energy Boards) will not have a tested, recommended Cumulative Effects Analysis approach to follow. As a result, decisions may not be based on the best available information and analyses, and the delineation of lease areas may not minimize cumulative effects on aerofauna.
Identifying source of cumulative effects	• What colony do individuals impacted by specific development projects originate from? • Suggestions for follow up include using tracking data to quantify the percentage of birds present by population at a given time and location; using genetic or biomarker approaches if birds could be captured at sea in potential development areas and at potential colonies of origin. • Work to quantify percentage of birds present using tracking data is under development for murres (international), and storm petrels (Canadian, possibly US). • Biomarker techniques have been piloted on juvenile Storm-petrels.	• Inability to attribute population-level impacts on Canadian or international colonies to offshore wind energy development in Canadian waters.

Gap	Gap Details and Suggested Follow Up	Risk

	• Understand what breeding populations Atlantic migrating tree bats are coming from and their movements.
	• Suggestions for follow up include combination of hair sample collection with tagging program.
	  ○ Stable isotope analysis to understand where source populations are connected through the region.
	  ○ Terrestrial and offshore Motus receivers and tagged bats to measure movement through offshore areas.
		• Potential to not evaluating cumulative effects on bats appropriately.

Survival, fitness and population level effects	• How do the pressures from operational offshore wind energy developments impact the survival, fitness, and population viability of aerofauna species or populations? • Suggestions for follow up include establishing baseline monitoring of survival, fitness, productivity, and diet at a subset of seabird colonies before, during, and after offshore wind energy development. These should include species/populations adjacent to proposed offshore wind energy developments, or that migrate to/through proposed development areas and should prioritize species/populations that are deemed most sensitive to offshore wind development.	• Inability to estimate population trends, population connectivity impacts from offshore wind energy development, including cumulative effects. Inability to detect offshore wind energy development impacts on populations as they occur, take corrective action, or mitigate impacts from future developments.
Ecosystem-based management	• How can Ecosystem Based Management help to integrate considerations of impacts across environmental (fish, marine mammals, benthos, zooplankton, aerofauna) and economic (fisheries, fishing) sectors? • Suggestions for follow up include Conduct a structured review of approaches used successfully in other jurisdictions (e.g., internationally, DFO) and evaluate the feasibility of building a decision support model that integrates considerations for both migratory birds and fisheries in Atlantic Canada.	• Inability to consider ecosystem-based management without consistency and integration of various environmental and economic factors.

Gap	Gap Details and Suggested Follow Up	Risk
Data Layers and Models	• Develop data layers to inform cumulative effects assessments. • Suggestions for follow up include a data layer quantifying the amount, species composition, and spatiotemporal distribution of fisheries bycatch by fishing gear type. • Data layers for petroleum pollution risk, vessel traffic, and artificial light at night are in development, expected by January 2025. These benefit from additional data sources and analytical tools (e.g. VMS data).	• Potential to underestimate cumulative pressures, such that the added pressure of offshore wind energy development/operation results in unexpectedly adverse outcomes for one or more seabird populations.
	• Develop data to estimate cumulative effects. • Suggestions for follow up: To estimate cumulative effects, robust population models and bioenergetics models are required. While this is long-term research, it should be prioritized (alongside shorter-term efforts to estimate impacts at individual developments) to understand cumulative effects.	• Potential to underestimate cumulative effects

Minimizing cumulative effects for certain aerofauna	• How can cumulative effects from offshore wind development and other pressures be minimized for certain species or taxa:
	  ○ Shorebirds;
	  ○ Northern Gannets;
	  ○ Great Black-backed Gull, Herring Gull, Atlantic Puffin, Common Murre, Leach's Storm-petrel;
	  ○ Common Eider and other sea ducks.
	• Suggestions for follow up include to conduct a Cumulative Effects Analyses following the analytical strategy and best practices described in the Interim Conceptual Framework for Assessing the Cumulative Effects of Offshore Wind Energy and Other Pressures on Aerofauna (Ferguson et al., 2024). The result should indicate where placement of offshore wind developments should be avoided, to minimize cumulative effects.
		• During various phases of offshore wind development industry development (i.e., site selection) decision makers (e.g., Canada's Offshore Energy Boards) will not have a tested, recommended Cumulative Effects Analysis approach to follow. As a result, decisions may not be based on the best available information and analyses, and the delineation of lease areas may not minimize

Gap	Gap Details and Suggested Follow Up	Risk
		cumulative effects on aerofauna.
Cumulative effects on Terns	• What are the cumulative effects of offshore wind energy developments and climate change impacts on breeding habitats for terns, including endangered Roseate Terns? • Suggestions for follow up include Baseline data collection (e.g., survival, productivity, fitness) and tracking.	• Inability to predict continued and future impacts on species, including population trends, community assemblages, impacts of invasive species, etc.
Pre- and post-installation case studies	• Pre- and post- offshore wind farm installation case study(ies) to detect and understand the impacts of wind farms on vulnerable species. • Suggestions for follow up include: For select priority species and locations where foraging ranges are expected to overlap a future wind installation. Establish a baseline of foraging distribution (via tracking), population size, reproductive success, diet, and health (e.g., baseline corticosterone, glucose, ketone, triglycerides, cholesterol). Repeat these measurements following the offshore wind farm installation. Pre- and post-assessments should each include several years of data to ensure 'natural' inter-annual variations are considered. • Potential Leach's Storm-petrel colonies for consideration, based on proposed development areas include Country Island (NS), Middle Lawn Island (NL), and Grand Colombier (SPM).	• Inability to accurately anticipate risk of displacement as additional installations are proposed. Inability to conclusively attribute wind farm installations to changes in survival and reproductive success at colonies, if applicable. Data are required to refine cumulative effects assessments and inform project-level Environmental Impact Assessment reviews.

Table Description: Summary of ECCC's submission to the Committee regarding knowledge gaps related to assessing the impact of offshore wind development on aerofauna. Their advice included input from the Canadian Wildlife Service (ECCC), Science and Technology Branch (ECCC), waterfowl researchers (ECCC), BRI, and the Shorebird Collective. The full submission is available on the Registry under document reference number 275, Aerofauna Knowledge Gaps and Recommended Research. See section 8 of this Report for more details on ECCC's input and initiatives regarding cumulative effects.

7.3.7 Committee Conclusions and Recommendations

To address data and information gaps related to aerofauna:

- The Committee recommends that more robust movement studies of aerofauna likely to intersect the Focus Area be conducted. Project proponents in collaboration with ECCC should optimize project siting to avoid any major migration corridors. Based on input from ECCC (ECCC, 2024a):
  - When possible, movement data should be collected using high accuracy tracking devices such as GPS.
  - Movement data should be analyzed with movement models that account for tracking errors, such as dBBMMs.
  - Tracking devices should be programmed to record for an extended period that covers both the spring and fall migration for migrants, and the whole year for residents/facultative migrants. If such a deployment is not possible, consider several deployments so all life stages spent in the study area by a given species are covered. A few long-term tracks can be more informative than a higher number of short-term tracks (Thaxter et al. 2017b).
  - The number of tracking devices deployed should be representative of the population in the area of interest. For example, between 13 and 41 birds were found to be required for Lesser Black-backed Gulls (*Larus fuscus*) to accurately describe 95% of their estimated habitat use (Thaxter et al. 2017b). On wide-ranging species with high inter-individual variation, at least 17 to 21 devices were required to minimise variations between individuals (Gutowsky et al. 2015). In both cases, increasing the number of tagged individuals also increases coverage of the total habitat used (Beal et al. 2023). Based on current literature, a minimum of 30 devices per species and colony should be deployed to ensure adequate representation. For colonial birds, devices should be deployed across all colonies expected to intersect with potential development areas. If deploying devices at all colonies that intersect an area of interest is not feasible, a modelling approach using tracking data of individuals from representative colonies can be used to create species predictive distributions.
  - Consider deploying devices across several years, as this better describes the total habitat used (Beal et al. 2023).
  - Ensure there is appropriate spatial variation between tracked individuals. If multiple colonies are present in or near the area of interest, distribute tracking devices on individuals across multiple colonies of importance.
  - Deploy devices across age classes for a species, especially if different behaviours, habitat use, or migratory pathways are expected to occur.
  - When possible, devices that record flight height data should be favoured, due to the lack of accurate flight altitude information for several species and the importance of altitude when considering collision vulnerability.
- The Committee recommends that ECCC endeavors to update all bird colony data. All known bird colonies should be revisited, and current species composition should be updated. This should also include identification of new colonies.
- The Committee recommends that colony-specific setback distances should be set on a case-by-case basis during project-level impact assessment. Project proponents should engage with ECCC during the planning stages of any project for advice on appropriate colony or species-specific setbacks based on best available data and subject matter expert information.[80]

[80] ECCC should be engaged through the one-window approach: (FCR_Tracker@ec.gc.ca) for departmental coordination.

- The Committee recommends that offshore wind project proponents should engage with ECCC and refer to current literature to consider any updated information on aerofauna and appropriate measures to avoid or mitigate impacts during project-level impact assessments. Where ECCC does not have this information, the proponent would be responsible for designing programs to gather the necessary information.
- The Committee recommends that a long-term evaluation of proposed development areas should be initiated that is designed to identify species that occupy the area, their key breeding, migration, foraging, staging, and wintering areas. This must include monitoring pre, during, and post development.
- The Committee recommends that project proponents should work with the appropriate federal or provincial agency and Indigenous communities on the development of species-specific avoidance, setback, buffer, or mitigation protocols.
- The Committee recommends that during project-level impact assessments regulators ensure proponents select project sites with appropriate buffer/setback distances to adequately protect both federally legislated and other non-federally designated important areas for aerofauna such as MBSs, NWAs, IBAs/KBAs, WHSRNs and Sea Duck Key Habitat Sites.
- The Committee recommends that proponents of offshore wind projects should engage with ECCC and refer to current literature for species density information to know where species might be congregating, and the areas where species might transit/migrate, and should avoid those areas during project siting.
- The Committee recommends that project proponents complete additional research related to bats and on approaches to mitigating the effects of offshore wind development on bats.

Based on input from Indigenous groups (see Section 7.1.3):

- The Committee recommends that any eagle mortalities that result from the construction, maintenance, operation, or decommissioning of offshore wind energy developments be treated with respect.
    - All eagle carcasses should be given to a representative of an appropriate Mi'kmaq community where the eagle carcasses were found, as soon as possible after discovery.

7.4 Marine Fish and Fish Habitat

The ocean environment around Newfoundland and Labrador is changing. Evidence is in the scientific literature, and in observations from Indigenous peoples, fish harvesters, tourism operators, and community residents.

The Focus Area falls within two Bioregions, the southern area of the NLS and the northern part of the Gulf of St. Lawrence Bioregion (nGSL). Figure 7.6.2 displays the overlap between these bioregions and the Focus Area in Section 7.6.1.2 of this Report.

The Focus Area is also described in terms of Northwest Atlantic Fisheries Organization (NAFO) fishery management units. Figure 7.7.2 displays the overlap between these fishery management units and the Focus Area in Section 7.7. Both descriptors are referenced throughout this section. Figure 7.4.1 displays the primary depth zones and bathymetric features of the Focus Area.

The marine environment and fish habitat in the Focus Area consists of physical oceanographic characteristics, the living environment, and a variety of invertebrate, fish, shark, and skate species. Due to the vast diversity of macrophytes, invertebrates, fish, shark, and skates found in the Focus Area, select species are discussed in the following section as examples for their respective groups. Exemplar species for the Focus Area were selected based on conservation concerns (see Section 7.4.1 of this Report), ecological, economical, cultural, and /or recreational importance to various groups, including government departments and agencies, Indigenous groups, and other interested parties, or due to availability of data and research.

Highlighting specific taxa here does not mean other species should be overlooked. A fulsome assessment of macrophytes, invertebrates, fish, shark, and skates potentially impacted by a project should take place during project-level impact assessments.

Figure 7.4.1. Primary Depth Zones and Bathymetric Features in the Focus Area

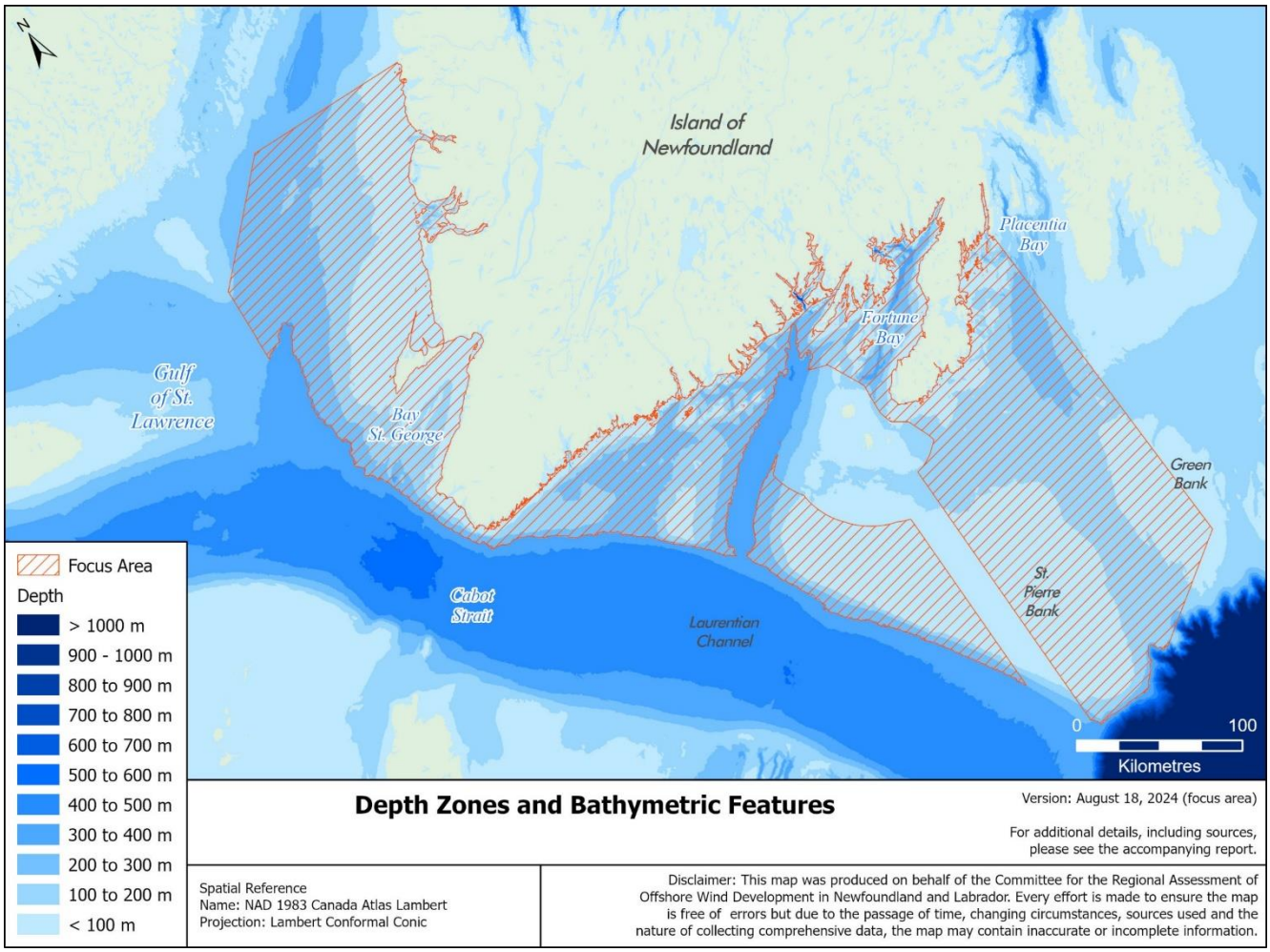


Figure Description: This map shows the primary depth zones in the Focus Area including St. Pierre Bank, Cabot Strait, and the Laurentian channel as well as bathymetry features (every 100 m).

Data Source: GEBCO Compilation Group, 2023.

7.4.1 Legislative Background

Under the IAA, project-level impact assessments must take into account changes to the environment that are likely to be caused by carrying out the project (*IAA,* 2019, c.28, s. 22(1)). This may include changes to the atmosphere, soil, wetlands, marine areas, vegetation, animals, fish, and birds (IAAC, 2020b). Project determinations by the IAAC and Minister of Environment and Climate Change Canada (i.e., whether an impact assessment is required, and whether the adverse effects of a designated project are in the public interest) focus on preventing and mitigating adverse effects in areas of federal jurisdiction (*IAA*, 2019, c.28, s. 16(2), 60(1)). Fish, shark, and skate species at risk are within federal jurisdiction. More information on the SARA (2002), and its protections is under Section 7.6.1.9 of this Report. Information on fish, skate, and shark species at risk in the Focus Area is under Section 7.4.2.7 of this Report.

The federal *Fisheries Act* (1985) protect all fish from death other than by fishing and all fish habitat from harmful alteration, disruption or destruction. Through recent amendments, the *Fisheries Act*, also provides further protections, permits, and management tools to protect, conserve, and in some cases restore, fish and fish habitat. The *Oceans Act* (1996) and its associated regulations also serve to protect and conserve fish and fish habitat through the designation and regulation of marine protected areas.

Regarding provincial protections, wildlife in Newfoundland and Labrador is managed under the provincial *Wild Life Act* (1990) and its regulations. Fish that spend some portion of their lives in the province's freshwater such as some species of diadromous fish, are protected through the provincial *Wild Life Act*. The Newfoundland and Labrador *Endangered Species Act* (2001) also protects some diadromous fish species at risk and their habitats. Provincial regulatory bodies like the DOECC may have additional impact assessment requirements for offshore projects in provincial waters. Finally, several programs and strategies also aim to protect fish and fish habitat. For example, the Fish and Fish Habitat Protection program or the Fishery Guardian program developed under DFO to support compliance with the *Fisheries Act*.

7.4.2 Existing Conditions

7.4.2.1 Existing Data and Monitoring Programs

The vast expanse of the Atlantic Ocean and all the diversity that lies within it, makes the data collection necessary to describe this ecosystem a challenge. However, there are a number of organizations and government departments tasked with regularly sampling, monitoring, surveying, and mapping various components of the Atlantic. A few of these programs are briefly described in the following section.

NAFO was established in 1979 as an intergovernmental fisheries science and management organization. It defines and regulates fishing areas, quotas, closures, and a number of other factors outside the 200-mile limit to ensure the conservation and sustainability of fisheries resources (NAFO, 2024a; NAFO Secretariat, 2020). NAFO has several scientific councils that periodically assess and publish reports and statistics on fish stocks, environmental conditions, ecological factors, and interactions between fish, fisheries, and the environment (NAFO, 2024b; NAFO Secretariat, 2020). NAFO Regulatory Areas (NRA) that overlap with the Focus Area include 4R, 3Pn, and 3Ps (DFO, 2009b). NAFO is also discussed in the section on Commercial Fisheries (see Sections 7.7 and 7.8 of this Report).

Since the 1970's, DFO has performed regular multi-species trawl surveys to gain a better understanding of the marine ecosystems and species distribution within the bioregions. These surveys are primarily used for stock assessments and resource management, but more recently, the data has been revisited to support various conservation and protection efforts (Bourdages et al., 2023; Wells et al., 2021).

In 1998, the Atlantic Zone Monitoring Program (AZMP) was established by the four DFO Atlantic Regions to "increase [DFO's] capacity to understand, describe, and forecast the state of the marine ecosystem and to quantify the changes in the ocean's physical,

chemical and biological properties" (DFO, 2023n). Through this program, regular surveys are conducted with data typically focusing on foundational trophic levels (e.g., physical oceanography and data on plankton populations). The sampling strategy is based on seasonal and opportunistic sampling along sections of the ocean to quantify the oceanographic variability in the Canadian northwest Atlantic shelf region.

These surveys support an understanding of the marine food web and its seasonal and interannual variations and the information provides input to decisions on ocean activities. AZMP survey locations are shown in Figure 7.4.2 including five locations within the Focus Area, i.e., Bonne Bay, Centre Gulf, Cabot Strait, southwest St. Pierre Bank, and southeast St. Pierre Bank (DFO, 2023n).

DFO also regularly reports on the health of Canada's oceans through technical syntheses published in the Canadian Technical Report series (Bernier et al., 2018; 2023) and as general summaries, such as the State of the Atlantic Ocean Synthesis Report (Bernier et al., 2023) and Canada's Oceans NOW Atlantic Ecosystems 2022 (DFO, 2024c). These reports identify the trends and status of several physical and biological indicators in the Bioregions of the Atlantic as defined by DFO, two of which occur in the Focus Area: GSL and NLS (DFO, 2009b).

Figure 7.4.2. AZMP section lines within the Focus Area

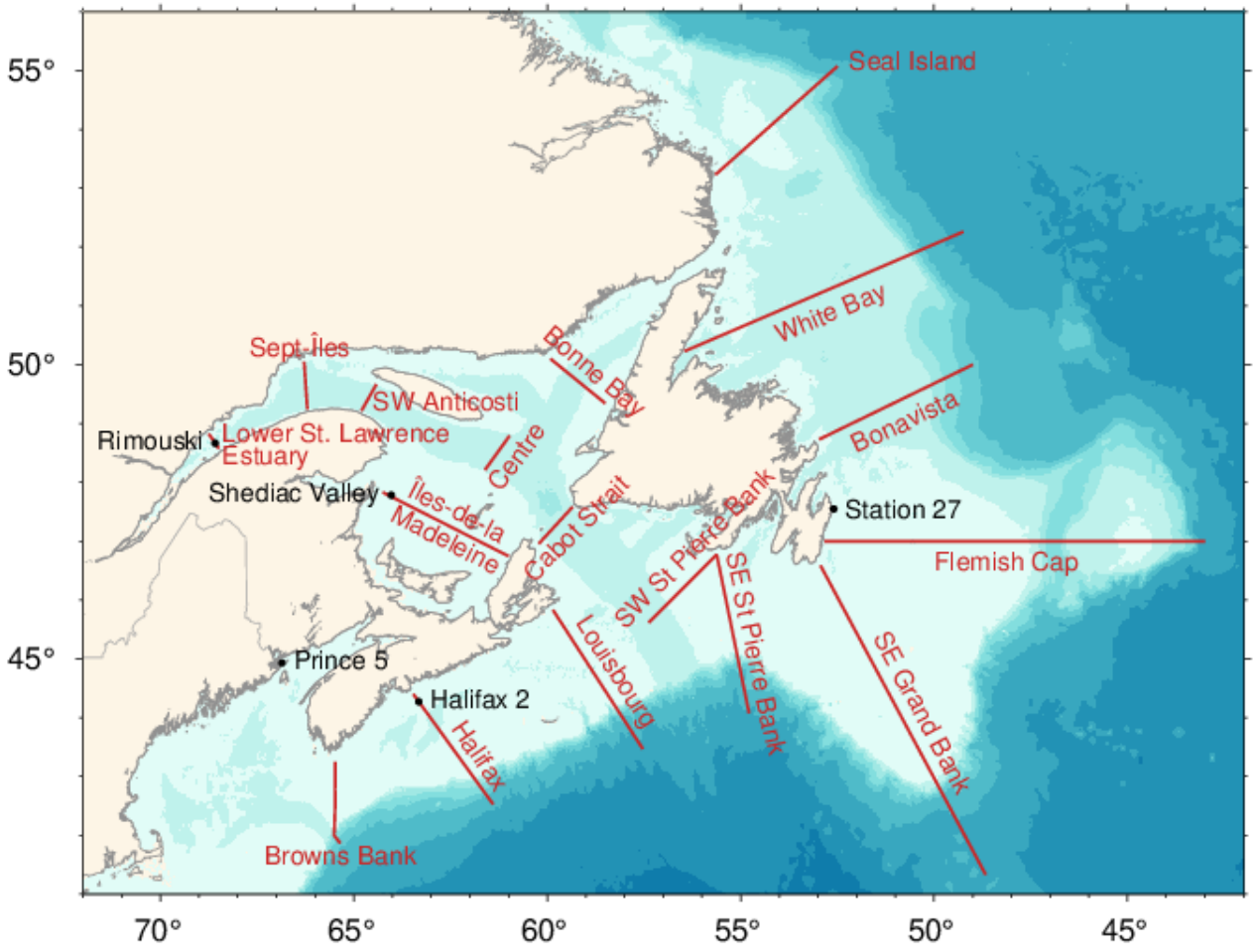


Figure Description: This figure displays the DFO AZMP section lines in the Focus Area including Bonne Bay, Centre Gulf, Cabot Strait, SW St. Pierre Bank, and SE St. Pierre Bank.

Source: Figure adopted from Oceanographic conditions in the Atlantic Zone in 2023 (p21), by Galbraith et al., 2024, DFO Can. Tech. Rep. Fish. Hydrog. Ocean Sci, 379. Copyright 2024 by the Government of Canada Open Data License Agreement.

7.4.2.2 Oceanographic Characteristics and Marine Ecosystems

7.4.2.2.1 Oceanographic conditions

The marine ecosystems of Atlantic Canada are changing. DFO's research into the physical, chemical, and biological components of the ecosystem indicate that climate change combined with human activities (anthropogenic drivers) and natural processes are affecting sea temperatures, currents, sea ice, chemistry, habitats, and the distribution of species (Bernier et al., 2023; DFO, 2023n). Recent observations (2021) reported warming surface and bottom water temperatures; reductions in sea ice duration, arial coverage, thickness, and/or volume; increasing acidity; changes in the thickness and temperature of the cold intermediate layer (CIL); declining oxygen in the CIL; and effects on marine biota across all trophic levels and functional groups in Atlantic Canada's marine ecosystems

(Bernier et al., 2023; Cyr & Galbraith, 2021). A figure of the oceanographic currents that surround Newfoundland and Labrador are displayed in Figure 7.4.3.

There are ongoing efforts to measure and monitor the effects of climate change on the ocean, such as the AZMP surveys described in Section 7.4.2.1 of this Report. Data on select variables are typically collected annually and described in terms of anomalies, or deviations from the long-term average in order to monitor the effects of climate change. The Newfoundland and Labrador Climate Index (NLCI) is a specific tool used to summarize these changes.[81] It summarizes anomalies for ten different variables including the winter North Atlantic Oscillation,[82] air temperature, sea ice season severity, iceberg count, seasonal sea surface temperature, vertically averaged temperature and salinity, summer CIL core temperature, summer CIL area, and bottom temperature.[83] Some variables are site specific (i.e., consistently measured at the same site(s) for comparison over time) while others are averages for a broader area. The key oceanographic variables and their trends are summarized in Table 7.4.1 and updated NLCI findings for 1950 - 2023 are displayed in Figure 7.4.4.

[81] The NLCI was developed for the NLS (Cyr & Galbraith, 2021). They describe it as "a simple way to relate average environmental conditions to the state of the ecosystem" (Cyr & Galbraith, 2021). It is also relevant for the Northwest Atlantic Ocean.

[82] The North Atlantic Oscillation describes two recurring atmospheric pressure patterns over the North Atlantic - low air pressure near Iceland, and high air pressure near the Azores Islands. Warm conditions across the eastern U.S. and northern Europe and cold conditions across southern Europe are linked to large pressure difference between these two systems. Conversely a smaller pressure difference between these two systems is linked to colder conditions across the eastern U.S. and northern Europe and warmer conditions across southern Europe (Lindsey & Dahlman, 2009).

[83] CIL refers to the cold intermediate layer, which is a layer of cold water that forms below warm surface waters of the ocean surrounding Newfoundland and Labrador. The CIL is formed in spring and summer when the surface waters become less dense, due to warming and an influx of freshwater from melting sea ice and run off from land, which restricts ocean mixing.

Figure 7.4.3. Oceanographic Currents in the Focus Area

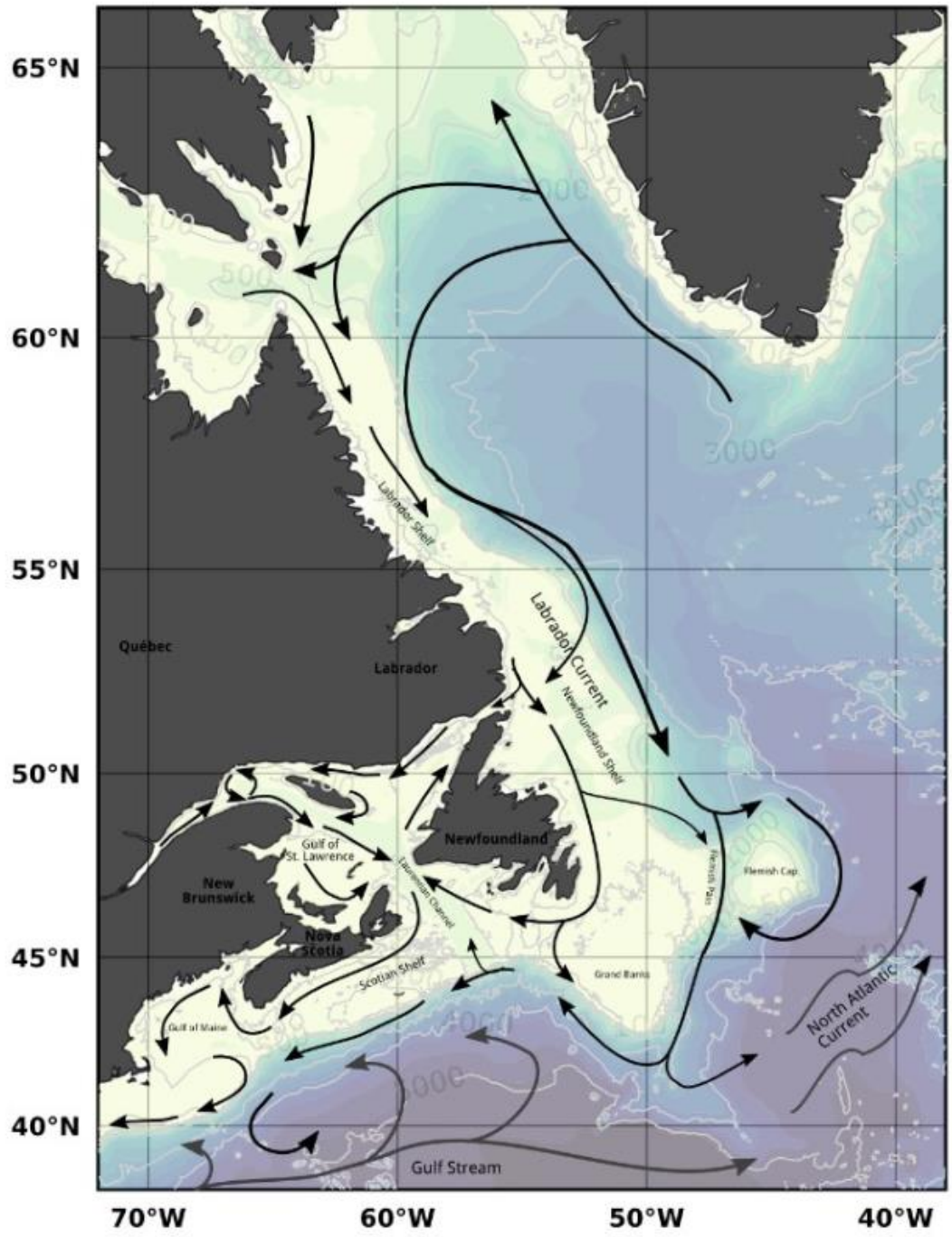


Figure Description: This map shows the oceanographic currents in and around the Focus Area including the Gulf Stream, the Labrador Current, and the North Atlantic Current.

Source: Figure adopted from State of the Atlantic Ocean Synthesis Report (p8), by Bernier et al., 2023, DFO Can. Tech. Rep. Fish. Aquat. Sci, 3544. Copyright 2023 by the Government of Canada Open Data License Agreement.

Figure 7.4.4. Newfoundland and Labrador Climate Index

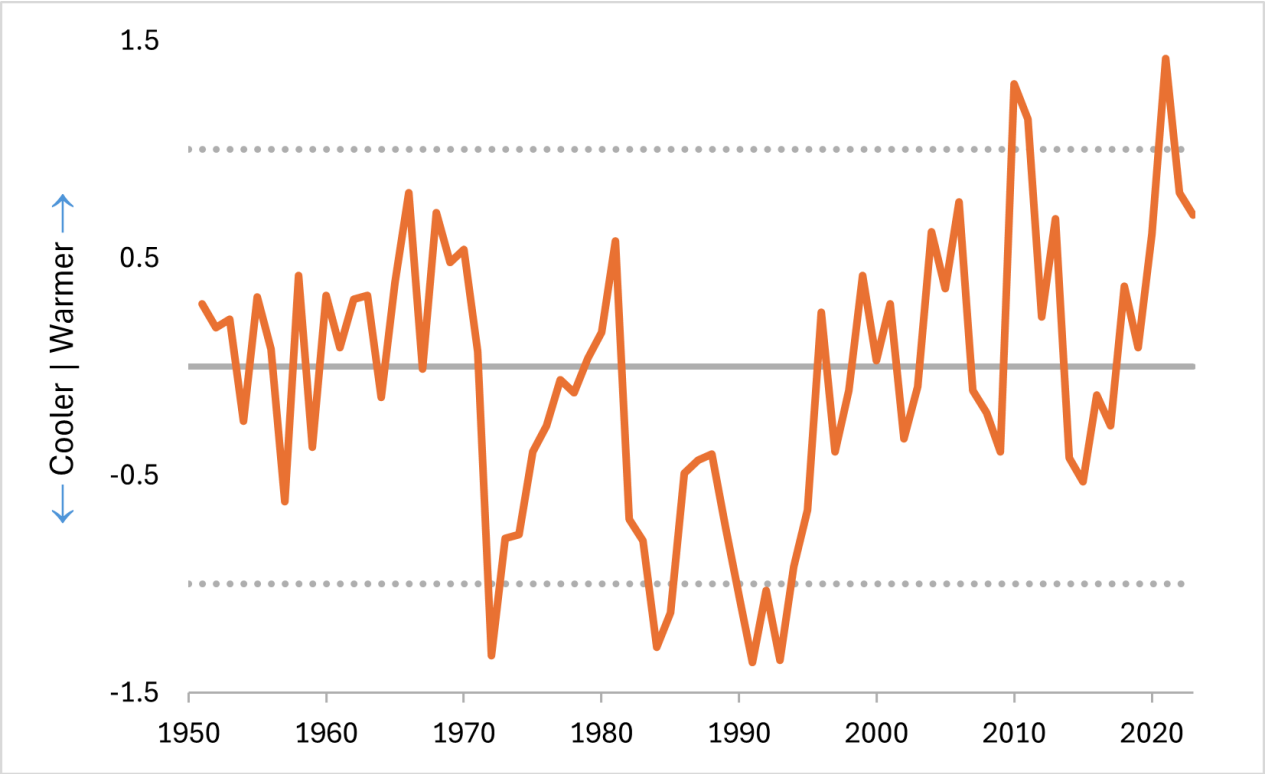


Figure Description: This figure displays the index of climate conditions on the NLS from 1950 - 2023 between max. and min. values of 1.5 and -1.5. Some of the coldest years on record since 1951 include 1972 which was followed by a warming trend, before dropping again in 1984, 1991, and 1993. Since the latest cold period in 1993, the index highlights a warming trend with the warmest year on record for the entire period (1950 - 2023) occurring in 2021.

Source: Figure adapted from Canada's Oceans Now: Atlantic Ecosystems (p9), by DFO (2024c). Copyright 2024 by the Government of Canada Open Data License Agreement. Adapted using updated data from (Cyr & Galbraith, 2020).

Table 7.4.1. Status and Trend Information for Several Key Oceanographic Variables in the Focus Area

Environmental Variable/ Common Name	Description
Physical Oceanography	

Ocean Temperature (sea surface)	• Sea temperatures vary vertically through the ocean year-round and is measured as part of three distinct layers: surface layer, CIL, and deeper water layer.
	• On average seasonal sea-surface temperature is warming on a similar scale to air temperatures, which is around a 1°C increase since the 1870's.
	  ○ Series record for warmest temperatures measured in 2021 for the NLS.
	  ○ 2021 represented the third-warmest year in the series for the Atlantic.
	• Deep waters have weak seasonal cycles in the Focus Area but are increasing or remaining stable. Four out of seventy-five of the annual averages for bottom water temperatures recorded in the Focus Area were below normal.
	• Increased ocean temperatures can have several impacts on marine fish and fish habitat by affecting prey availability, species distribution, species health, allowing for the introduction of invasive species, and damage to the living environment, among others.

Ocean Temperature (deep/bottom)	
CIL volume	• A CIL forms when warming surface water, melting ice, and runoff increase the surface freshwater layer, trapping colder water beneath in the CIL. The extent and depth of the CIL affect the bottom sea temperatures. • Temperatures of the CIL can be <0°C on the NLS and <1°C in the GSL. However, data shows that the CIL is weakening. ○ The NLS and nGSL bioregions are both exhibiting warmer than normal trends in their CIL since 2018. • Weakening of the CIL can impact fish and fish habitat through changing nutrient and oxygen concentrations as well as having direct effects on invertebrate mortality and fecundity.

Environmental Variable/ Common Name	Description
Sea ice (Sea ice index)	• Sea ice forms seasonally during the winter and its formation is highly correlated with air temperature. It is measured using three indicators: volume, duration, and thickness. ○ All three sea ice indicators have been lower on average and reached record lows in 2021 across the GSL and the NLS. • The presence or absence of sea ice can impact marine fish and fish habitat through cumulative effects with other ocean temperature variables that cause changes to the oceanographic conditions.
Stratification (Stratification index)	• Vertical stratification in the water column can affect biological processes and physical mixing properties such as the distribution of plankton, nutrients, and oxygen. • Recent measurements indicate that sea temperature is increasing or remaining stable at all depths which may affect the ocean's vertical stratification in some areas. ○ Stratification index records have been variable in the nGSL and NLS. • Changes in stratification can impact fish and fish habitat through changing prey availability (plankton), nutrient, and oxygen concentrations.

Mean Sea Level	• Observed local relative sea levels (RSLs) are rising around the world due to melting glaciers and ice sheets and ocean warming. Geological movements that cause vertical motion of the continent can offset this and result in sea level fall in some areas.
	  ○ In the nGSL overall trends are small – RSL is rising in some areas and falling in others.
	  ○ In the NLS, RSL is falling in the north (20 cm/century).
	• Sea level changes can impact fish by causing changes to or destruction of existing habitat, creating new habitats, and affecting other oceanographic variables.

Environmental Variable/ Common Name	Description
Water Chemistry	

Ocean Acidity (pH)	• Acidity is indicated by a low pH reading (< 7), the average ocean pH is around 8.1.
	• The Atlantic is becoming more acidic (pH units are decreasing). pH measurements are decreasing 0.03 – 0.04 pH units/decade.
	  ○ Since 2019, acidity is increasing in the GSL with pH units decreasing 0.04 pH units/decade since 1934. 2023 represents record acidity in series, with pH consistently recorded below 7.6.
	  ○ The pH of the NLS is measuring around 7.8 - 8 pH units (neutral) since 2018. There is strong interannual variability for measurements between 2014 and 2021.
	• Atmospheric CO_2 has affected the chemistry of the ocean by increasing the acidity (lowering the pH).
	• The levels of ocean acidification are expected to continue to increase due to climate change.
	• Increasing acidity can impact fish and fish habitat by reducing the ability of crustaceans, corals, mollusks, and other invertebrates that depend on calcium carbonate, to build strong shells and skeletons.
	• In some cases, ocean acidification may even dissolve shells and skeletons. This can have negative effects both directly on the organisms as well as on the environment and throughout the food chain.

Carbonate saturation state (Ω)	• Atmospheric CO_2 has affected the chemistry of the ocean by lowering carbonate saturation. If the level of carbonate saturation state is < 1 the ocean is undersaturated.
	  ○ In the nGSL bottom waters are undersaturated for aragonite.
	  ○ In the NLS deeper areas are slightly undersaturated.
	• Lowering carbonate saturation can impact fish and fish habitat by reducing the ability of crustaceans, corals, mollusks, and other invertebrates that depend on calcium carbonate to build strong shells and skeletons.

Environmental Variable/ Common Name	Description

Dissolved oxygen	• Dissolved oxygen has been reduced in the top 1,000 m of the world's oceans.
	• The levels of reduced dissolved oxygen caused by climate change is expected to continue increasing.
	  ○ In the nGSL deep channels are consistently hypoxic (below 30% saturation).
	  ○ In the NLS dissolved oxygen levels are high on average.
	• If there is insufficient oxygen in any of the oceans' layers, it can cause hypoxia which can result in mortality or exclusion from existing habitats for many species.

Nutrients and Plankton	

Nutrients
(Deep nitrate)
	• Nutrients are cycled vertically through the water column via wind-driven mixing of water in late fall and winter. This carries nitrates from deep layers to surface depths.
	• Deep nitrate levels can impact fish and fish habitat as levels of nitrate in the deeper waters (50 - 150 m) are a measure of future availability for phytoplankton (the deep-nitrate inventory).
	• The deep nitrate inventory has shown considerable inter-annual variability.
	• After record lows in 2017 and 2018, nutrients have increased to near normal in 2019 – 2020 in the Atlantic.
	  ○ In the nGSL records show a shift in nutrients from below normal to above normal.
	  ○ In the NLS records show a shift in nutrients from below normal to mostly above normal.

Phytoplankton (Chlorophyll *a* index)	• Phytoplankton are the microscopic plants and algae that form the base of the ocean food web. They drift with current and use photosynthesis, sunlight, and nutrients to grow.

Environmental Variable/ Common Name		Description
		• The 'spring bloom' of phytoplankton results from increased sunlight, carbon, and nutrients available in the spring. The time of initiation of the spring bloom, its magnitude, and duration are the key aspects monitored in the AZMP due to their importance to ocean ecosystems. • Phytoplankton levels can impact marine fish and fish habitat through the food chain as phytoplankton are a main food source for zooplankton, and small filter feeders. • In the Atlantic abundance is near normal. ○ Since 2017, abundance is near or above normal in the nGSL and NLS.

Zooplankton (Copepods)	*Calanus finmarchicus*	• Zooplankton are comprised of copepods, krill, arrow worms, larval stages of fish and invertebrates, and gelatinous species.
		• *C. finmarchicus* is a large copepod and with a high energy content and wide distribution in the Northwest Atlantic, it is a significant part of the zooplankton biomass.
		• *Pseudocalanus spp*. is one of the more abundant zooplankton species and has a wide distribution in the temperate and sub-arctic waters of the Atlantic.
		• The abundance (biomass) of zooplankton is at near-normal levels, due in part, to the increase in the populations of the copepod, *C. finmarchicus*.
		  ○ After record low recorded in 2015, *C. finmarchicus* is rebounding and near normal in the Atlantic.
		  ○ After reaching their maximum in 2015, *Pseudocalanus spp.* abundance has been in decline to near normal in the Atlantic.
		  ○ *Pseudocalanus spp.* has had an abundance near or above normal in the nGSL and NLS.
		• Zooplankton can impact fish and fish habitat as they are prey for many species, directly from fish through whales, and indirectly through other species that have eaten zooplankton.

	Pseudocalanus spp.	

Table Description: This table describes the oceanographic variables and planktonic organisms within the bioregions that overlap with the Focus Area as well as any relevant trends.

This table is adapted from State of the Atlantic Ocean Synthesis Report, by Bernier et al., 2023, DFO Can. Tech. Rep. Fish. Aquat. Sci, 3544.
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Sources: Aarbakke et al., 2014; Bernier et al., 2023; Cyr et al., 2022; Cyr & Galbraith, 2021; DFO, 2012a; 2023ee; n; Dzierzbicka-Głowacka, 2004; Galbraith et al., 2024; Herbert et al., 2021; IPCC, 2019; Jiang et al., 2019; Pepin et al., 2005.

7.4.2.2.2 Macrophytes

Marine vegetation (macrophytes) can be found in a range of habitats (Novaczek & McLachlan, 1989). Research into macrophytes has increased during the last decade, especially on eelgrass (*Zostera marina)* and kelp, although there are no standardized, annual regional surveys and previous research is limited (Barrell et al., 2015 as described in Bernier et al., 2023). Eelgrass observations have been recorded for the GSL and along the north and east coasts of Newfoundland with scattered observations in southern Labrador (Murphy et al., 2021). Studies to date on kelp have been confined to a few sites in the GSL.

Both eelgrass and kelp have important roles in an ecosystem (Bernier et al., 2023). Table 7.4.2 describes eelgrass and kelp and summarizes status and trend information for both macrophytes.

Eelgrass decline is attributed largely to nutrient loading but coastal construction, invasive species spread, more frequent storms, and ocean warming are also contributing to the decline (Matheson et al., 2016). There have not been any recent investigations of the present distribution or state of kelp forest ecosystems in either NLS or nGSL (Barrell et al., 2015 as described in Bernier et al., 2023).

The increasing water temperature is anticipated to be harmful to both eelgrass and kelp (Bernier et al., 2023). Temperatures that stay above 23°C in shallow areas of eelgrass beds can affect growth and survival (Krumhansl et al., 2021). Sea temperature rises may increase the northern extent of kelp, it is also increasing the presence of invasive species, especially bryozoans which are harmful to kelp (Carman et al., 2019; Wilson & Lotze, 2019).

Table 7.4.2. Status and Trend Information for Macrophytes in the Focus Area

Common Name/ Species Name		Description	Bioregion	Status/ Trend Information
Macroalgae (Kelp)		• Grow in dense groups forming underwater forests. • Serves as food sources and habitat for many species while also providing other important ecosystem services. • Ocean water temperatures have direct physiological effects on kelp, with higher temperatures having negative effects on survival and fecundity. • *Laminaria digitata*, *Hedophyllum nigripes*, and *Alaria esculenta* grow more commonly at shallow depths. *Saccharina latissimi* and *Agarum clathratum* prefer deeper waters. • Kelp beds are threatened by the presence of sea urchins, that can graze so extensively on kelp that they create sea urchin barrens. • The abundance and distribution of kelp could impact fish and fish habitat, as kelp serve as food sources and habitat for many species while also providing other important ecosystem services. ○ Important to commercial fish and crustaceans during juvenile stages or throughout their lifetime, for species such as Atlantic Cod (*Gadus morhua*), Atlantic Tomcod (*Microgadus tomcod*), White Hake (*Urophycis tenuis*), American Lobster (*Homarus americanus*), Rock Crab (*Cancer irroratus*), and Jonah Crab (*Cancer borealis*).	nGSL/ NLS	No recent data on status and trends.
Marine Plant (Eelgrass)	*Zostera marina*	• Sea grass species found in coastal and estuarine habitats. • Act as a food source for some species.	nGSL	Some beds are stable or increasing but over half are decreasing.

Common Name/ Species Name		Description	Bioregion	Status/ Trend Information
		• Provide substrate for other plants, add stability to the seabed, and can assist in shoreline protection from erosion. • Highly productive in terms of nutrient cycling and secondary productivity from associated benthic infauna and epifauna. • Provide a nursery function for invertebrates and several species of fish, providing protection and an enriched food supply. • Designated as an Ecologically Significant Species in Atlantic Canada. • Species that can be found in eelgrass include juvenile Atlantic Cod, Greenland Cod (*Gadus ogac*), White Hake, and invertebrates such as Rock crab. • Some areas are in recovery after a massive decline in the 1930's following the introduction of wasting disease, but many continue to decline. • The reduction or disappearance of eelgrass has been shown to cause declines in species which depend on it as a food source such as geese, clams, lobsters, scallops, and flounder.	nGSL/ NLS	Majority of beds are stable or expanding in NLS; half the beds are decreasing in the nGSL and in Placentia Bay.

Table Description: This table describes the key macrophytes that make up fish habitat in the bioregions that overlap with the Focus Area as well as relevant information on species status or trends.

This table is adapted from State of the Atlantic Ocean Synthesis Report, by Bernier et al., 2023, DFO Can. Tech. Rep. Fish. Aquat. Sci, 3544. Copyright 2023 by the Government of Canada Open Data License Agreement.

Sources: Barrell et al., 2015 as described in Bernier et al., 2023; Bernier et al., 2023; Carman et al., 2019; DFO, 2009b; c; 2023ee; ECCC, 2020b; Gorman et al., 2009; Hooper & van Soest, 2002; Krumhansl et al., 2021; Laurel et al., 2003; Lunzmann-Cooke et al., 2021; Matheson et al., 2016; Merzouk & Johnson, 2011; G. Murphy et al., 2021; Novaczek & McLachlan, 1989; Wilson & Lotze, 2019; Wong & Dowd, 2015.

7.4.2.3 Invertebrates

Invertebrates exist in all habitats, trophic levels, and ecological niches in the ocean and have many different roles in the ecosystem. Smaller invertebrates that are sessile (immobile) can provide substrate or habitat for other species, act as important food sources, and can serve a similar role to earthworms on land. Invertebrates found in the coastal waters of the Focus Area include corals, sponges, sea anemones, jellyfish, and larger species such as crustaceans, molluscs, worms (annelids), and echinoderms (Catto et al., 1999; Christian et al., 2010; Hooper, 1997).

Many invertebrates are harvested commercially or support other fish species as part of the food chain. Both commercially and non-commercially representative large marine invertebrate species from these groups that can be anticipated to have or create habitats within the Focus Area are discussed below.

Changes in the ocean climate (see Section 7.4.1.2 of this Report) may be affecting the structure of marine communities. In the nGSL, there have been changes to the proportions of some invertebrate groups between 2006 and 2022 with the biomass of both demersal and mesopelagic micronekton (e.g., small shrimps, amphipods, etc.) decreasing (Bourdages et al., 2023).[84] However, no clear trend has been observed for piscivorous, filter feeding, limnivorous, and detritivorous invertebrates (Bourdages et al., 2023).[85]

7.4.2.3.1 Cnidaria and Porifera

Corals (including sea pens), sea anemones, and jellyfish are classified under phylum cnidaria which are characterized by the stinging cells they possess while, sponges of phylum porifera are often characterized by their pores (Beckmann & Özbek, 2012; Christian et al., 2010; Hand & Fautin, 2024; Hooper & van Soest, 2002; Sarà, 2024). There is a large variety of cnidaria and porifera species known to occur within the Focus Area (Gullage et al., 2022). For the purpose of this Report, corals and sponges will be discussed as groups and exemplar species for sea anemones and jellyfish will be described (Christian et al., 2010). Descriptions and trend information for several invertebrate species that are characteristic of habitats within the Focus Area are summarized in Table 7.4.3.

Marine fish and invertebrate habitats are often considered in terms of vertical and horizontal parameters, substrate, sea ice, exposure, currents/tide, water temperature, salinity, and vegetation among other variables (Christian et al., 2010). Habitat can also consist of, and be created by, some of the invertebrates present in the marine ecosystem. Corals and sponges act as ecosystem engineers by creating, destroying, or modifying habitat in their environment and regulating the availability of resources within it (Bernier et

[84] Demersal means occurring near the bottom of the ocean and mesopelagic means the midwater zone occurring from 200 - 1,000 m deep.
[85] Piscivorous describes an organism that feeds on fish. Limnivorous describes an organism that feeds on organic matter found in mud and algae. Detritivorous describes an organism that feeds on dead or decaying organic matter.

al., 2023; Gullage et al., 2022). Coral and sponge distribution within the Focus Area is shown in Figure 7.4.5 and Figure 7.4.7. Presence data was available for sea pens - which are a type of coral - within the NLS region and displayed in Figure 7.4.6. Data displayed in Figures 7.4.5 - 7.4.7 are based on publicly available data from OBIS which combines occurrence records from thousands of datasets into one (OBIS, 2024). The data sets are submitted by a variety of users, institutions, and partners and must meet data quality control standards set by OBIS. The data presented in Figures 7.4.5 - 7.4.7 are not a true indication of species distribution and should be considered a qualitative representation of the taxa and groups identified (see Section 7.4.6, Data Gaps and Limitations). Project-level assessments should be used to further evaluate the distribution and abundance of cnidaria and porifera species at and around projects sites.

Figure 7.4.5. Distribution of Hard and Soft Corals in the Focus Area

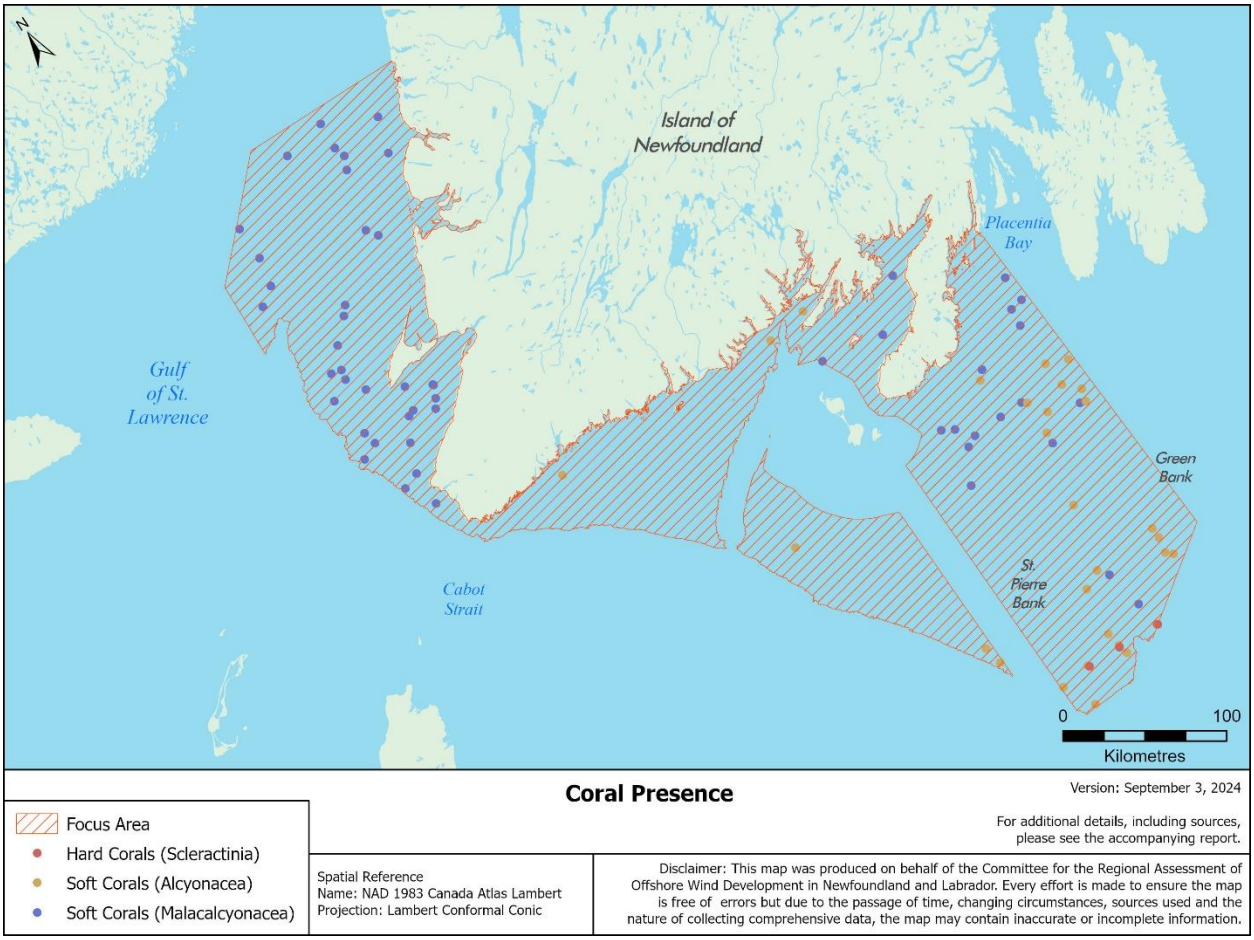


Figure Description: This map displays presence data points for hard corals and two genera of soft corals in the Focus Area. The highest density of hard corals within the Focus Area occurs on St. Pierre Bank close to the continental shelf edge. Soft corals appear in the highest densities within the Focus Area off the west coast of Newfoundland and on St. Pierre Bank.[86]

Data Source: OBIS, 2024.

[86] Identified trends reflect available data and are not a quantitative representation of species distribution.

Figure 7.4.6. Distribution of Sea Pens in the Focus Area

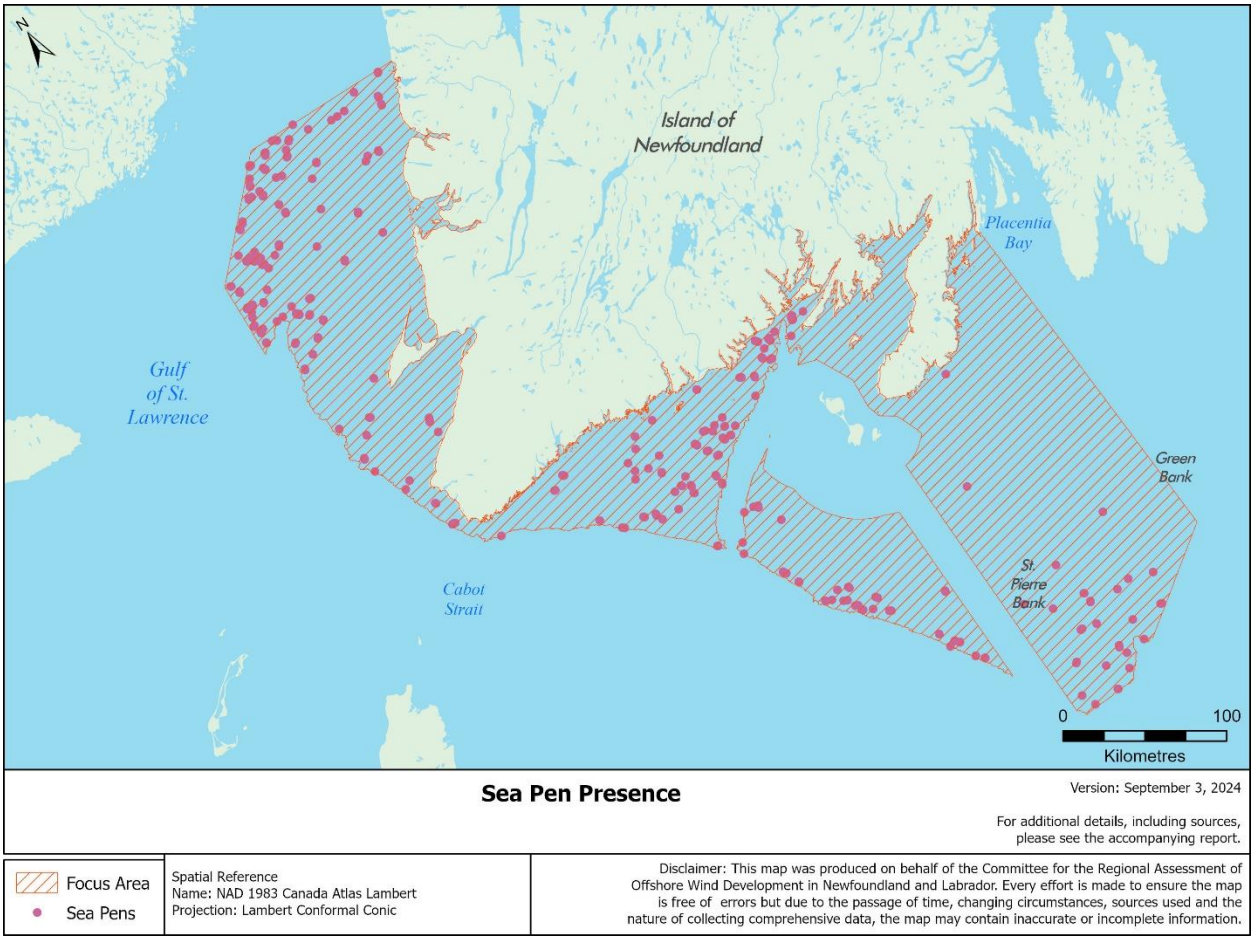


Figure Description: This map displays presence data points for sea pens in the Focus Area. Sea pens occur in high densities within the Focus Area off the west coast of the Island of Newfoundland and off the islands south coast, west of St. Pierre and Miquelon's EEZ.[87]

Data Source: OBIS, 2024.

[87] Identified trends reflect available data and are not a quantitative representation of species distribution.

Figure 7.4.7. Distribution of Sponges in the Focus Area

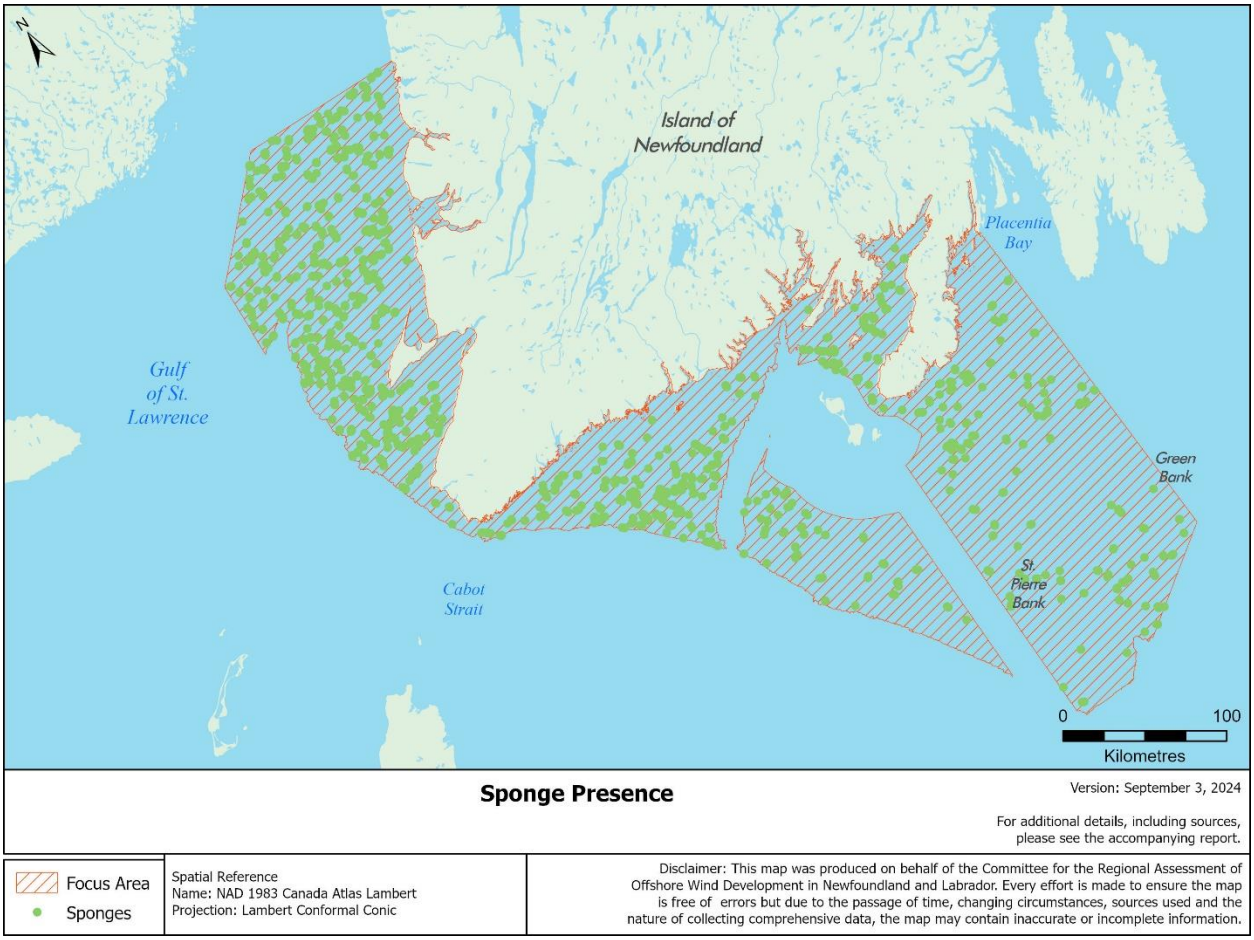


Figure Description: This map displays presence data points for sponges in the Focus Area. Sponges occur in relatively high densities throughout the Focus Area.[88]

Data Source: OBIS, 2024.

Invertebrates such as sea anemones and jellyfish provide shelter, feeding opportunities, nurseries, and habitat for various other invertebrate and fish species (Burke da Silva & Nedosyko, 2016; Griffin et al., 2019; Nagelkerken et al., 2016; Randall & Fautin, 2002). Distribution and abundance data on sea anemones, Lion's Mane Jellyfish (*Cyanea capillata*) and Moon Jelly (*Aurelia aurita*) in the Focus Area are not currently available.

Anthropogenic threats to cnidaria and porifera species include destructive fishing practices, pollution and debris, overfishing and harvesting, mining, coastal and oceanic development, and sedimentation (DFO, 2015b; Morley et al., 2014; NOAA, 2024a; Purcell et al., 2007; The Coral Reef Alliance, 2003; Vad et al., 2021). There are several areas of importance for corals and sponges in the Focus Area, including protected and special

[88] Identified trends reflect available data and are not a quantitative representation of species distribution.

areas such as EBSAs, Vulnerable Marine Ecosystems, and SBAs. Protected and Special Areas are described in Section 7.6.1 of this Report.

Climate change is affecting corals through a number of mechanisms including ocean acidification, warming ocean temperatures, sea level rise, and damage from storms (DFO, 2015b; Morley et al., 2014; NOAA, 2024a; The Coral Reef Alliance, 2003). The effects of climate change on sponges and sea anemones is poorly understood but they are anticipated to be impacted through similar mechanisms to corals (DFO, 2015b; Vad et al., 2021). Jellyfish may benefit from the effects of climate change on ocean ecosystems due to changes in prey availability and factors that influence interspecies competition, but further research is required to assess the nature and direction of effects (Nagelkerken et al., 2016; Purcell et al., 2007).

Table 7.4.3. Description and Status Information for Corals, Sponges, Sea Anemones, and Jellyfish in the Focus Area

Common Name/ Scientific Name	Description	Bioregion	Status

Corals (Cnidaria)	• Occur in the Focus area year-round.
	  ○ Highest densities occur off the west coast of Newfoundland and on St. Pierre Bank.
	• Found across the continental shelf, in valleys, troughs, canyons, and across the shelf edge.
	  ○ Occurrence on shelf or channel edges may be linked to the flow of water carrying food particulates and preventing build-up of fine sediments.
	• Preferred substrate varies with species between muddy bottoms or soft substrate and hard substrate or gravel.
	• Occur at depths of < 100 – 2,900 m but most frequently found 600 - 1,470 m.
	• Multi-species colony building organisms.
	  ○ Form reefs in shallow waters and fields in deep waters.
	  ○ Associated with biodiversity hotspots when found in large groups.
	• Slow growing, benthic,[89] sessile, filter feeders.
	• Provide habitat for other species and have a role in carbon processing and biogeochemical cycling in the deep waters.
		nGSL/ NLS	Abundant

[89] Benthic means occurring on or associated with the bottom of a body of water.

Common Name/ Scientific Name		Description	Bioregion	Status

Sponges (Porifera)		• Occur in the Focus area year-round.
		  ○ Highest densities occur off the west and southwest coasts of Newfoundland.
		• Found across the continental shelf, in valleys, troughs, canyons, and across the shelf edge.
		• Occurrence on shelf or channel edges may be linked to the flow of water carrying food particulates and preventing build-up of fine sediments.
		• Often prefer hard substrate but can be found in areas with soft substrate and higher levels of sediment.
		• Occur at depths of < 105 – 8,000 m but most frequently found 950 - 1,470 m.
		• Multi-species colony building organisms.
		  ○ Form multispecies groups or sponge grounds; Newfoundland sponge grounds are known to be dense.
		  ○ Associated with biodiversity hotspots when found in large groups.
		• Slow growing, benthic, sessile, filter feeders.
		• Provide habitat for other species and have a role in carbon processing and biogeochemical cycling in the deep waters.
		• Enrich ecosystems and encourage primary productivity in area with upwelling.
			nGSL/ NLS	Abundant

Sea Anemones (Cnidaria)	Frilled Anemone (*Metridium senile*)	• Distribution ranges from the Arctic to Delaware Bay, U.S. in the northwest Atlantic. • Benthic, found in intertidal waters up to 150 m on hard and soft substrates. ○ Sessile on hard substrates. • Eurythermic – prefers waters < 5°C and > 15°C. • Occur as solitary or colonial congregations. • Feeds on crustacean and larval plankton. • Predators include sea stars, nudibranchs, and fish.	nGSL/ NLS	Abundant

Common Name/ Scientific Name		Description	Bioregion	Status

Jellyfish (Cnidaria)	Lion's Mane Jellyfish (*Cyanea capillata*)	• Occur from Labrador to mid-U.S. (Cape Hatteras).
		  ○ Swarm in its northern range in late spring/summer.
		  ○ More commonly found inshore in fall, due to currents.
		• Prefer warm water (6 - 25°C), high salinity (24 - 33 ppt), and deep-water environments.
		  ○ Typically found near sea surface (< 20 m) in late spring/summer.
		• The largest species of jellyfish, with bell diameters up to 2 m.
		• Feed on zooplankton (e.g. small fish, shrimp, copepods).
		  ○ Feed near the surface at night and travel into deeper water during the day (pelagic).
		• Predators include Leatherback Sea Turtles (*Dermochelys coriacea*).
			nGSL/ NLS	Abundant

	Moon Jelly *(Aurelia aurita)*	• Distribution range spans from Greenland to Cape Cod, U.S. in the Northwest Atlantic.
		• Prefer temperate ocean regions but thought to be highly adaptable to a variety of environmental conditions.
		  ○ Tolerant of low dissolved oxygen in the water.
		• Dormant in winter with rapid growth in spring and early summer.
		  ○ Found in inshore water from late summer to fall.
		  ○ Typically occurs in the upper layer of the ocean (20 - 40 m) but has been recorded as deep as 200 m (pelagic).
		• Swimming and digestion may be affected by changes in water temperature.
		• Feeds on plankton and fish eggs.
		  ○ Feed near the surface at night and travel into deeper water during the day.
		• Predators include Leatherback Sea Turtles, Sunfish (*Mola mola*), and occasionally seabirds.
			nGSL/ NLS	Abundant

Table Description: This table describes the species and groups that contribute to fish habitat in the Focus Area, the bioregions they occur in, and the status of the populations. Descriptions include available information on distribution, movement, behaviour, diet, predators, and other information where relevant.

Table adapted from State of the Atlantic Ocean Synthesis Report, by Bernier et al., 2023, DFO Can. Tech. Rep. Fish. Aquat. Sci, 3544. Copyright 2023 by the Government of Canada Open Data License Agreement.

Sources: Bernier et al., 2023; Burke da Silva & Nedosyko, 2016; Catto et al., 1999; Christian et al., 2010; DFO, 2015b; 2017e; 2023g; Francis, 1979; Gilkinson & Edinger, 2002; Gosner, 1999; Guijarro et al., 2016; Gullage et al., 2017; 2022; Hooper & van Soest, 2002; Hooper, 1997; Kenchington et al., 2014; 2016; Kozloff, 1990; Morley et al., 2014; NOAA, 2024a; Pham et al., 2019; Pierrejean et al., 2020; Randall & Fautin, 2002; The Coral Reef Alliance, 2003; Vad et al., 2021; Wareham Hayes & Edinger, 2007; Wilson & Ruff, 1988.

7.4.2.3.2 Crustaceans

There are a large variety of crustacean species known to occur within the Focus Area (Bernier et al., 2023; Christian et al., 2010; Gosner, 1979; Wong & Dowd, 2015). For the purpose of this Report example species will be discussed and their key characteristics will be described in Table 7.4.4 (Chabot et al., 2013; Christian et al., 2010). Though Northern Shrimp (*Pandalus borealis*) are important to Newfoundland and Labrador they are not numerous within the Focus Area and are not discussed further in this Report.

Since the fisheries for American Lobster, Snow Crab (*Chionoecetes opilio*), Jonah Crab, Toad Crab (*Hyas coarctatus*), and Rock Crab were established in the 1900's they have all experienced periods of decline which are largely attributed to overfishing that was occasionally exacerbated by environmental conditions (Bernier et al., 2023; Christian et al., 2010; Department of Fisheries & Aquaculture, n.d.-c; DFO, 2008a; 2017f; 2018h; 2021c; 2022l).

During public engagement sessions in June 2024, fish and lobster harvesters repeatedly mentioned that American Lobster landings and abundance have been increasing over the past several years. This change is also reflected in the literature (DFO, 2021c). This increase in abundance may be due to warming sea waters which are thought to be favourable for habitat and recruitment (Chabot et al., 2013). However, landings and relative abundance of other crab species are low or declining in recent years (Bernier et al., 2023; Chabot et al., 2013; Mullowney et al., 2014).

The primary anthropogenic threats to American Lobster and several crab species in the Focus Area are overfishing and variations in oceanographic conditions (see Section 7.4.1.2 of this Report), followed by disturbance to habitat, and seismic activity (Bernier et al., 2023; Carroll et al., 2017; Morley et al., 2014; Mullowney et al., 2014; Weilgart, 2018).

Climate change and the associated warming of ocean waters is anticipated to have a negative impact on Snow Crabs and Toad Crabs as they require cold waters to develop properly. Warming ocean temperatures may affect other crab species in the area through similar mechanisms, but further research is required (Guenette, 2013; Thirukanthan et al., 2023). American Lobsters develop more quickly in warm water and are more likely to benefit from changing ocean conditions, potentially leading to range expansion (DFO, 2021c; Perkins, 1972).

Table 7.4.4. Large Crustaceans that Occur in or Adjacent to the Focus Area

Common Name (Scientific name)	Description	Bioregion	Status/ Trend Information

American Lobster (*Homarus americanus*)	• Distribution range spans from southern Labrador to Cape Hatteras, U.S.
	• Prefer rocky coastal habitats; warmer waters are causing them to appear offshore on the shelves.
	• Non-migratory but tend to be found in deeper water during winter and shallower region in spring/summer.
	• Kelp is important for juveniles and provides cover from predators.
	• Adults feed primarily on benthic invertebrates, crab, sea urchins, mussels, periwinkles, polychaetes with a preference for more calcium rich prey near moulting.
	  ○ Diet changes throughout life stages
	• The larvae and juvenile stages are prey for fish, zooplankton, and bottom-feeders.
	• Predators include crabs, octopus, fish, sharks, and skates for adults.
	• Spawning occurs in summer and fall, with female lobsters carrying the developing eggs until hatching (May - July).
	  ○ Bay St. George noted as an important spawning area by participants during engagement.[90]
	  ○ Water temperatures influence the rate of development with colder temperatures causing longer development times.
		nGSL/ NLS	Healthy/ Increasing

[90] A summary of this engagement session is available on the Registry under document reference number 385.

Common Name (Scientific name)	Description	Bioregion	Status/ Trend Information

Snow Crab (*Chionecetes oplio*)	• Distribution range spans from Greenland to the Gulf of Maine in the northwest Atlantic.
	• Prefers colder water temperatures between -1°C - 6°C.
	  ○ Temperatures > 7°C are detrimental to Snow Crab.
	• Usually found on soft (mud or mud/sand) bottoms at depths of 60 - 400 m.
	• Spawning occurs April - May in shallow waters (10 - 40 m) with larvae presence peaking mid-June/July.
	• Adult diet consists of polychaetes, clams, sea stars, and brittle stars.
	  ○ Diet changes throughout life stages.
	• Predators include various groundfish, Thorny Skate (*Amblyraja radiata*), other Snow Crab, and seals.
	• Participants noted that 3Ps is an important area for Snow Crab fisheries.[91]
		nGSL/ NLS	Healthy/ declining

Jonah Crab (*Cancer borealis*)	• Distribution range spans from southern Labrador to Florida, U.S. in the west Atlantic, with some presence in Newfoundland and Labrador. • Prefer inter-tidal to deep water, occur at depths of 5 - 450 m but most often found in shallow waters < 20 m in the northern part of its range. • Spawning occurs April - May in shallow waters (10 - 40 m) with larvae presence peaking mid-June/July. • Found in habitats with rocky to silt/clay bottoms.	nGSL/ NLS	Recent decline

[91] A summary of this engagement session is available on the Registry under document reference number 385.

Common Name (Scientific name)	Description	Bioregion	Status/ Trend Information
Toad Crab (*Hyas spp*.)	• Distribution range spans both sides of the Atlantic Ocean, abundant off Newfoundland coast. • Prefer shallow sub-tidal habitat and depths up to 700 m. • Prefer gravel, sand, or mud substrate. • Overlap with Snow and Rock crab distributions but prefer habitat farther offshore. • Larvae hatch in the warm summer months. • Planktonic larvae are prey for surface feeding fish and other zooplankton. • Adult diets consist of amphipods, polychaetes, bivalves, sea urchins, ophiuroids, gastropods, smaller crabs, and scavenged fish. • Predators include groundfish, skate, seals, lobster, and other crustaceans. • Water temperatures may affect egg development.	nGSL/ NLS	Unknown
Rock Crab (*Cancer irroratus*)	• Distribution range spans from southern Labrador to Florida, U.S. in the west Atlantic, with some presence in Newfoundland and Labrador. • Prefer inter-tidal to deep water, occur at depths of 5 - 450 m but most often found in shallow waters < 20 m in the northern part of its range. • Common in inshore waters along all coastlines. • Spawning occurs April - May in shallow waters with larvae hatching mid-June. • Adult diet includes juvenile scallops, mussels, snails, urchins, brittle stars, amphipods, shrimp, and polychaetes. ○ Diet changes throughout life stages. • Predators include groundfish, lobster, and occasionally sea birds.	nGSL/ NLS	Recent decline (nGSL)

Table Description: This table describes the representative large crustacean species that occur in the Focus Area, the bioregions they occur in, and the status and trends of their populations. Descriptions include available information on distribution, movement, behaviour, diet, predators, reproduction, and other information where relevant.

Table adapted from State of the Atlantic Ocean Synthesis Report, by Bernier et al., 2023, DFO Can. Tech. Rep. Fish. Aquat. Sci, 3544. Copyright 2023 by the Government of Canada Open Data License Agreement.

Sources: Bernier et al., 2023; Carroll et al., 2017; Carter & Steele, 1981; Chabot et al., 2013; Christian et al., 2010; Department of Fisheries & Aquaculture, n.d.-c; DFO, 2007a; 2008a; 2017f; 2018h; 2021c; 2022l; Ennis, 1973; Gosner, 1979; Guenette, 2013; Morley et al., 2014; Mullowney et al., 2014; Perkins, 1972; Thirukanthan et al., 2023; Weilgart, 2018; Wong & Dowd, 2015.

7.4.2.3.3 Molluscs and Annelids

There are a large variety of mollusc and annelid species known to occur within the Focus Area. For the purpose of this Report example species will be discussed and their key characteristics described in Table 7.4.5 (Bernier et al., 2023; Chabot et al., 2013; Christian et al., 2010; DFO, 2023g; h).

Stock assessments for all the molluscs and marine annelids discussed below have not been conducted in the Focus Area and population abundance is unknown.

Anthropogenic threats to the various species include exploitation, variations in oceanographic conditions (see Section 7.4.1.2 of this Report), disturbance of habitat, seismic activity, and pollution (Bernier et al., 2023; Carroll et al., 2017; Chen, 2021; Christian et al., 2010; Morley et al., 2014; Rogers et al., 2023).

Molluscs (with the exception of squid) are at a considerable risk due to the effects of climate change as ocean acidification may affect their ability to form shells from calcium carbonate (Byrne & Fitzer, 2019; Christian et al., 2010). Sedentary molluscs such as scallops, Surf Clams, and whelks may also experience negative effects due to the warm water conditions caused by climate change (Christian et al., 2010). Marine annelids require specific water temperatures for spawning, fertilization, and development and are anticipated to also be negatively impacted by climate change and the associated warming of ocean waters (Christian et al., 2010; Wilson & Ruff, 1988). However, Northern Shortfin Squid (*Illex illecebrosus*) and Longfin Inshore Squid (*Loligo pealeii*) prefer warmer water temperatures and may experience positive effects such as range expansion or changes to migration, as a result of climate change (Christian et al., 2010).

Table 7.4.5. Molluscs and Annelids that Occur in or Adjacent to the Focus Area

Common Name (Scientific name)	Description	Bioregion	Status/ Trend Information
Molluscs			

Sea Scallop (*Placopecten magellanicus*)	• Found throughout the sheltered shallow, coastal waters around Newfoundland on sand-gravel or gravel-pebble bottoms.
	  ○ Common in Port au Port, Salmonier Arm, Long Harbour, and western Placentia Bay.
	• Three aggregations of soft substrates on St. Pierre Bank identified as potential habitat.
	• Juveniles attach themselves to solid material on various substrates with a preference for firm gravel and cobble with good water flow.
	• Susceptible to elevated sea temperatures, e.g. 20 - 24°C.
	• Larvae are planktonic, feeding on plankton and being prey for planktivores.
	• Both juvenile and adult Sea Scallops can swim and do this to evade predators.
	• Adults are filter feeders and tend to remain in place in areas with strong currents.
	  ○ Aggregate in dense groups called beds.
	• Predators include Rock Crab, American Lobster, sea stars, moon snails, cod, American Plaice (*Hippoglossoides platessoides),* wolffish, sculpins, and Winter Flounder (*Pseudopleuronectes americanus*), as well as worms and sponges.
		nGSL/ NLS	Unknown/ Healthy

Icelandic Scallop (*Chlamys islandica*)	• Distribution range spans from the Hudson Strait and Northwest Territories to mid-U.S. ○ Common in the southwest Avalon Peninsula, Placentia Bay, and St. Pierre Bank. • Found in areas 50 - 100 m water depth on hard substrates of mixtures of sand, gravel, rocks, boulders, and shell fragments with strong currents. • Spawning occurs April - May in Newfoundland and July - August in the nGSL. • Larval hatch occurs hours after egg fertilization.	nGSL/ NLS	Unknown/ Healthy

Common Name (Scientific name)	Description	Bioregion	Status/ Trend Information
	• Adults are filter feeders and tend to remain in place in areas with strong currents. • Aggregate in dense groups called beds. Predators include Rock Crab, American Lobster, sea stars, moon snails, cod, American Plaice, wolffish, sculpins and Winter Flounder as well as worms and sponges. • Key predators are sea stars and Waved Whelk (*Buccinum undatum*).		
Atlantic Surf Clam (*Spisula solidissima*)	• Distribution range spans from the GSL to North Carolina, U.S. in the northwest Atlantic. • Largest bivalve in the western Atlantic Ocean. • Long lived (~35 years), filter feeders. • Planktonic larvae and juveniles burrow into medium to fine sands at 50 - 80 m depth. • Adults live in medium to coarse grained gravel from intertidal zones to depths of 50m. • Predators include snails, crabs, and fish (e.g. cod, Haddock (*Melanogrammus aeglefinus*)).	nGSL	Stable
Arctic Surf Clam (*Mactromeris polynyma*)	• Distribution range spans from the Arctic south to Rhode Island, U.S. in the northwestern Atlantic Ocean. • Prefer sandy bottoms and intertidal habitats up to depths of 100 m. ○ Found inshore in the GSL. • Slow growing, long lived, and sedentary species. • Filter feeders with microalgal (small algae) diet. • Spawning often occurs in fall, though some inshore populations may spawn in spring. • Larvae hatch 1 - 4 days after spawning depending on water temperature. • Predators include sea stars and large groundfish. Species such as Waved Whelks, Toad Crab, and Rock Crab scavenge them.	nGSL	Stable

Common Name (Scientific name)	Description	Bioregion	Status/ Trend Information
Waved Whelks (*Buccinum undatum*)	• Distribution range spans throughout Newfoundland, GSL, and into New Jersey U.S. • Found in intertidal areas to depths of 100 m with greatest densities at 15 - 30 m on soft bottoms. • Prefers cold water environments < 0°C - 5°C. • Sedentary, often partially buried, but can move along the seafloor. • Females lay eggs in spring/summer (in nGSL), hatching 3 – 8 months later. • Diet consists of molluscs and other invertebrates. ○ Feed on live or dead animal tissue. • Key predators are sea stars, crab, lobster, and some fish species. • Some participants noted that whelk are important to the fisheries in 3Ps.	nGSL/ NLS	Declining/ Abundant

Northern Shortfin Squid (*Illex illecebrosus*)/ Longfin Inshore Squid (*Loligo pealeii*)	• Most abundant in Newfoundland and Labrador from late summer to early Fall.
	  ○ Grow rapidly during summer and early fall then are believed to move south to spawn off southeastern U.S in winter.
	• Longfin Inshore Squid prefer temperatures of 6 - 7°C and tend to stay in deep water during daylight hours.
	  ○ Migrate seasonally to avoid colder water temperatures < 8°C.
	• Highly cyclical in occurrence.
	• Pelagic, travel in schools.
	• Diet consists of crustaceans, fish, and squid.
	  ○ Diet changes throughout various life stages.
	• Predators include fish, marine mammals, and birds.
		nGSL/ NLS	Low productivity state/ Unknown

Common Name (Scientific name)	Description	Bioregion	Status/ Trend Information
Annelids			

Clam Worms (*Nerais spp.*)	• Distribution range spans from the Arctic to mid U.S. waters in the western north Atlantic.
	  ○ Typical found in 'sea grass' habitats such as in St. Paul's Bay, Port au Port Bay, Mortier Bay, and St. Mary's Bay (North Harbour).
	• Prefer upper intertidal to deep subtidal waters, with sediments ranging from sand to gravel.
	  ○ Can be found at depths from 11 - 20 m.
	• Often use burrows for feeding but can also hunt in the open.
	  ○ Considered both benthic and pelagic
	• Often considered solitary animals; can form small reefs in sheltered habitats where populations are dense.
	• Spawning and fertilization success may be dependent on water temperature and typically occurs April – June.
	• Diet consists of amphipods, other worms, and invertebrates.
	• Predators include demersal fish, crab, lobster, sea birds, and shore birds.
		nGSL/ NLS	Unknown

Lugworms (*Arenicola marina*)	• Distribution range spans from the Arctic to mid U.S. waters (Cape Cod).
	  ○ Typical of 'sea grass' habitat such as in St. Paul's Bay, Port au Port Bay, Mortier Bay, and St. Mary's Bay (North Harbour).
	• Prefer intertidal to subtidal waters with soft substrate.
	  ○ Considered both benthic and pelagic.
	• Often considered solitary animals; can form small reefs in sheltered habitats where populations are dense.
	• Spawning and fertilization success may be dependent on water temperature and typically occurs in the fall.
	• Filter feeders, burrow in muddy sediments.
		nGSL/ NLS	Unknown

Common Name (Scientific name)	Description	Bioregion	Status/ Trend Information
Terebellid Worms (*Amphitrite spp.*)	• Distribution range spans from the Arctic to mid U.S. waters. ○ Typical of 'kelp bed' habitat common on coasts of Newfoundland and Labrador. • Intertidal species, burrows on mudflats and eelgrass beds with low salinity. • Considered both benthic and pelagic. • Often considered solitary animals; can form small reefs in sheltered habitats where populations are dense. • Detritus feeder, using sticky tentacles to capture food.	nGSL/ NLS	Unknown

Hard Tube Worms (*Spirorbis spp.*)	• Distribution range spans from the Arctic to Long Island, U.S.
	  ○ Typical of 'kelp forest' habitat common on coasts of Newfoundland.
	• Prefer intertidal to deep water.
	  ○ Attach to rockweed, rocks, and shells.
	• Typically breed in the winter and brood from late spring to fall with spawning occurring from May - September.
	  ○ Temperature may restrict spawning success.
	• Often considered solitary animals; can form small reefs in sheltered habitats where populations are dense.
	• Form calcareous tubes and filter feed.
		nGSL/ NLS	Unknown

Fan Worms (*Mexicola infundibulum*)	• Distribution range spans from the Arctic to mid U.S. waters in the northwest Atlantic. ○ Typical of 'scallop bed' habitat typical of Newfoundland's coastal areas. Prefer lower intertidal waters in their northern range. • Often found at depths of 1 - 20 m but can occur as deep as 500 m. • Prefer temperate waters (8 - 10°C). • Attaches to wharves, pilings, rocks, and buoys. Often found with other sessile animals.	nGSL/ NLS	Unknown

Common Name (Scientific name)	Description	Bioregion	Status/ Trend Information
	• Often considered solitary animals; can form small reefs in sheltered habitats where populations are dense. • Suspension feeder using tentacles. • Spawning, fertilization, and development occurs from July - February.		

Table Description: This table describes the representative mollusc and annelid species that occur in the Focus Area, the bioregions they occur in, and the status and trends of their populations. Descriptions include available information on distribution, movement, behaviour, diet, predators, reproduction, and other information where relevant.

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Sources: Bernier et al., 2023; Byrne & Fitzer, 2019; Carroll et al., 2017; Catto et al., 1999; Chabot et al., 2013; Chen, 2021; Christian et al., 2010; DFO, 2001; 2007e; 2010b; 2011d; 2013b; 2020d; 2021j; 2023g; h; Gosner, 1979; 1999; Hooper, 1997; Kenchington et al., 2014; Morley et al., 2014; Naidu et al., 1999; Ollerhead et al., 2004; Rogers et al., 2023; Rowell, 1986; Wilson & Ruff, 1988.

7.4.2.3.4 Echinoderms

There are a number of echinoderm species that are an integral part of the ecosystem in the Focus Area (Christian et al., 2010). For the purpose of this Report, example species for each group will be described in this section and in Table 7.4.6 (Bernier et al., 2023; Christian et al., 2010; Gosner, 1979; Wong & Dowd, 2015).

Green Sea Urchins (*Strongylocentrotus droebachiensis*) are part of a commercial fishery in Newfoundland and Labrador and experienced a decline in abundance from 2004-2008 (DFO, 2020c). The cause of this decline is associated with fishing effort rather than species abundance (DFO, 2020c; Pisces Consulting Limited, n.d.). More recently the landings for nGSL are in decline, indicating a potential reduction in species abundance in the region (Bernier et al., 2023; Chabot et al., 2013). Stock and abundance assessments have not been performed for the other representative echinoderms in the Focus Area.

The primary anthropogenic threats to echinoderms in the Focus Area are disturbance to habitat, overexploitation, variations in oceanographic conditions, coastal development, and pollution (Bernier et al., 2023; Christian et al., 2010; Dhir & Graham, 2022; Harris, 2012; Mercier et al., 2023; Pisces Consulting Limited, n.d.; Sartori et al., 2023; Weilgart, 2018; Yu et al., 2021).

Climate change and the associated changes in oceanographic conditions are anticipated to have a number of potential negative impacts on echinoderms which require specific temperatures for spawning, prey availability, and development (Bernier et al., 2023; Christian et al., 2010; Harris, 2012). Additionally, ocean acidification, changes to benthic habitats, and a number of other oceanographic changes may also pose a threat to the health of echinoderms (Bernier et al., 2023; Christian et al., 2010; Dhir & Graham, 2022; Harris, 2012; Sartori et al., 2023; Yu et al., 2021).

Table 7.4.6. Echinoderms that Occur in or Adjacent to the Focus Area

Common Name (Scientific name)	Description	Bioregion	Status/ Trend information
Sea Cucumbers (Holothuroidea)			
Orange-footed Sea Cucumber (*Cucumaria frondosa)*	• One of the most abundant and widely distributed echinoderm species on Canada's east coast with circumpolar distribution. • Found from the lower intertidal to depths of 300 m. • Planktonic larvae before settling show a preference for rock/gravel areas with mussel beds. • Adults typically gather in dense aggregations (beds), on rock or gravel substrates. • Spawning occurs from winter to late spring and is associated with phytoplankton blooms. • Adults are believed to be sessile and exhibit low rates of movement. • Adults are filter-feeding planktivores depending on current to feed. • Predators include sea stars, lobster, and Snow Crab. • Some participants noted that sea cucumbers are important to the fisheries in 3Ps.[92]	nGSL/ NLS	Unknown

[92] A summary of this engagement session is available on the Registry under document reference number 385.

Common Name (Scientific name)	Description	Bioregion	Status/ Trend information
Sea Urchins (Echinodermata)			
Green Sea Urchin (*Strongylocentrotus droebachiensis*)	• Typically, most abundant in the shallow subtidal area, (5 - 10 m), but can be found in deeper waters (40 - 60 m.) • Prefer stable rocky grounds (e.g. cobble, boulders). • Planktonic larvae are fed upon by zooplankton and surface feeding fish before settling on the seabed. • Intolerant of low salinity at all stages of life and of temperatures greater than 12°C. • Spawning occurs from spring to early summer. Sometimes spawning can occur in fall if temperature and food conditions are sufficient. • In addition to kelp and other algae, urchins are scavengers on dead animals and can prey successfully on mussels, barnacles, and periwinkles. ○ Can create 'sea urchin barrens' by excessive grazing of kelp. • The main predators of sea urchins in Newfoundland and Labrador coasts include lobsters, crabs, sea stars, flatfish, wolffish, sculpins, Ocean Pout (*Zoarces americanus*), and seabirds.	nGSL/ NLS	Decline in nGSL

Common Name (Scientific name)	Description	Bioregion	Status/ Trend information
Sand Dollars (*Echinarachnius parma*)	• Circumpolar occurrence, distribution range spans from Labrador to Cape Hatteras, U.S. in the northwest Atlantic. • Prefer shallower depths at northern range (intertidal) but can be found as deep as 800 m or greater. • Found on sandy or fine gravel bottoms. • Tend to form dense beds, plays a role in structuring communities in soft bottom habitats. • Spawning occurs late spring/early summer. • Characteristic of 'clam bed' and 'Sea Scallop' habitats which appear along the coasts of Newfoundland. ○ Identified in Shallow Bay, Bonne Bay, Port au Port Bay, Fortune Bay, western Placentia Bay, and Harbour Le-Cou. • Filter feeders. • Predators include sea stars, crab, and sea urchins.	nGSL/ NLS	Unknown
Star Fish (Asteroidea)			
Northern Sea Star (*Asterias rubens* – formerly *A. vulgaris*)	• Distribution range spans from Labrador to Cape Hatteras U.S. in the Northwest Atlantic. • Prefer intertidal habitat in its northern range, and water temperatures < 15°C. • Found in tidal pools, pilings, sandy to stoney bottoms. • Associated with 'sea urchin barrens' habitat which occurs along the coasts of Newfoundland. • Spawning occurs in the spring. ○ Planktonic larvae metamorphose when settled.	nGSL/ NLS	Unknown

Common Name (Scientific name)	Description	Bioregion	Status/ Trend information
	• Adult diet consists of molluscs, brittle stars, and sea urchins. • Predators include crustaceans, fish, other sea stars, and birds.		
Brittle Stars (Ophiuroidea)			
Daisy Brittle Star (*Ophiopholus aculeata*)	• Distribution ranges from the Arctic to Cape Cod, U.S. in the northwest Atlantic. • Typically found in the intertidal zone. • Found at depths up to 1,500 m. • Breeds during late spring/summer. • Adult diet consists of detritus, polychaetes, and small crustaceans. • Predators include lobsters, sea stars, and fish.	nGSL/ NLS	Unknown

Table Description: This table describes the representative echinoderm species that occur in the Focus Area, the bioregions they occur in, and the status and trends of their populations. Descriptions include available information on distribution, movement, behaviour, diet, predators, reproduction, and other information where relevant.

Table adapted from State of the Atlantic Ocean Synthesis Report, by Bernier et al., 2023, DFO Can. Tech. Rep. Fish. Aquat. Sci, 3544. Copyright 2023 by the Government of Canada Open Data License Agreement.

Sources: Bernier et al., 2023; Catto et al., 1999; Chabot et al., 2013; Christian et al., 2010; DFO, 1996; 2001; 2007e; 2010b; 2013b; 2019d; 2020c; 2023g; h;; Dhir & Graham, 2022; Filbee-Dexter & Scheibling, 2014; Gosner, 1999; Harris, 2012; Himmelman, 1986; Medeiros-Bergen & Miles, 1997; Mercier et al., 2023; Naidu et al., 1999; Pisces Consulting Limited, n.d.; Sartori et al., 2023; Weilgart, 2018; Wong & Dowd, 2015; Yu et al., 2021.

7.4.2.4 Fish, Sharks, and Skates

Fish (and other marine species) are often described based on where they occur within the water column and separated into three groups: pelagic, demersal, and diadromous.

Pelagic fish such as Capelin (*Mallotus villosus*), herring, mackerel, tuna, some sharks, and Swordfish (*xiphias gladius*), inhabit open ocean waters, from the sea surface to the seabed. Their movement within the open ocean varies with seasons and life stages.

Demersal fish such as cod, plaice, flounder, redfish, skates, and some sharks, live close to the ocean floor, feeding on smaller fish, benthic invertebrates, or zooplankton.

Diadromous fish such as salmon or eels, are defined by their use of both freshwater and ocean environments at different times in their life cycle. Anadromous species migrate from the sea to freshwater to spawn, e.g., salmon, Striped Bass (*Morone saxatilis*), Sea Lamprey (*Petromyzon marinus*). Catadromous fish migrate from freshwater to salt water to spawn, e.g. eels.

Examples of several fish, shark, and skate species that likely occur regularly in the Focus Area are described below, grouped as pelagic species, forage species, demersal species, and diadromous species. Many marine fish are harvested commercially or support other species as part of the food chain. Both commercially and non-commercially important fish species that have habitats in the Focus Area are discussed below.

The overall biomass of the fish community decreased in the late 1980s and early 1990s across the NLS bioregion resulting in structural changes to the fish community. These changes caused a regime shift, from which. fish stocks have not yet recovered (DFO, 2023h). Some biomass returned between 2020 – 2021, but this does not represent a long-term trend and is not consistent across all species (DFO, 2023h; t).

Changes in the ocean climate (see Section 7.4.2.2 of this Report) may be affecting the structure of marine communities (Bourdages et al., 2023). In the nGSL, one study observed changes to the proportions of fish groups with the biomass of benthivorous fish species (American Plaice, Atlantic Halibut (*Hippoglossus hippoglossus*), Witch Flounder (*Glyptocephalus cynoglossus*) increasing between 2006 and 2022 (Bourdages et al., 2023). The biomass of fish species that prefer warm water (i.e. Silver Hake (*Merluccius bilinearis*)) have also increased between 1990 – 2021 while species that prefer cold water habitats (i.e. Arctic Cod (*Boreogadus saida*), Lumpfish (*Cyclopterus lumpus*), Greenland Halibut (*Reinhardtius hippoglossoides*)) have been in decline (Bourdages et al., 2023). Surveys in the GSL, show major changes in the ecosystem and community structure with higher-than-normal temperatures at all depths (Bourdages et al., 2023). The Focus Area is currently considered to be in a low productivity state (Bernier et al., 2023; DFO, 2023l).

7.4.2.4.1 Large Pelagic Fish and Sharks

Large pelagic species are migratory and can be found throughout the water column typically living solitary lifestyles (Andrzejaczek et al., 2022; COSEWIC, 2011a; Department of Fisheries & Aquaculture, n.d.-b; DFO, 2016b; 2023l). Information on the large pelagic

fish and sharks anticipated to occur in the Focus Area, either as resident or seasonal migrants, is provided in Table 7.4.7. Bigeye Thresher Shark (*Alopias superciliosus*), Tiger Shark (*Galeocerdo cuvier*), Oceanic Whitetip Shark (*Carcharhinus longimanus*), Atlantic Sharpnose Shark (*Rhizoprionodon terraenovae*), and Dusky Shark (*Carcharhinus obscurus*) may migrate through the Focus Area but are not known to regularly occur. These species will not be considered further due to lack of their sporadic presence in the Focus Area.

Distribution of sharks in the Focus Area is largely related to feeding – following prey such as fish, squid and marine mammals. Trends show that both Great White Shark (*Carcharodon carcharias*) and Porbeagle Shark (*Lamna nasus*) are increasing in abundance (Buren et al., 2014; Bernier et al., 2023). During Regional Assessment public engagement, there was anecdotal evidence of sightings of other species observed off the coast of the Island of Newfoundland.[93]

The historic declines in the populations of large pelagics and sharks were primarily caused by overfishing, accidental catch, and changes in prey availability (COSEWIC, 2009b; 2011a; 2014b; 2016; 2019d; 2021b; ICCAT, 2009). Other jurisdictions outside of Canadian waters still maintain fisheries for some at-risk species which likely contribute to the ongoing decline of some species despite prohibitions in Canada (COSEWIC, 2009b; 2011a; 2014b; 2016; 2019d; 2021b; ICCAT, 2009). Most population data is collected via fisheries (bycatch) or opportunistic sightings and many large pelagic species are not commercially fished. The occurrence and abundance for several of these species is unknown for the Focus Area (DFO, 2023h; l).

The current anthropogenic threats to large pelagics and sharks in the Focus Area include overfishing, bycatch, changes to oceanographic conditions, changes to habitat, pollution, underwater noise, and vessel collisions (Bernier et al., 2023; COSEWIC, 2009b; 2011a; 2014b; 2016; 2019d; 2021b; ICCAT, 2009). There are conservation concerns about several shark species described in Section 7.4.1.6 of this Report.

The general expectation is that ocean warming will cause pelagic sharks to extend their distribution northward and arrive earlier in the season (Bernier et al., 2023; DFO, 2023l). The oceanographic changes that result from climate change are also anticipated to impact the health and productivity of large pelagics and various shark species (Bernier et al., 2023; Dell'Apa et al., 2018; 2023; DFO, 2023l; Erauskin-Extramiana et al., 2023). Potential impacts are contested due to the long evolutionary history and high adaptive capacity of sharks (Hazen et al., 2019).

[93] A summary of this engagement session is available on the Registry under document reference number 385.

Table 7.4.7. Large Pelagic Species that Occur in or Adjacent to the Focus Area

Common Name (Scientific name)	Description	Bioregion	Trend Information/ COSEWIC or SARA Status*
Atlantic Bluefin Tuna (*Thunnus thynnus*)	• Canada represents the northern end of their range – highly migratory. • Seasonal migrants. Present in summer months off the coast of Newfoundland and Labrador. ○ Yearly variances in their distribution within the Focus Area and around Newfoundland. • Prefer temperate waters of pelagic ecosystems throughout the North Atlantic. • Prefer surface and subsurface waters but known to dive to depths > 1,000 m. • Adults are opportunistic predators of fish (i.e. herring and mackerel) • Juveniles eat crustaceans, fish, and cephalopods.	nGSL/ NLS	Endangered (COSEWIC)
Swordfish (*Xiphias gladius*)	• Highly migratory, wide distribution across the Atlantic. • Seasonal migrants. Present in the Focus Area from May – November. • Live throughout the water column, present near surface for basking and feeding. • Spend a considerable amount of time near the surface for feeding. • Feed on invertebrates groundfish, pelagics, and deep-water fish.	NLS	Increasing

Common Name (Scientific name)	Description	Bioregion	Trend Information/ COSEWIC or SARA Status*

Porbeagle Shark (*Lamna nasus)*	• Distribution range spans from Newfoundland and Labrador to Cape Hatteras U.S.
	• Perform long-distance seasonal migrations.
	  ○ Move into GSL and NLS in spring and remains until early-winter.
	• Prefer cold, temperate waters from the coast to open ocean.
	  ○ Thermoregulator: can increase or decrease its internal body temperature relative to surrounding water temperatures.
	• Often found in deep basins and along the shelf edge at depths of < 200 m.
	• Found at up to 1,360 m depth in water temperatures of –2 - 15°C.
	• Bear live young (females at age 13 years plus; average litter of 4 pups); pupping is in the Sargasso Sea.
	• Opportunistic predators eat pelagic species (mackerel, herring, squid) in the first part of the year then cod, Lumpfish, and other groundfish in the fall.
	• Highly susceptible to external stressors (e.g., hooking on fishing line; handling and release aboard fishing boat), resulting in physiological lactic acidosis and post-release mortality.
		nGSL/ NLS	Abundance is increasing; Endangered (COSEWIC)

Common Name (Scientific name)	Description	Bioregion	Trend Information/ COSEWIC or SARA Status*

Great White Shark (*Carcharodon carcharias)*	• Distribution ranges from Newfoundland and Labrador to Mexico as part of the Northwest Atlantic population.
	  ○ Present in the Focus Area year-round.
	• Highly mobile migratory species.
	  ○ In Newfoundland and Labrador waters in summer and fall.
	• Range widely in coastal and oceanic waters, often found over the continental shelves.
	  ○ Spend more time in coastal areas during the summer for feeding.
	• Found in depths from near surface up to > 1,000 m but typically at < 50 – 500 m.
	• Long lived (at least 40 years) with a low reproductive rate.
	• An apex predator and opportunistic feeder with diet changing as the shark grows and dentition increases – changes from demersal fish and invertebrates to marine mammals.
	  ○ Adults are opportunistic scavengers of dead whales.
	• Thermoregulator: can increase or decrease its internal body temperature up to 10°C difference with surrounding water temperatures.
		nGSL/ NLS	Abundance is increasing; Endangered (SARA/COSEWIC)

Basking Shark (*Cetorhinus maximus)*	• Coastal, pelagic shark with circumpolar occurrence. • Migratory, moving north in summer and south in late fall). • Huge, filter feeding shark: can be more than 15 m in length. • Swim in near surface waters for feeding. • Prefer water temperatures between 6 – 16°C.	nGSL/ NLS	Special Concern (COSEWIC)

Common Name (Scientific name)	Description	Bioregion	Trend Information/ COSEWIC or SARA Status*
	• Slow swimmer, either individually or in a school. • Feed on plankton, using gill rakers to filter prey.		
Shortfin Mako Shark (*Isurus oxyrinchus)*	• Distribution ranges from Newfoundland and Labrador to Argentina in the Atlantic. • Highly migratory, associated with warm water from the Gulf. ○ In Newfoundland and Labrador waters in summer and fall. Migrate south for over-wintering. • Mainly a tropic species but also found in temperate waters 17 - 22°C. • Found in surface waters up to 500 m depth. • Prey includes squid, mackerel, tuna, bonito, Swordfish, porpoise, sea turtles, other sharks, and on occasion marine mammals.	nGSL/ NLS	Endangered (COSEWIC)
Blue Shark (*Prionace glauca*)	• Found from Newfoundland and Labrador to Argentina, abundant throughout its range. • Highly migratory. ○ Seasonal migrant to Newfoundland and Labrador waters in summer and fall. Migrate south for over-wintering. • Use surface waters to depths of 600 m. • Found in both temperate and tropical waters and prefer water temperatures of 12 - 20°C. • Prey consists of mainly pelagics (mackerel, herring), hakes, and cod, sea ravens, butterfish, tuna, and Swordfish. Opportunistic scavengers of dead whales.	nGSL/ NLS	Not at Risk (COSEWIC)

Common Name (Scientific name)	Description	Bioregion	Trend Information/ COSEWIC or SARA Status*

Common Thresher Shark (*Alopias vulpinus)*	• Eastern Newfoundland represents the northern end of their range in the western Atlantic.
	• Highly migratory – seasonal migrants.
	  ○ Present in the Focus Area from July - November.
	• Prefer temperate to tropical waters.
	• Swim at the surface in coastal waters but can be found at depths of 350 m.
	  ○ Young found in shallow inshore water.
	• Feed on schooling fish and cephalopods.
		nGSL/ NLS	Not Assessed (COSEWIC)

Greenland Shark (*Somniosis microcephalus*)	• Mainly found in polar regions but can be present in Newfoundland and Labrador waters and on occasion as far south as the Gulf of Mexico. • Often found at great depths. In summer at 180 - 730 m but may swim at the surface in cold winter months. Seasonal movements are not well understood. • Slow growing cold-water shark (-2 – 7°C). • No data on life span; expected to be the longest-living vertebrate. • Prey includes Capelin, char, halibut, herring, Lumpfish, salmon, other fish, and marine mammals (e.g. seals, sea lions, whales). • Sometimes mistakenly identified as Basking Shark.	nGSL/ NLS	COSEWIC (not assessed)

Common Name (Scientific name)	Description	Bioregion	Trend Information/ COSEWIC or SARA Status*
Spiny Dogfish (*Squalus acanthias)*	• Distribution ranges span the coastal waters of the Atlantic with the highest abundance between Nova Scotia and Cape Hatteras, U.S. ○ Semi-resident off southern Newfoundland and in the GSL, moving inshore in summer, offshore in winter. • Found in temperate to cold waters (0 - 15°C), from the surface up to 730 m depth. • Wide salinity tolerance; can be found in estuaries. • Can form large schools. • Opportunistic and omnivorous feeder with a diet of small fish and invertebrates.	nGSL/ NLS	Special Concern

Table Description: This table describes the representative large pelagic fish and shark that occur in the Focus Area, the bioregions they occur in, and the status and trends of their populations. Descriptions include available information on distribution, movement, behaviour, diet, and other information where relevant.

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* COSEWIC Status (and SARA classification for Great White Shark) indicated where applicable and where trend information was not available for a species. The protection status of species at risk are described further in Section 7.4.2.7.

Sources: Bernier et al., 2023; Campana et al., 2012; COSEWIC, 2009b; 2010d; 2011a; 2014b; 2016; 2019h; 2021b; Dell'Apa et al., 2018; 2023; Department of Fisheries & Aquaculture, n.d.-b; DFO, 2006b; 2008c; 2015c; 2016b; 2023h; l; Erauskin-Extramiana et al., 2023; ICCAT, 2009; Kulka et al., 2020; Morgan & Sulikowski, 2015; Young et al., n.d.

7.4.2.4.2 Small Pelagics – Forage Species

Small pelagic species (also called forage species) live throughout the water column often forming schools. They are important sources of food for larger fish as well as sharks, seabirds, and marine mammals (Bernier et al., 2023; Wells et al., 2021). While there are a variety of small pelagics that are an integral part of the ecosystem in the Focus Area, example species will be described in this section and in Table 7.4.8 (DFO, 2023h).

The Capelin stock in the NLS bioregion collapsed in 1991 due to overexploitation, and changes to oceanographic conditions. During engagement, DFO indicated that they disagreed with this characterization and stated that the Newfoundland and Labrador Capelin stock did not collapse due to overexploitation.[94] Capelin stock is still at low levels, affecting the abundance of larger fish through the food chain (DFO, 2023h; Murphy et al., 2021). Capelin are at relatively low abundance on the south coast but Capelin stock within 4R have rebounded and are now considered 'Healthy' (DFO, 2023h). Atlantic Herring and Mackerel stock are currently undergoing declines caused by overfishing, changes in environmental conditions, and predation (Calder et al., 2023; DFO, 2023d; e).

Current anthropogenic threats to small pelagic fish continue to include overexploitation, changing oceanographic conditions, pollution, and habitat destruction (Calder et al., 2023; DFO, 2023h; Murphy et al., 2021; Nissar et al., 2022). Climate change is anticipated to affect small pelagic fish through causing changes to prey availability, success of various life stages, growth, development, and fertilization (Calder et al., 2023; DFO, 2023h; Murphy et al., 2021; Nissar et al., 2022).

[94] This submission is available on the Registry under document reference number 379, CSAS IA - NL OSW - RA Draft Report for Public Comment - DFO Science Review (2024).

Table 7.4.8. Small Pelagic Species (Forage Species) that Occur in or Adjacent to the Focus Area

Common Name (Scientific name)	Fishery Management Unit	Description	Bioregion	Stock Status

Capelin (*Mallotus villosus*)	3Ps	• Distribution range spans western Greenland to Maine, U.S. in the northwest Atlantic with the highest distribution on the NLS.
		  ○ Relatively low density along the south coast of Newfoundland.
		• A small schooling forage fish.
		• Sensitive to changes in oceanographic conditions and food availability resulting in 'boom and bust' population cycles.
		• Filter feeders (plankton sized crustaceans).
		• Predators include fish, marine mammals, and birds.
		• 3Ps stock status is unknown due to insufficient data. Efforts to improve data collection includes the Citizen Science Capelin Beach Spawning Diary Network.
		• Spend most of their lives offshore, moving inshore only to spawn.
		  ○ Spawning occurs in summer (June) both at the beach and in deep-water (demersal, < 40 m).
		  ▪ During an engagement session on June 5th, 2024, in Port aux Basques a participant mentioned Capelin spawning occurring near St. Andrews, but that abundance appeared to be declining.
		  ○ Spawning often results in high mortality rates.
			nGSL/ NLS	Unknown

	4RST	• Highest abundance thought to be in 4R. • Spend most of their lives offshore. ○ Spawning occurs (April - August) both at the beach or in deep-water (demersal, < 40 m).		Unknown

Common Name (Scientific name)	Fishery Management Unit	Description	Bioregion	Stock Status

Atlantic Herring (*Clupea harengus*)	3Ps	• Distributed throughout the North Atlantic Ocean.
		  ○ Atlantic herring have their highest densities along the south coast of Newfoundland.
		• Migratory species that travel long distances between feeding, spawning, and overwintering areas.
		• A small schooling forage fish.
		• Filter feeder - diet consists of zooplankton, krill, and fish larvae.
		  ○ Feed at the surface during the night.
		• Predators include fish, marine mammals, shark, and birds.
		• Two stock complexes in 3Ps (south coast of Newfoundland): St. Mary's Bay-Placentia Bay and Fortune Bay.
		  ○ Fortune Bay stock status is low, marked as negative.
		  ○ Placentia Bay overall stock status is uncertain.
		• Spawn in spring and fall at both locations; spring dominant at Fortune Bay.
			nGSL/ NLS	Unknown

	4R	• Two stock complexes in 4R (west coast of Newfoundland) designated by spawning times. ○ No significant risk identified in the short term for both 4R stocks. • Spawn in spring (April/May) and fall (August/September).		Unknown

Common Name (Scientific name)	Fishery Management Unit	Description	Bioregion	Stock Status

Atlantic Mackerel (*Scomber scombrus*)	Northern contingent (3Pn and 4R)	• Distribution range spans from Newfoundland and Labrador to Cape Hatteras U.S. in the western Atlantic.
		  ○ Highest abundance within the Focus Area around the Bay of Islands on the west coast and Placentia Bay on the south coast.
		• Highly migratory species: overwinter at the edge of continental shelf, spawn inshore during spring (June/July), disperse for feeding in summer.
		  ○ During migration some of the northern contingent travels into or through 3P and/or 4R (August - November).
		• A small schooling forage fish.
		• Filter feeder – diet consists of crustaceans, squid, fish, and ascidians.
		• Predators include fish and marine mammals.
		• Spawning Stock Biomass is critically low.
		  ○ Recovery limited by “truncated age structure, low recruitment, and high predation pressure”.
		• Stock decline is associated with overfishing.
		• Commercial and bait mackerel fishing closed in Canada as of 2022/2023.
			nGSL/ NLS	Critical

Table Description: This table describes the representative small pelagic species that occur in the Focus Area, the bioregions they occur in, and the status and trends of their populations. Descriptions include available information on distribution, movement, behaviour, diet, predators, reproduction, and other information where relevant.

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Sources: Bernier et al., 2023; Bourne et al., 2023; Calder et al., 2023; DFO, 2007c; d; 2022a; g, 2023a; d; e; h; Émond et al., 2024; Murphy et al., 2021; Nissar et al., 2022; NOAA, 2024b; g; OCEANA, n.d.-a; b; Wells et al., 2021.

7.4.2.4.3 Demersal Fish and Skates

Demersal fish, also sometimes referred to as groundfish, and skates live and feed near the ocean floor and are an important part of the fisheries in Newfoundland and Labrador. While there are a variety of demersal fish and skates that are an integral part of the ecosystem in the Focus Area, example species will be described in this section and in Table 7.4.9 (Bernier et al., 2023; Bourdages et al., 2023; DFO, 2007c; d; 2023h; Murphy, 1995; Templeman, 2007; Wells et al., 2021).

Many demersal species populations collapsed in the 1990's due to overfishing in the region. The collapse of demersal fisheries in NLS is described in Sections 7.7 and 7.8. While some stocks have recovered back to healthy numbers, many others remain critical or threatened. There are conservation concerns about several demersal fish and skate species described in Section 7.4.2.7. The stock increases for some species are occurring in the southern part of the NLS bioregion (DFO, 2022j). Current anthropogenic threats to demersal fish and skate species are overfishing, bycatch, variations in oceanographic conditions due to climate change, changes to habitat, pollution, and seismic activity (Bernier et al., 2023).

While, most groundfish species prefer cold water environments, some demersal fish prefer warmer waters including Silver Hake, Cusk (Brosme brosme), Haddock, and Sand Lance (*Ammodytidae dubius*). White Hake and Atlantic Wolffish (*Anarhichas lupus*) have a broader temperature range (Bourdages et al., 2023; COSEWIC, 2012c; DFO, 2023h). Climate change is anticipated to affect demersal fish species and skates through causing changes to their prey availability, distribution, development, as well as through other changes to oceanographic conditions. The demersal fish species that prefer cold water may be more susceptible to ocean warming and experience range contractions while those that prefer warmer water or have wider temperature tolerances may experience lesser effects and range expansions (Bourdages et al., 2023; COSEWIC, 2012c; DFO, 2023h).

Table 7.4.9. Demersal Species that Occur in or Adjacent to the Focus Area

Common Name (Scientific name)	Description/ Trend Information	Bioregion	Stock Status/ COSEWIC or SARA Status*

Atlantic Cod (*Gadus morhua)*	• Distribution range spans from Greenland to Cape Hatteras U.S. in the northwest Atlantic.
	  ○ Occur in the highest densities in the northern areas of NLS.
	• Prefer cold water habitats with coarse sediment bottoms.
	• Live near the ocean floor along slopes and ledges at depths of 10 - 155 m.
	• No specific habitat requirements for spawning, can occur in both shallow or deep water.
	• Planktonic larvae, young settle to the bottom for 1 - 4 years in coastal waters (e.g., eel grass beds), or offshore in 50 – 150 m depth.
	• Juveniles feed on shrimp and small crabs, adults eat shellfish, Capelin, mackerel, herring, and young Haddock.
	• Cod are eaten by sharks, marine mammals, and Spiny Dogfish.
	• 3Ps:
	  ○ Spawning occurs April - August, though timing is variable.
	  ○ Stock occurs from Cape St. Mary's to west of Burgeo Bank, covers St. Pierre Bank, and much of Green Bank.
	  ○ Spawning stock biomass is critically low. Species expected to experience modest growth in the short-term.
	  ○ Recovery limited by increased natural mortality (poor fish condition) and low recruitment.
	• 3Pn and 4R:
	  ○ Spawning occurs March - June, though timing is variable.
	  ○ Spawning stock biomass is critically low. Species expected to experience modest growth in the short-term.
	  ○ Fisheries closure for the species during spawning and winter.
		GSL
		NLS
			3Ps: Critical
			3Pn and 4R: Critical;
			Endangered (COSEWIC)

Common Name (Scientific name)	Description/ Trend Information	Bioregion	Stock Status/ COSEWIC or SARA Status*

Atlantic Halibut (*Hippoglossus hippoglossus)*	• Extensive range from northern Greenland to Virginia, U.S in the northwest Atlantic.
	• Prefer water temperatures between 3 - 5°C.
	• Prefer deep-water channels (200 - 500 m) for habitat. Larger individuals spend winter in deeper waters.
	• Juveniles prey on benthic invertebrates, hermit crabs, mysids, and other crabs while adults' prey on flatfish, redfish, and pollock.
	• Predators include seals, Killer Whale (*Orcinus orca*), and the Greenland Shark.
	• 3Ps:
	  ○ Stock is increasing but spawning stock biomass is low.
	  ○ Spawning time/location unknown, but anecdotal information from harvesters suggests it occurs in deep water December - March.
	  ○ Historically overfished; stocks increasing since 1990's, considered 'Healthy' as of 2022.
	• 4R:
	  ○ Avoid cold intermediate depth layer (50 - 100 m).
	  ▪ Seasonally migratory; summer in shallow waters (< 50 m) and travel to deeper waters in winter.
	  ○ Stock has steadily increased since the 2000's.
		nGSL/ NLS	3Ps and 4R: Healthy

American Plaice (*Hippoglossoides platessoides*)	• Distribution range spans from southern Greenland to New England, U.S in the northwest Atlantic. ○ Wide distribution around Newfoundland and Labrador. • Often found on continental shelves > 300 m but can live in deep water > 1,000 m deep. • Prefer cold water but have a wide temperature tolerance (-0.5 - 5°C) • Inhabit areas with soft sediment suitable for burrowing.	NLS	Critical; Threatened (COSEWIC)

Common Name (Scientific name)	Description/ Trend Information	Bioregion	Stock Status/ COSEWIC or SARA Status*

	• Adult diet includes sand dollars, brittle stars, polychaetes, Capelin, and Sand Lance.
	• Relatively sedentary on the sea floor but move up at night to capture prey.
	• 3Ps:
	  ○ Stock is critically low with little to no growth, expected to remain below limit reference point.
	  ○ Spring spawning, no specific grounds.
	  ○ Recovery potentially limited by warming water, and increased presence of warm water fishes contributing to structural changes in the habitat.		

Haddock (*Melanogrammus aeglefinus*)	• Distribution range spans from Strait of Belle Isle to Cape Hatteras U.S. in the northwestern Atlantic.
	• Some seasonal movement to deep water in winter, shoreward in summer.
	• As adults found on smooth sea bottoms of gravel, hard sand, pebbles in deeper water.
	  ○ Juveniles prefer shallower water on banks and shoals.
	• Adult diet consists of crustaceans, polychaetes, molluscs, echinoderms, and some fish.
	• Predators include Spiny Dogfish, skates, and groundfish when juvenile as well as some marine mammals such as Grey Seals (*Halichoerus grypus*) when adults.
	• 3Ps:
	  ○ Spawning occurs in the spring on the St. Pierre Bank.
	  ○ As of 2018, species abundance, biomass, and spawning stock biomass remains in the critical zone.
	  ▪ Recovery is potentially limited by the reduced productivity conditions (bloom magnitude and zooplankton biomass) of the 3Ps ecosystem.
	  ○ Large sporadic recruitment events important for the 3Ps stock have not been observed since 2007.
		NLS	Critical

Common Name (Scientific name)	Description/ Trend Information	Bioregion	Stock Status/ COSEWIC or SARA Status*

Lumpfish (*Cyclopterus lumpus*)	• Distribution ranges from Hudson's Bay to New Jersey, U.S. in the northwest Atlantic.
	  ○ Occur in nGSL with high concentrations on the St. Pierre Bank.
	• Often attach to solid objects in the water column.
	• Found in coastal waters from 20 - 1,000 m.
	• Prefer deeper colder water as juveniles and adults (-1.9 - 12°C).
	• Migrate during late spring to shallow coastal waters to spawn, laying sticky masses of eggs on the rocky sea bottoms.
	• Adult diet consists of shrimps, amphipods, copepods, and small fish (e.g. herring, Sand Lance).
	• Preyed on by seals, Sperm Whales, and Greenland Shark.
	• 3P and 4R:
	  ○ Inshore fishery for female roe (eggs) established in 1976, with discarding of males at sea.
	  ○ Commercial landings in sharp decline since 2005 across its Canadian range, but abundance is stable in the nGSL.
		nGSL/ NLS	Threatened (COSEWIC)

Sand Lance (*Ammodytidae dubius*)	• Distribution range spans from Greenland to Cape Hatteras U.S. in the northwestern Atlantic.
	  ○ High density populations on St. Pierre Bank, Green Bank, and Fortune Bay.
	• Considered relatively non-migratory.
	  ○ Spends summer in areas deeper offshore and returns to the coastal areas in the fall.
	  ○ Larger populations offshore than inshore.
	• Prefer water depths < 100 m but can be found in areas deeper than 270 m.
	• Prefer temperature waters from 1 - 11°C. Spawn during winter in sand.
	• Burrow during night in sand or gravel bottoms.
		nGSL/ NLS	Healthy

Common Name (Scientific name)	Description/ Trend Information	Bioregion	Stock Status/ COSEWIC or SARA Status*
	○ Leave burrows in schools during the day to feed. • Replace Capelin as primary forage fish for cod, Haddock, and American Plaice in southern areas • Juvenile and adult diet consists primarily of copepod *C. finmarchicus*, though they also consume other planktonic organisms. • Predators include seabirds, shore birds, fish, and marine mammals.		
Pollock (*Gadidae*)	• Distribution range spans from Southern Labrador to Cape Hatteras, U.S. in the North Atlantic. ○ Newfoundland represents the northern end of their range, with presence along the slopes of St. Pierre Bank. ○ Young pollock occasionally school in harbours along the south coast in summer. • Cold water species that prefer water temperatures of 0 - 10°C. • Semi-pelagic species that spends little time at the ocean bottom. • Often congregate in large groups • Adult diet consists of crustaceans, primarily amphipods, and other fish. • 3Ps: ○ Commercial landings peaked in 1986 but have since declined. ▪ Under a moratorium since 1993. ○ Recovery is potentially limited by the reduced productivity conditions (bloom magnitude and zooplankton biomass) of the 3Ps ecosystem.	NLS	Critical

Common Name (Scientific name)	Description/ Trend Information	Bioregion	Stock Status/ COSEWIC or SARA Status*

White Hake (*Urophycis tenuis*)	• Distribution range spans from the Grand Banks to North Carolina, U.S.
	  ○ Present in the GSL and the slopes of St. Pierre Bank.
	• Prefer water temperature 4 - 10°C.
	• Large adults tend to prefer deep waters while juveniles typically stay in shallow areas close to shore or around shallow banks offshore.
	• Competition from Silver Hake in area of new habitat poses a concern.
	• 3Ps:
	  ○ Last large sporadic recruitment in 2000.
	  ○ Biomass is stable around historical average (1996 - 2017).
	  ○ The primary index for this stock has not been completed since 2019. Surveys indicate most of the stock is in 3Ps. Recovery is potentially limited by the reduced productivity conditions (bloom magnitude and zooplankton biomass) of the 3Ps ecosystem.
		GSL/ NLS	Unknown; Threatened (COSEWIC)

Silver Hake (*Merluccius bilinearis)*	• Distribution range spans from Labrador to Cape Hatteras, U.S. in the northwest Atlantic. • Prefer warmer water (2 - 17°C), known to be bottom dwellers (50 - 400 m). • Travel higher in the water column at night to feed. • Seasonal migration in winter to deeper waters and inshore in summer. • Peak spawning occurs in summer (July - August) in shallow waters. • Adult diet consists of fish, crustaceans, and squid. • 3Ps: ○ Stock has steadily increased since 2008; currently the most dominant piscivorous fish species in 3Ps.	NLS	Unknown

Common Name (Scientific name)	Description/ Trend Information	Bioregion	Stock Status/ COSEWIC or SARA Status*

Witch Flounder (*Glyptocephalus cynoglossus)*	• Distribution range spans from Labrador to North Carolina, U.S. in the west Atlantic.
	  ○ Present in shelf slope waters along the eastern edge of the Laurentian Channel and the southeastern slope of St. Pierre Bank.
	• Prefers deep water (100 - 400 m) and can be found as deep as 1,600 m.
	• Often found in soft substrate habitats with water temperatures of 3 - 6°C.
	• Not known to migrate seasonally but may travel for spawning (January - May).
	  ○ Forms dense groups during spawning.
	• Adult diet consists of annelids and other benthic invertebrates.
	• 3Ps:
	  ○ Stock fluctuated between 1970 - 1990, with low abundance in the mid 1990's.
	  ▪ The stock has remained stable since 2016.
		NLS	Healthy

Greenland Halibut (*Reinhardtius hippoglossoides)*	• Distribution range spans from Baffin Island to Grand Banks in the north Atlantic. • Highly migratory • Prefer cold waters and deep channels (200 - 400 m) with softer substrates. • Spawning occurs annually in early spring (January - March) southwest of Newfoundland in the Laurentian Channel. • Juvenile diet consists of Northern Shrimp, small fish, and squid while adults' prey on crustaceans, and other fish such as Capelin and redfish. • Predators include Hooded Seals (*Cystophora cristata*), Beluga Whale (*Delphinapterus leucas*), and Greenland Shark. • 4R: ○ Stock expected to remain stable, stock status listed as "cautious" as a precautionary measure.	nGSL	Cautious

Common Name (Scientific name)	Description/ Trend Information	Bioregion	Stock Status/ COSEWIC or SARA Status*

Acadian Redfish (*Sebastes fasciatus*)/ Deepwater Redfish (*Sebastes mentella)*	• Distribution ranges from Hudson Strait to Maine, U.S. (*S. fasciatus*) and Baffin Bay to the Scotian Shelf (*S. mentella*).
	• Found in depths of 150 - 300 m (*S. fasciatus*) and 350 - 500 m (*S. mentella*).
	• Prefer cold water habitats (4.5 - 7.0°C) along slopes and migrate vertically in the water column daily (semi-pelagic).
	• Adult diet consists of planktonic and benthic invertebrates, and small fish.
	• Predators include large fish such as cod and other redfish, Harp Seals (*Pagophilus groenlandicus*), and skates.
	• 3Pn, 3Ps, and 4R:
	  ○ All stocks had a significant population decline between 1970 - 1995.
	  ▪ Recovery efforts and management as of 1995 with a moratorium in place for 3Pn and 4R, no moratorium in 3Ps.
	  ○ Biomass increase in all regions since 2016.
	  ○ Deepwater Redfish spawning stock biomass in the Healthy Zone.
	  ○ Stocks expected to continue increasing in biomass in the near future.
		nGSL/ NLS	*S. fasciatus:* Unknown**; Threatened (COSEWIC)
			S. Mentella: Healthy; Threatened/ Endangered (COSEWIC)

Common Name (Scientific name)	Description/ Trend Information	Bioregion	Stock Status/ COSEWIC or SARA Status*
Northern Wolffish (*Anarhichas denticulatus*)/ Spotted Wolffish (*Anarhichas minor*)/ Atlantic Wolffish (*Anarhichas lupus*)	• Distribution ranges from Labrador Sea (A. *denticulatus* and *A. minor)* and Baffin Island (*A. lupus*) to the Grand Bank of Newfoundland (all species), the GSL (*A. minor* and *A. lupus*) and Scotian Shelf (*A. lupus*). • Found in depths of 200 - 750 m (*A. minor*) and 500 - 1,000 m (*A. denticulatus)* on the continental shelf and in deep trenches. • Water temperature plays a significant role in habitat selection with preferred temperatures of 2 - 5°C (A. *denticulatus* and *A. minor)* and -1.5 - 13°C (*A. lupus*). • Fairly sedentary species as adults; juveniles can travel far. • Adult diet consists primarily of echinoderms, crustaceans, molluscs and sometimes fish (*A. minor* and *A. lupus*), while the main prey for *A. denticulatus* are jellyfish, ctenophores (comb jellies) and infrequently fish Predators include seals and large fish. • Historically significant declines in abundance (> 90%) and species range. • All three species have experienced small increases in abundance and range. • Insufficient data for stock assessments of the species. • Critical habitat has been identified in the Focus Area for all three species (see Section 7.4.6 for more details). • A participant noted there being wolffish in Bay St. George during an engagement session on June 5th, 2024, in Stephenville.	nGSL/ NLS	A. *denticulatus* and *A. minor*: Threatened (*SARA*) *A. lupus:* Special Concern (*SARA*)
Cusk (*Brosme brosme*)	• Highest abundance across distribution range is found from Grand Banks to Gulf of Maine U.S. ○ Rare, but present in deep waters along the continental shelf edge off Newfoundland and Labrador. • Most prevalent at depths 50 – 375 m and recorded as deep as 1,185 m, seldom found closer to shore.	NLS	Endangered (COSEWIC)

Common Name (Scientific name)	Description/ Trend Information	Bioregion	Stock Status/ COSEWIC or SARA Status*
	• Prefers warm waters 6 - 10°C. • Found over hard rock or gravel bottoms. • Spawning occurs outside the Focus Area. • Adult diet consists of crustaceans, krill, squid, and numerous fish species. • Predators include Spiny Dogfish, Winter Skate, Atlantic Cod, Atlantic Halibut, White Hake, Atlantic Monkfish (*Lophius americanus*), and Grey Seals. • Population declined from the 1970's – 2000's. ○ Population abundance has been low but stable since 1999. • By-catch in longline and lobster fisheries.		

Roundnose Grenadier (*Coryphaenoides rupestris*)	• Distribution range spans from Davis Strait to Georges Bank in north Atlantic Canadian waters.
	• Prefer water temperatures between 3.5 - 4.5°C.
	• Deep water species, most abundant at depths > 800 – 1,000 m.
	• Long lived (60 years), slow growing, can form large schools.
	• Adult diet includes invertebrates, amphipods, and squid.
	• Population depleted by commercial fishing between 1950 - 1990's.
	  ○ Moratorium in place since 1997. Populations thought to be stable since the 2000's.
	  ○ Appears in bycatch.
		nGSL/ NLS	Endangered (COSEWIC)

Roughhead Grenadier (*Macrourus berglax*)	• Distribution range spans from Baffin Bay to the Scotian Shelf in Canadian waters. ○ Not found in the GSL, • Prefer water temperatures between -0.5 - 5.4°C. • Prefers deep water, found mainly at 800 – 1,500 m depths on continental slope.	NLS	Not at Risk (COSEWIC)

Common Name (Scientific name)	Description/ Trend Information	Bioregion	Stock Status/ COSEWIC or SARA Status*
	• Adult diet includes invertebrates such as brittle stars, polychaetes, gastropods, bivalves, crustaceans, and fish. • Predators include other fish such as the Greenland Halibut, and seals. • Population has increased since 1995. ○ Appears in bycatch and fisheries outside the Focus Area.		

Smooth Skate (*Malacoraja senta*)	• Distribution ranges from mid-Labrador coast to Georges Bank in Canadian waters.
	• Prefer waters from 2.7 - 10°C and soft bottom substrates.
	• Found in greatest concentrations between 150 - 550 m but found as shallow as 25 m and as deep as 1,436 m.
	• Egg cases are laid on the seabed when spawning. Young hatch as free-swimming juveniles.
	• Adult diet consists primarily of crustaceans as well as some fish (Capelin).
	• Predators include marine mammals and eggs may be preyed upon by gastropods.
	• Species may benefit from warming water trends through an expansion of suitable habitat
	• Appears in bycatch of numerous commercial fisheries.
	• 3P and 4R:
	  ○ Stock declined in the 1980/90's and has remained low.
	  ▪ Last stock assessment indicated a stable trend in biomass as of 2015 and a population increase for the Laurentian-Scotian population.
		nGSL/ NLS	Special concern (3P)

Common Name (Scientific name)	Description/ Trend Information	Bioregion	Stock Status/ COSEWIC or SARA Status*

Thorny Skate (*Amblyraja radiata*)	• Distribution range spans from Greenland to South Carolina, U.S. in the western Atlantic.
	  ○ Occur in the GSL and on St. Pierre Bank, Green Bank, and Burgeo Bank.
	• Bottom-dwellers, prefer water temps 0 - 10°C.
	• Found on both hard and soft seabeds.
	• Adult diet consists of krill, crustaceans, polychaetes, other invertebrates, and fish.
	• Predators include other fish and potential seals.
	• Reported landings have declined since 2000, particularly in their southern range.
	• Appears in by-catch of numerous commercial fisheries.
	• 3Ps:
	  ○ Stock is stable at low biomass. Stock is currently above the limit reference point.
	  ○ Low biomass in GSL but increasing in areas within the NLS.
		nGSL/ NLS	Data limited;
			Special Concern (COSEWIC)

Winter Skate (*Leucoraja ocellata*)	• Distribution range spans from the nGSL to Cape Hatteras, U.S. in the northwest Atlantic. • Predators include other fish and potential seals. • Bottom-dwellers, prefer water temps 5 - 16°C. • Winter Skate diet changes with increasing size: crustaceans decrease in importance as skate length (and mouth gape) increases, while fish become increasingly important prey for larger (> 81 cm) Winter Skates and can constitute > 50% of the diet. Predators include other skates, sharks, and seals, particularly Grey Seals. • Abundance has declined since the 1970's and remains low. ○ Appears in by-catch.	nGSL/ NLS	Endangered (COSEWIC)

Table Description: This table describes the representative demersal fish and skate species that occur in the Focus Area, the bioregions they occur in, and the status and trends of their populations. Descriptions include available information on distribution, movement, behaviour, diet, predators, reproduction, and other information where relevant.

Table adapted from State of the Atlantic Ocean Synthesis Report, by Bernier et al., 2023, DFO Can. Tech. Rep. Fish. Aquat. Sci, 3544. Copyright 2023 by the Government of Canada Open Data License Agreement.

* COSEWIC Status (and SARA classification for wolffish) indicated where applicable and where Stock Status was not available for a species. The protection status of species at risk are described further in Section 7.4.2.7.

** DFO indicated that the Stock status for this species has recently been re-assessed but is not yet published. DFO's feedback on the Draft Report is available on the Registry under document reference number 379, CSAS IA - NL OSW - RA Draft Report for Public Comment - DFO Science Review (2024).

Sources: Bernier et al., 2023; Brodziak, 2005; COSEWIC, 2009a; 2010a; d; 2012f; i; 2013c; 2017b; Department of Fisheries & Aquaculture, n.d.-a; DFO, 2007c; d; 2010c; 2013e; 2014b; 2015d; 2016a; 2017d; 2018a; e; h; 2019f; g; 2020d; 2021h; 2022b; f; j; k; 2023cc; h; l; u; v; Murphy, 1995; NOAA, 2024d; Pitt, 1984; Robards et al., 1999; Scott, 1985; Sosebee et al., 2024.

7.4.2.5 Diadromous Fish

Diadromous fish regularly migrate between the salt water of the sea and freshwater (DFO, 2023t). These fish include anadromous species that spawn in freshwater but spend much of their lives in the sea and catadromous species that spawn at sea but spend most of their lives in freshwater (DFO, 2023t). Species that likely occur regularly in the region are described in Table 7.4.10.

Striped Bass have recently been observed farther north than their known range in southern Labrador and may potentially migrate into Newfoundland waters in the future (DFO, 2023t). This recent change in presence is currently attributed to an expansion of range, a return to previous habitat, increased retention limits, or unmonitored removal (Andrews et al., 2019). As Striped Bass are likely to migrate through the Focus Area they will be considered as one of the anadromous species of concern in this Regional Assessment.

Historic declines in Atlantic Sturgeon (*Acipenser oxyrinchus*), Atlantic Salmon, and Striped Bass were primarily due to overfishing and habitat loss/degradation as well as migration route blockages, bycatch, entanglement, degraded water quality, pollution, and vessel strikes (COSEWIC, 2010b; 2011b; 2012h). All three species have not recovered from their historic declines. Stocks for these species are currently in decline, have low population abundance, or are in recovery (COSEWIC, 2010b; 2011b; DFO, 2021j). Current threats to anadromous species are similar to historical ones. There are conservation concerns about several diadromous fish species that likely occur regularly in the Focus Area described in Section 7.4.2.7 of this Report.

The American Eel is of importance to Indigenous groups, including Mi'kmaq, for both cultural significance and as food. There is only one breeding population of American Eel, so they are vulnerable to threats and changes in the environment (COSEWIC, 2012a; DFO, 2011e). Historical declines in American Eel populations are attributed to migration barriers (e.g. dams, culverts), overfishing, habitat destruction, and pollution (COSEWIC, 2012a; DFO, 2011e). Current anthropogenic threats affecting American Eels including fishing, habitat quality degradation, migration barriers, and pollution (COSEWIC, 2012a; DFO, 2011e).

The fact that diadromous species use both freshwater and ocean environments makes them vulnerable to the adverse effects of human activities on lakes and rivers as well as the marine environment (Waldman & Quinn, 2022). The effects of climate change on water quality and quantity in spawning rivers could affect recruitment of anadromous species. These stresses may be exacerbated by changes in ocean waters associated with climate change. The effects of climate induced changes in ocean waters on anadromous species is understudied (DFO, 2023t; NOAA, 2024c; f). American Eels are suspected to be affected by the changing oceanographic conditions caused by climate change, but these effects are not well understood (COSEWIC, 2012a; DFO, 2011e). Current anticipated effects include variances in migration, reproduction, and changes in fitness and food supply (COSEWIC, 2012a; DFO, 2011e). Warming ocean waters could expand the range of this species

northward as they are currently limited by cold Arctic waters (COSEWIC, 2012a; DFO, 2011e).

Table 7.4.10. Diadromous Fish Species that Occur in or Adjacent to the Focus Area

Common Name (Scientific name)	Description	Bioregion	COSEWIC Status*
Anadromous			

Atlantic Sturgeon (*Acipenser oxyrinchus*)	• Distribution ranges from Ungava Bay Labrador to the Gulf of Mexico in the Atlantic.
	• Found up to 50 m deep on coastal shelf regions.
	• Long lived, late-maturing species.
	• Lives in freshwater rivers and estuarine habitats when juvenile and for spawning.
	  ○ Prefer shallow rocky-gravel substrate (1 - 3 m) in deep pools and areas with moving water (strong currents/waterfalls).
	• Spawning occurs in June - July in Canadian waters when temperatures reach 16 - 20°C.
	  ○ Spawning occurs outside the Focus Area.
	• Matures and resides in coastal and marine shelf habitats.
	• Diet consists of benthic invertebrates and sometimes small fish.
	• Abundance declined in the 1980 - 1990s. Population has stabilized since 2000.
	  ○ Commercial Fisheries in the St. Lawrence.
	  ○ Appear in bycatch in Newfoundland and Labrador.
		nGSL/ NLS	Threatened (COSEWIC)

Atlantic Salmon (*Salmo salar)*	• South and southwest Newfoundland populations are distributed from the southeastern tip of the Avalon Peninsula westward to Cape Ray and up the west coast south of Bonne Bay. • Migrate far distances for feeding. • Adults may migrate through the Focus Area en route to the Labrador Sea. ○ During an engagement session on June 13, 2024, in Harbour Breton, a participant mentioned concern regarding the potential impacts to fish migration routes and specified that salmon migration routes in particular represent an important data gap.	nGSL/ NLS	Special Concern (nGSL)/ Threatened (NLS) (COSEWIC)

Common Name (Scientific name)	Description	Bioregion	COSEWIC Status*
	• Spawning occurs in their natal rivers (river in which they were hatched) in spring and summer; salmon rivers are found throughout Newfoundland and Labrador. • Juveniles spend 3 - 4 years in freshwater before migrating to the ocean as smolts. • Prefer shallow water (< 10 m) and ocean temperatures of 3 - 10°C (1 - 12.5°C at the surface) but will enter deeper water for foraging opportunities on occasion. ○ Warm (14°C) and cold (6°C) water temperatures at sea can affect mortality of smolts. • Adult salmon are opportunistic feeders, but feed primarily on invertebrates and fish. • Predators include birds, fish, sharks, mammals, and seals. • Populations levels are low, with south Newfoundland populations in decline. Southwestern populations are increasing. • Indigenous and recreational fisheries in Newfoundland and Labrador.		

Striped Bass (*Morone saxatilis*)	• Distribution range spans the Atlantic coast from the St. Lawrence River to the St. Johns River, U.S.
	  ○ Anticipated to migrate into the Focus Area due to the changing conditions of the ocean.
	• Adult habitat ranges from riverine, estuarine, and sometimes offshore environments for foraging opportunities.
	  ○ Adult Striped Bass spend summers in coastal waters and rivers.
	  ○ Over winter in estuaries and freshwater habitat.
	• Diet includes Atlantic Salmon smolts, teleost fish, and invertebrates.
	• No fishery permitted in GSL due to low numbers since 1990s, evidence of increases (anecdotal).
		nGSL	Threatened (COSEWIC)

Common Name (Scientific name)	Description	Bioregion	COSEWIC Status*
Catadromous			

American Eel (Anguilla rostrata)	• Distribution range spans from Greenland to northern South America in the Western Atlantic. Highly migratory species.
	  ○ Adults may migrate through the Focus Area en route to their spawning areas.
	  ○ Juveniles may travel on currents through the Focus Area.
	• Adult habitat ranges from riverine, estuarine, and coastal marine waters.
	• Benthic species that use substrate, debris, and vegetation for cover and protection.
	  ○ Eelgrass is important habitat for this species.
	• Spawning occurs in the ocean near the Sargasso Sea and growth takes place in coastal and fresh water from Greenland to South America.
	• When juveniles return to coastal waters they become “glass eels”. Predators include fish, mammals, and birds.
	• Important to Indigenous peoples throughout its range.
	• Experienced dramatic population declines since the 1950’s.
		nGSL/ NLS	Threatened (COSEWIC)

Table Description: This table describes the diadromous species that occur in the Focus Area, the bioregions they occur in, and the status and trends of their populations. Descriptions include available information on distribution, movement, behaviour, diet, predators, reproduction, and other information where relevant.

Table adapted from State of the Atlantic Ocean Synthesis Report, by Bernier et al., 2023, DFO Can. Tech. Rep. Fish. Aquat. Sci, 3544. Copyright 2023 by the Government of Canada Open Data License Agreement.

* COSEWIC Status indicated as stock status was not available for diadromous species in the Focus Area. The protection status of species at risk are described further in Section 7.4.2.7.

Sources: Andrews et al., 2019; Bernier et al., 2023; COSEWIC, 2010b; 2011b; 2012a; h; DFO, 2011e; 2013c; 2022i; 2023t; NOAA, 2024c; f; Porter, 1975; Waldman & Quinn, 2022.

7.4.2.6 Invasive Species in the Focus Area

DFO describes invasive species as "*plants, animals, aquatic life and microorganisms that can out-compete native species when introduced outside of their natural environment.*" (DFO, 2012a). Invasive species are difficult to control as they have few or no natural predators in their 'new' environment, are typically capable of thriving in a variety of different habitats, and have high rates of reproduction (DFO, 2012a). Invasive species can negatively affect native plants and animals and cause ecosystem and economic damage (DFO, 2012a). There are seven confirmed invasive species in the Focus Area, European Green Crab (*Carcinus maenas*), Vase Tunicate (*Ciona intestinalis*), Golden Star Tunicate (*Botryllus schlosseri*), Violet Tunicate (*Botrylloides violaceus*), Coffin Box Bryozoan (*Membranipora membranacea*), Japanese Skeleton Shrimp (*Caprella mutica*), and Oyster Thief Seaweed (*Codium fragile*) (DFO, 2023bb). They are described below.

European Green Crab are aggressive, fast, and prolific breeders (DFO, 2010a; 2011b). They have no natural predators in the Focus Area or Newfoundland and Labrador and readily out-compete native species (DFO, 2010a; 2011b). While hunting for prey and seeking shelter, European Green Crab cause considerable damage to eelgrass beds (DFO, 2012a). They are considered a high-risk species for ecology, biodiversity, and economics. In particular, European Green Crab are negatively affecting American Lobster abundance and landings in Placentia Bay (DFO, 2011b; Rayner & McGaw, 2019). The European Green Crab was first observed in North Harbour, Placentia Bay, in 2007 and is believed to have been introduced through ballast water from non-local vessels. It has since spread extensively in Placentia Bay, along the south coast, including Fortune Bay, and on the west coast in Bay St. George, Bay of Islands, and Parsons Pond (DFO, 2023bb). During a public engagement session in Port Aux Basques on June 5th, 2024, one participant mentioned that they had seen European green crab and were concerned regarding the potential effects to Eelgrass and spawning grounds for salmon.

Tunicates are sessile, filter feeding, marine invertebrates, typically with a hard outer coat (tunic) (Carman et al., 2019). They can be solitary or form large colonies (DFO, 2019h; k). The Vase Tunicate can attach to any hard surface, creating significant biofouling on wharves, vessels, buoys (DFO, 2013a; 2023bb). Vase Tunicate were first observed in Marystown in 2012, and containment measures were effective until 2020 when it began to spread (DFO, 2023bb). This tunicate is easily spread through the movements of fishing gear, boats, vessels, and shellfish (DFO, 2013a; 2023bb).

The Violet Tunicate lives on hard surfaces. It grows quickly and can cover nearby plants and small organisms, smothering them (DFO, 2019k; 2023bb). Individual tunicates are erect on a gelatinous mat, closely packed together in random arrangements of rows (DFO, 2019k; 2023bb). The Violet Tunicate secretes a chemical that impedes attachment to surfaces by other organisms and repels predators. It can be harmful to aquaculture gear, shellfish harvesters and benthic organisms (DFO, 2019k; 2023bb). Violet Tunicate is native to the Pacific Ocean, in Asia, and was introduced to eastern Canada through vessels. To date, it occurs in only one location in the Focus Area, Belloram on the south coast (DFO,

2019k; 2023bb). It can be spread by fishing gear, shellfish, and recreational or commercial vessels (DFO, 2019k; 2023bb).

The Golden Star Tunicate is a biofouling organism that forms colonies on hard surfaces such as buoys, ropes, and floating docks (DFO, 2019h; 2023bb). These large colonies can compete with scallops and mussels for food or grow so rapidly they can cover other organisms. The Golden Star Tunicate was first seen in 1975, in Bonne Bay on the west coast and is now found along the south coast of Newfoundland. It can be spread by fishing gear, vessels, and shellfish (DFO, 2019h; 2023bb). It is not known if the warming of the ocean will increase the spread of this species (DFO, 2019h; 2023bb).

The Coffin Box Bryozoan is a tiny, filter feeding invertebrate, typically found living in sedentary colonies that secretes a calcium carbonate outer coat (DFO, 2011a). They originate from Pacific Ocean kelp beds and were first observed in Newfoundland and Labrador in 2002 (DFO, 2023bb). It is now common throughout the coastal areas of the Island of Newfoundland and the southeast coast of Labrador (DFO, 2011a). There are large populations in Bay of Islands and Bonne Bay within the Focus Area and a 2009 survey found Coffin Box Bryozoans in areas of Placentia Bay. The colonies impede photosynthesis and the release of spores which can make kelp brittle and die (DFO, 2011a). Coffin Box Bryozoan spreads through planktonic larvae carried by currents and colonies on vessel hulls (DFO, 2011a). Like molluscs, they're ability to form calcium carbonate coats may be impeded by the ocean acidification caused by climate change (Byrne & Fitzer, 2019; Christian et al., 2010).

Japanese Skeleton Shrimp are hairy shrimp native to the subarctic regions of the Sea of Japan (DFO, 2023bb). They were described in 1976 and have since spread to many parts of the world, including to some areas of Newfoundland and Labrador (some locations in Fortune Bay and Placentia Bay) (DFO, 2023bb). They were likely carried in ballast water of vessels and can form dense infestations, up to 100,000/m (DFO, 2023bb). They are opportunistic, adaptable feeders, and can be a nuisance on gear but have no known ecosystem effect (DFO, 2019i; 2023bb).

Oyster Thief Seaweed also known as Dead Man's Fingers is a sedentary algae that grows in shallow subtidal waters (DFO, 2019j). Oyster Thief Seaweed can form dense 'meadows' on the seafloor that restrict movement of species that typically inhabit kelp forests for food and shelter, such as sea urchins (DFO, 2023bb; 2019j). With its rapid growth rate, it can replace native species of eelgrass and kelp. As well, it can foul shellfish beds and aquaculture equipment (DFO, 2019j). Oyster Thief Seaweed is native to Japan and likely arrived in Canada as biofouling. It can attach to ships' hulls, grow quickly and tolerate large ranges of temperature and salinity (DFO, 2019j; 2023bb). Oyster Thief Seaweed was first observed in the GSL in 1996 and found in Newfoundland and Labrador in 2012. Surveys for this species from 2006 – 2017 found evidence of Oyster Thief Seaweed in only a very few locations in Fortune Bay and Placentia Bay (DFO, 2019j).

Many of the invasive species that occur in the Focus Area are near their temperature tolerance limit which contributes to their abundance on the southern coast of

Newfoundland. Ocean warming associated with climate change may allow existing invasive species to spread further north or new invasive species to colonize the area (DFO, 2023bb).

7.4.2.7 Marine Fish Species at Risk

There are several species of conservation concern, including species at risk, that may occur in the Regional Assessment Focus Area and are described in Table 7.4.11. These species are identified and protected through provincial, federal, and international legislation or initiatives. The primary mechanisms for identifying and protecting marine fish, sharks, and skates in Canada are *SARA* (2002) and COSEWIC which are described in Section 7.6.1.1. Marine fish habitats that are at risk are protected through protected and special areas (see Section 7.6.1 of this Report).

One species of large pelagic fish and four species of pelagic sharks found in the Focus Area are designated species at risk under Schedule 1 of *SARA*. Critical habitat has not been defined for any shark species in Canadian water. However, Great White Shark are under consideration for critical habitat that may lie within the Focus Area (COSEWIC, 2021b). The greatest existing anthropogenic threats to pelagics in Newfoundland and Labrador are overfishing (commercial, recreational, or sport), bycatch or accidental capture, bioaccumulation (accumulation through ingestion) of pollutants, underwater noise, changes to habitat, and vessel collisions (COSEWIC, 2009b; 2011a; 2014b; 2016; 2019d; 2021b). Several of these species have long generation times (late age of maturity and low fecundity) which increases the risk associated with threats as it is difficult for such species to recover from population declines (COSEWIC, 2009b; 2014b; 2016; 2019d; 2021b).

Twelve species of demersal fish and skates found in the Focus Area are designated species at risk under Schedule 1 of *SARA*. Critical habitat has been identified within or adjacent to the Focus Area for Spotted and Northern Wolffish as part of their recovery strategy and are displayed in Figure 7.4.7 (COSEWIC, 2012e; g).[95] The greatest existing anthropogenic threats to demersal fish and skates in Newfoundland and Labrador are overfishing, bycatch, disease, pollution, changes in habitat, and climate variation (COSEWIC, 2008a; 2009a; 2010a; 2010d; 2012b; c; e; f; g; i; 2013c; 2015a; 2018). A significant non-anthropogenic threat to some of these at-risk species is increased predation, particularly by grey and harp seals (COSEWIC, 2009a; 2010a; 2012f; i; 2013c; 2015a).

Three species of diadromous fish found in the Focus Area are designated species at risk under Schedule 1 of *SARA*. The greatest existing anthropogenic threats to diadromous fish

[95] Critical habitat is defined under SARA (2002) as habitat necessary for the survival or recovery of a wildlife species listed under Schedule 1 of the *SARA,* as identified in their species recovery document Critical habitat is specifically identified for species listed as Endangered or Threatened and species recovery documents are available on the Species at Risk Public Registry. See Section 7.6.1.1.8 of this Report, Protected and Conserved Areas of this Report for more information on critical habitats.

in Newfoundland and Labrador are climate change, changes to ocean ecosystems and habitats including obstruction of migration routes, pollution, and fishing (COSEWIC, 2010b; 2011b; 2012a; g; DFO, 2022j; Waldman & Quinn, 2022). Recent publications also indicate that interbreeding between wild and aquaculture salmon is impacting wild fish and represents a considerable anthropogenic effect (Dempson et al., 2024, Bradbury et al., 2020; 2022).

Figure 7.4.7. Critical Habitat for Northern and Spotted Wolffish within the Focus Area

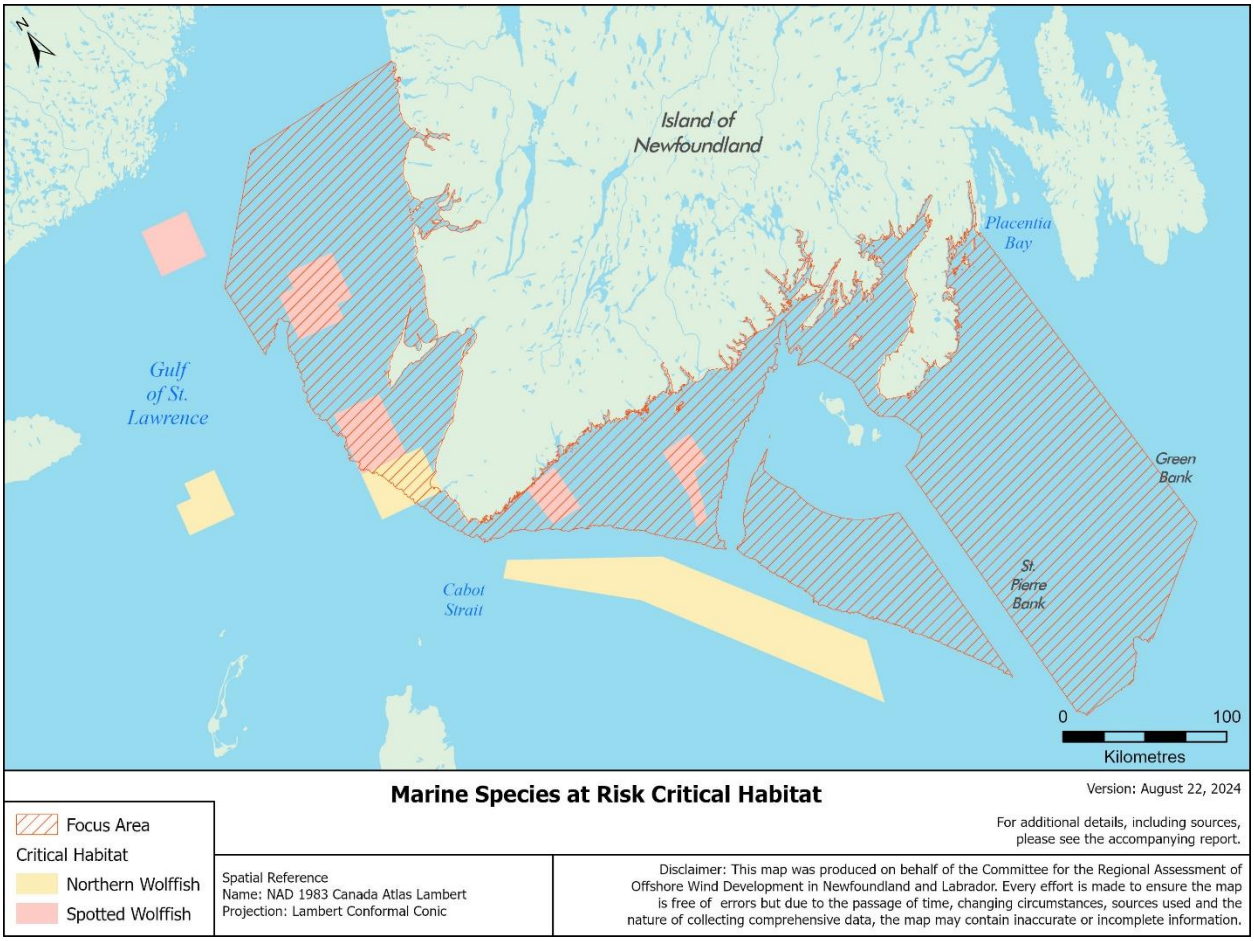


Figure Description: This map displays eight critical habitat polygons that have been identified for Northern Wolffish and Spotted Wolffish in and around the Focus Area. There are three separate polygons identified for Northern Wolffish and five for Spotted Wolffish.

Data Source: DFO, 2024h.

Table 7.4.11. Marine Fish Species at Risk in or Adjacent to the Focus Area and their Federal 'At Risk' Status

Species Name	Population	Population Trend	NL Region Status	Current *SARA*	COSEWIC Status	Anthropogenic threats
Large Pelagic Species						
Atlantic Bluefin Tuna (*Thunnus thynnus*)		Decline	No Status	NAR	EN	Overfishing (direct and indirect), pollution (oil spills), underwater noise, threats to habitat.
Porbeagle Shark (*Lamna nasus*)	Northwest Atlantic	Low but stable	Not at Risk	NAR	EN	Overfishing (direct and indirect).
White Shark (*Carcharodon carcharias)*		Stable	At Risk	EN	EN	Fishing and capture (direct and incidental), and pollution (bioaccumulation).
Basking Shark (*Cetorhinus maximus*)	Atlantic	Unknown/ Decline	Not at Risk	NAR	SC	Fishing (direct and incidental) vessel collisions.
Shortfin Mako Shark (*Isurus oxyrinchus*)	North Atlantic	Decline	Not at Risk	NAR	EN	Overfishing (direct and incidental).
Blue Shark (*Prionace glauca)*	North Atlantic	No Trend*	At Risk	NAR	NAR	Fishing (direct and incidental) and catch, pollution (bioaccumulation).
Demersal Fish, Shark, and Skate Species						
Atlantic Cod (*Gadus morhua*)	Laurentian North/ Newfoundland and Labrador	Low but increasing	At Risk	NAR	EN	Overfishing, disease, pollution, changes in habitat, and climate variation.

Species Name	Population	Population Trend	NL Region Status	Current *SARA*	COSEWIC Status	Anthropogenic threats
American Plaice (*Hippoglossoides platessoides)*	Maritime/ Newfoundland and Labrador	Critically low but stable	At Risk	NAR	TH	Overfishing and climate variation.
Lumpfish (*Cyclopterus lumpus*)		Stable but Low/ Decline		Under Consideration/ NAR	TH	Fishing, change in habitat, seismic exploration, and climate variation.
White Hake (*Urophycis renuis)*	Atlantic and nGSL	Increasing	At Risk	NAR	TH	Overfishing.
Acadian Redfish (*Sebastes fasciatus*)	Atlantic	Increasing	At Risk	NAR	TH	Fishing (direct and incidental) and climate variation.
Deepwater Redfish (*Sebastes mentella)*	GSL and Laurentian Channel	Increasing	At Risk	NAR	EN/ TH	Fishing (direct and incidental) and climate variation.
Atlantic Wolffish (*Anarhichas lupus)*		Stable/ Increase	At Risk	SC	SC	Commercial fishing (direct and indirect) and climate variation.
Northern Wolffish (*Anathichas denticulatus)*		Stable/ Increase	At Risk	TH	TH	Bycatch, habitat degradation, and climate variation.
Spotted Wolffish (*Anarhichas minor)*		Stable/ Increase	At Risk	TH	TH	Commercial fishing (direct and indirect), habitat degradation, and climate variation.

Species Name	Population	Population Trend	NL Region Status	Current *SARA*	COSEWIC Status	Anthropogenic threats
Cusk (*Brosme brosme*)		Stable	At Risk	NAR	EN	Overfishing (direct and indirect).
Roundnose Grenadier (*Coryphaenoides rupestris*)		Stable	At Risk	NAR	EN	Overfishing (direct and indirect).
Roughhead Grenadier (*Macrourus berglax*)		Increase/ stable	At Risk	NAR	NAR	Overfishing (direct and indirect).
Smooth Skate (*Malacoraja senta*)	Laurentian-Scotian/ Nose of the Grand Bank	Unknown	At Risk	NAR	SC/ DD	Climate variation and fishing (indirect).
Thorny Skate (*Amblyraja radiata*)		Increase	At Risk	NAR	SC	Fishing.
Winter Skate (*Leucoraja ocellata*)	Eastern Scotian Shelf-Newfoundland/ Southern GSL	Decline	At Risk	Under Consideration/ NAR	EN	Overfishing (direct and indirect).

Species Name	Population	Population Trend	NL Region Status	Current *SARA*	COSEWIC Status	Anthropogenic threats
Diadromous species						
Atlantic Sturgeon (*Acipenser oxyrinchus*)	St. Lawrence	Unknown	At Risk	NAR	TH	Fishing, changes to habitat, and pollution.
Atlantic Salmon (*Salmo salar*)	South Newfoundland/ Southwest Newfoundland	Unknown/ Increase	At Risk	NAR	TH/ NAR	Climate change, changes to ocean ecosystems and habitats, and fishing.
Striped Bass (*Morone saxatilis*)	Southern GSL/ Bay of Fundy/ St. Lawrence River	Unknown		NAR/ EN	EN/ SC	Habitat degradation and change, pollution, climate change, and fishing.
American Eel (*Anguilla rostrata*)		Unknown	At Risk	NAR	TH	Habitat degradation and change, pollution, climate change, and fishing.

Table Description: This table identifies species listed under Schedule 1 of the SARA which may occur offshore Newfoundland and Labrador. Species which may become listed (e.g., recently assessed by COSEWIC) or that have 'at-risk' status in the region of Newfoundland and Labrador are also identified. COSEWIC was established under SARA as an independent body of experts responsible for identifying and assessing wildlife species considered to be at risk. This is the first step towards protecting wildlife species at risk. The anthropogenic threats listed for each species were identified through COSEWIC assessments.

'Current SARA' means the current or most recent designation for a species under Schedule 1 of the SARA. SARA categories include NAR (not at risk), SC (special concern), TH (threatened), and EN (endangered). COSEWIC categories include NAR (not at risk), DD (data deficient), SC (special concern), TH (threatened), and EN (endangered).

Blank cells indicate the information in not applicable for the species (e.g., no population-specific COSEWIC assessment or SARA designation, no population trend data, etc.,).

Table adapted from Eastern Newfoundland Offshore Geophysical, Geochemical, Environmental and Geotechnical Programs 2015-2024: 2018 Environmental Assessment Update, by AMEC Foster Wheeler Environment & Infrastructure, 2018, Prepared for ExxonMobil Canada Ltd. Copyright 2018.

* Results uncertain due to data availability.

Sources: AMEC, 2014; 2018; COSEWIC, 2008a; 2009a; b; 2010a; b; d; e; 2011a; b; 2012a; b; c; e; f; g; h; i; 2013c; 2014b; 2015a; 2016; 2017b; 2018; 2019d; 2021b; DFO, 2010c; 2011c; 2013e; 2014b; 2018d; 2022i.

7.4.2.8 Key Areas and Times

Climate induced changes in the ocean waters themselves are evoking changes in the occurrence and distribution of some marine species as they continue to seek their preferred temperature range and prey (Bernier et al., 2023). Temperature varies seasonally, north-south with currents, and by depth (Bernier et al., 2023; Cyr et al., 2022; DFO, 2023n). Marine invertebrates and numerous species of fish are found at many different depths and over differing types of sea bottoms (Bernier et al., 2023; DFO, 2023h, 2023l). There have been changes in community structure within the marine ecosystem since the decline of fish stocks in the late 1980s and early 1990s. Since then, there has been a slow rebuilding of biomass (DFO, 2023h). There is recognized uncertainty in forecasting the consequences for marine life from the pressures of climate change and anthropogenic factors (Bernier et al., 2023).

Many invertebrate, fish, and skate species are present in the Focus Area year-round whereas large pelagic fish and sharks are highly migratory and tend to be seasonal residents (see Sections 7.4.2.3. and 7.4.2.4 of this Report). Smaller seasonal migrations from deeper water to coastal and inshore regions are common for a variety of fish, skate, and shark species (see Section 7.4.2.4 of this Report). Most invertebrates are found in intertidal or coastal areas along the shores of the Focus Area (see Section 7.4.2.3 of this Report). For both residential and migratory species, abundance is highest from spring to summer when prey availability is highest, and spawning occurs. Spawning that occurs within the Focus Area most commonly occurs from late spring to fall. During this period some species moving inshore to breed (see Sections 7.4.2.3 and 7.4.2.4 of this Report).

Important habitat for invertebrates, fish, sharks, and skates have been identified on St. Pierre Bank and in Placentia Bay, where abundance of several species is highest (see Sections 7.4.2.3 and 7.4.2.4 of this Report). These areas have been used to inform EBSAs and may be used to inform delineation of future critical habitats (Wells et al., 2019). Eelgrass habitat are also important areas for a variety of invertebrate and fish species. Known eelgrass habitat exists around the Bay of Islands, the Port au Port Peninsula, Port aux Basques, and around Placentia Bay (Rao et al., 2014). Critical habitat for Northern Wolffish and Spotted Wolffish have been identified off the west coast of Newfoundland within the Focus Area (Figure 7.4.7). Critical habitat for Great White Sharks is currently being assessed within the Focus Area.

DFO or the UNCBD has identified, evaluated, and selected five EBSAs within or near the Focus Area based, in part, based on the areas importance to invertebrates, fish, sharks, and skates. The areas importance for these taxa relates to their biodiversity and density in the area, and the importance for reproduction and survival (West Coast of Newfoundland, South Coast, Laurentian Channel, Placentia Bay, and St. Mary's Bay) (Templeman, 2007; UNCBD, 2019). EBSAs are described further in Section 7.6.1.1.2 of this Report and depicted in Figure 7.6.3.

7.4.3 Potential Effects

Invertebrate, fish, shark, and skate species, as well as their habitat, may be impacted by a variety of activities during all phases of offshore wind development. These activities are described in Section 4 of this Report. Offshore wind development activities can have both temporary or permanent, and physical or behavioral effects on the various invertebrate, fish, shark, and skate species in and around the Focus Area. Table 7.4.12 summarizes potential impact pathways and effects during each project phase.

Any impact on marine fish or fish habitat could have direct or indirect effects on other components (e.g. Fisheries and Other Ocean Uses, Aerofauna, Marine Mammals and Sea Turtles etc.,). Section 7.4.3.2 of this Report briefly describes these potential indirect effects. Accidents, spills, and other malfunctions can also occur during offshore wind development and have potential effects on marine fish or fish habitat. Accidental effects are discussed in Section 9. Cumulative effects are described in Section 8 of this Report.

7.4.3.1 Effects of Planned Offshore Wind Activities

Depending on the project phase, offshore wind development may impact marine fish and fish habitat through underwater noise and vibration, benthic disturbance, presence of infrastructure, entanglement, artificial lighting, electromagnetic frequency (EMF) emissions, and high-voltage direct current (HVDC) emissions (Table 7.4.12).

Table 7.4.12. Potential Impact Pathways and Effects of Offshore Wind Development on Marine Fish and Fish Habitat

Project Phase	Effects
Underwater Noise	
Pre-construction and Construction	• Temporary (TTS) or permanent auditory injury (PTS). • Temporary or permanent behavioural changes (e.g., startle response, increased activity, avoidance, habitat abandonment, variation in migration routes, change in swimming direction, speed, and depth). • Temporary changes to communication. • Temporary or permanent changes in foraging efficiency. • Temporary or permanent changes in predator avoidance success. • Temporary or permanent psychological changes (increased stress). • Temporary or permanent changes in immune response. • Temporary changes in mortality of larvae, juveniles, and adults. • Temporary or permanent physical injury (e.g. barotrauma).
Operation	• Temporary or permanent behavioural changes (e.g., avoidance, habituation). • Temporary or permanent psychological changes (increased stress).
Decommissioning	• Temporary or permanent behavioural changes (e.g., startle response, increased activity, avoidance, habitat abandonment, variation in migration routes, change in swimming direction, speed, and depth). • Temporary changes to communication. • Temporary or permanent psychological changes (increased stress).

Project Phase	Effects
Sediment Suspension	
Construction and Decommissioning	• Temporary or permanent habitat alteration, or loss. • Temporary behavioural changes (e.g., increased activity, avoidance, habitat abandonment). • Temporary changes in foraging efficiency. • Temporary changes in respiration. • Temporary changes in mortality of larvae, juveniles, and adults.
Presence of Infrastructure	
Construction, Operation	• Temporary or permanent habitat alteration, or loss • Temporary or permanent behavioural changes (e.g., disorientation, displacement, attraction). • Temporary or permanent changes in foraging efficiency. • Temporary behavioural changes (increased stress). • Permanent damage to fish and invertebrate eggs and larvae. • Temporary or permanent alteration of fish species availability and abundance. • Temporary or permanent alteration of fish community composition and abundance. • Temporary or permanent alteration of non-native and invasive species occurrence. • Temporary or permanent spread of invasive species.
Decommissioning	• Temporary or permanent habitat alteration, or loss • Temporary or permanent behavioural changes (e.g., disorientation, displacement, habitat abandonment). • Temporary or permanent changes in foraging efficiency. • Temporary psychological changes (increased stress). • Permanent damage to fish and invertebrate eggs and larvae. • Temporary or permanent alteration of fish species availability and abundance. • Temporary or permanent alteration of fish community composition and abundance.

Project Phase	Effects
Entanglement	
Construction and Operation	• Temporary or permanent entanglement risk. • Temporary changes in foraging efficiency. • Temporary or permanent changes in predator avoidance success.
Vessel Collisions	
All	• Temporary increased risk of collisions.
Artificial Light	
All	• Temporary behavioural change (e.g., startling, attraction, avoidance)
Presence of EMF	
Operation	• Behavioural change (e.g., attraction, avoidance, increased movement, increased foraging behaviour). • Temporary changes to communication (e.g. navigation, and orientation). • Temporary changes in foraging efficiency. • Temporary or permanent changes in predator avoidance success. • Temporary or permanent anatomical change (e.g., earlier hatching). • Potential impact on ability to use natural EMF cues.
Presence of HVDC	
Operation	• Behavioural change (e.g., attraction, avoidance). • Temporary or permanent changes in foraging efficiency near substations.

Table Description: This table summarizes the potential effects of various offshore wind development activities for different project phases (e.g. pre-construction, construction, operation, decommissioning) and identifies if the effects are likely to be temporary or permanent. See Section 4 of this Report for an overview of offshore wind development phases and activities.

Sources: Andrzejaczek et al., 2022; Bailey et al., 2014; Bat et al., 2013; Bergström et al., 20132014; Bray et al., 2016; Carroll et al., 2017; CEF Consultants Ltd., 2011; CMACS, 2003; Cordes et al., 2016; CSA Ocean Sciences Inc., 2021; CSA Ocean Sciences Inc. & Exponent, 2019;

Dannheim et al., 2020; Day et al., 2016; De Mesel et al., 2015; Defingou et al., 2019; Degraer et al., 2012; 2020; DFO, 2004b; 2020f; 2021k; DNV energy, 2007; Engas et al., 1996; English et al., 2017; Farr et al., 2021; Fewtrell & McCauley, 2012; Fowler et al., 2020; Galparsoro et al., 2022; Gillson et al., 2022; Glarou et al., 2020; Guan et al., 2022; Guan & Miner, 2020; Hammar et al., 2015; Hansen et al., 2012; Harsanyi et al., 2022; Hawkins, Johnson, et al., 2020; Hawkins, Pembroke, et al., 2015; Hawkins & Popper, 2017; 2018; HDR, 2018; Hermans et al., 2022; Hewitt et al., 2009; Hinzmann et al., 2017; Hudson et al., 2022; Hutchinson et al., 2018; ICF, 2020; ICF Jones & Stokes & Illingworth and Rodkin Inc., 2009; Jézéquel et al., 2022; Kaldellis et al., 2016; Karlsson et al., 2022; Kikuchi, 2010; Krone et al., 2013; Langhamer et al., 2016; Levin & Ernst, 1997; Lindeboom et al., 2011; Løkkeborg et al., 2012; Lüdeke, 2017; Maxwell et al., 2022; McCauley et al., 2000; 2003; ; Mooney et al., 2020; Morley et al., 2014; Nedwell et al., 2003; 2007; Nedwell & Howell, 2004; Normandeau et al., 2011; NYSERDA, 2017g; i; 2021; Payne et al., 2009; Popper et al., 2007; Popper et al., 2014; Popper & Hastings, 2009; Popper & Hawkins, 2012; ; Reubens et al., 2013; 2014; Schoeman et al., 2020; Scott et al., 2018; 2021; SEER, 2022a; Sivle et al., 2015; Slotte et al., 2004; Smith, 2016; Smyth et al., 2015; Souissi et al., 2017; Stantec Consulting Limited, 2022; Stöber & Thomsen, 2021; Streever et al., 2016; Svendsen et al., 2022; Taninoki et al., 2017; Taormina et al., 2020; Thomsen et al., 2020; Thrush et al., 2004; Verfuss et al., 2019; Watson et al., 2024; Weilgart, 2013; Whitehouse et al., 2011.

7.4.3.1.1 Underwater Noise and Vibration

Invertebrates, fish, sharks, and skates rely on sound and particle motion for communication, predator avoidance, feeding, and to gain an understanding of their environment (ICF Jones & Stokes & Illingworth and Rodkin Inc., 2009; Popper et al., 2014; Stantec Consulting Limited, 2022).

Underwater sound has two components - vibration and pressure. Sound is detected by most species, either as particle motion or sound waves (pressure) or as or both (CSA Ocean Sciences Inc., 2021; Hudson et al., 2022; Mooney et al., 2020). Aquatic species such as fish, sharks, and skates vary in their hearing frequency ranges and sensitivity to sound levels and pressures (Hawkins, Pembroke, et al., 2015; Mickle & Higgs, 2022; Nieder, 2023; Popper et al., 2019; Popper & Hawkins, 2018). The available research to date focuses primarily on hearing in bony fishes compared to cartilaginous fishes such as sharks and skates (ICF Jones & Stokes & Illingworth and Rodkin Inc., 2009). Bony fish species with swim bladders are also at risk of barotrauma injuries from increased pressure caused by underwater noise (CSA Ocean Sciences Inc., 2021).

There are two types of fish hearing groups. Hearing generalists (i.e., salmon) interpret sound both through their inner ear as well as sound energy through their swim bladder, whereas hearing specialists (i.e., herring) have a number of different hearing mechanisms that make their hearing more sensitive and more at risk to loud noises (ICF Jones & Stokes & Illingworth and Rodkin Inc., 2009). As a result, different species respond differently to underwater noise associated with offshore wind development. Factors like the type of activity/equipment generating noise, an individual's proximity to the noise source, and noise duration can also influence an individuals' response (Carroll et al., 2017; Hawkins & Popper, 2017; Popper et al., 2007; Popper et al., 2014; Popper & Hastings, 2009; Popper & Hawkins, 2012; 2016). For example, physiological effects caused by offshore wind development for fish, sharks, and skates can range in severity from auditory masking of communication and behavioural changes (e.g., changes in habitat use or foraging), to auditory injury, tissue damage, and mortality (Carroll et al., 2017; Popper & Hawkins, 2012; 2016).

Auditory Injury

Auditory injury is often associated with a loss of hearing or hearing sensitivity caused by noise exposure over a significant period and sound pressure level (Popper et al., 2014). Hearing sensitivity loss because of auditory injury is known as noise-induced threshold shift (NITS). The injury is considered a TTS if the (NITS) is temporary and hearing sensitivity returns to normal. If the hearing threshold shift remains elevated it is called a PTS (Popper et al., 2014). PTS may be less likely to occur in fish compared to other marine species due to their ability to regenerate lost or damaged sensory cells of the ear. However, research on permanent hearing loss in fish is limited and high-intensity sound may still be capable of causing PTS (Carroll et al., 2017; Smith, 2016).

The effects of sound and pressure varies based on fish type. Cartilaginous fishes and most invertebrates detect sound only through particle motion, are the most sensitive to low

frequency sounds, and are more resilient to anthropogenic sound exposure (Carroll et al., 2017; Hawkins & Popper, 2017; Morley et al., 2014). Pelagic species are also expected to have more sensitive hearing than demersal species as they have hearing thresholds at lower frequencies (Carroll et al., 2017). The clupeidae family which includes herring, have relatively sensitive hearing and can detect mid-frequency sonar ranges as well as the low frequency ranges typical of most fish species (Mooney et al., 2020)

Canada does not currently have formal guidelines or regulatory thresholds that protect invertebrates, fish, sharks, and skates from the effects of underwater noise. However, DFO has developed a document providing minimum standard mitigation requirements and other guidance related to seismic sound (DFO, 2020e). Quantitatively defining thresholds for underwater noise levels is challenging because specific factors influence species' and individuals' response to noise (e.g., sound types, exposure levels, age, sex, environmental conditions, source proximity). Project-level assessments should be used to further consider effects of noise on invertebrates, fish, sharks, and skates (Carroll et al., 2017; Hawkins & Popper, 2017; Popper et al., 2007; Popper et al., 2014; Popper & Hastings, 2009; Popper & Hawkins, 2012; 2016).

Noise Sources and Effects Across Project Phases

The presence and effects of underwater noise throughout offshore wind development varies. Depending on the project phase and design, sources of noise may include marine vessels, helicopters and drones; systems used to penetrate the ocean floor during site surveys; pile driving during construction; turbine operation; and water jets used to cut foundations during decommissioning.

Vessel Use throughout Development

Noise associated with marine vessel activity can have a number of impacts on invertebrates, fish, and sharks (Popper et al., 2014; Rider et al., 2021; Solé et al., 2023; Weilgart, 2018). Vessels produce varying acoustic signatures depending on size, speed, propeller types, and onboard machinery, but generally the sounds produced are low frequency and can propagate a great distance underwater (CSA Ocean Sciences Inc., 2021; Nolet, 2017). Anthropogenic noise produced by vessel traffic is already generated within the Focus Area by a number of other ocean users (shipping, recreation, fishing, oil and gas development, etc.). However, the potential increase in vessel traffic associated with offshore wind development may concentrate vessel activity and underwater noise production in new areas or exacerbate the effects of existing noise pollution (CSA Ocean Sciences Inc., 2021; DFO, 2004b; Weilgart, 2013).

The underwater sound produced by marine vessels can mask the communication signals of fish, sharks, and skates, by potentially impeding foraging, impairing predator detection, displacing species from their habitat, or causing physiological stress (CSA Ocean Sciences Inc., 2021; DFO, 2004b; Rider et al., 2021; Weilgart, 2013; 2018). As vessels are required for all phases of offshore wind development, the effects have the potential to be chronic, with periods of elevated vessel activity having more pronounced impacts.

Pre-Construction Site Surveys

During the pre-construction phase, site surveys characterize site conditions and the seafloor (CSA Ocean Sciences Inc., 2021; Mooney et al., 2020). The available evidence for physiological, behavioural, and biological effects of anthropogenic noise caused by site surveying activities on fish and invertebrates is conflicting and contradictory (Carroll et al., 2017; CEF Consultants Ltd., 2011; DFO, 2004b; Payne et al., 2009; Popper et al., 2014; Streever et al., 2016).

Systems used to penetrate the seafloor for offshore wind development are lower energy (quieter) and use intermittent short pulses, but generate noise throughout the water column and on/in the seabed that may have behavioural or biological impacts on some invertebrates, fish, and sharks species at certain stages of their life cycle (Bat et al., 2013; Carroll et al., 2017; CSA Ocean Sciences Inc., 2021; Day et al., 2016; Weilgart, 2013). Sessile or less mobile early life stages of fish (i.e. eggs, larvae, fry) that are incapable of moving out of areas impacted by anthropogenic sound are at a greater risk of physiological effects including mortality (DNV energy, 2007; Popper et al., 2014). The risk posed by site surveying systems to marine invertebrates, fish, and shark species is highest during critical periods (e.g. breeding, spawning, early life stages) and can potentially be mitigated through proper planning (see Section 7.4.4 for mitigation measures) (DNV energy, 2007; Hawkins & Popper, 2017; McCauley et al., 2000; Mooney et al., 2020; Sivle et al., 2015). Invertebrate and fish physical, behavioural, and biological responses to site mapping activity can occur at varying distances depending on species and the method used (Carroll et al., 2017; Weilgart, 2013).

Pile Driving during Construction

The construction phase of offshore wind development produces high noise levels and poses the highest risk to fish, sharks, and skates. Pile driving, which is required for some kinds of foundations, creates a significant amount of noise at both high and low frequencies. This may cause auditory injury at close range (CSA Ocean Sciences Inc., 2021; Popper et al., 2014). The available research on the potential effects of particle motion on invertebrates and fish is limited. However, the effects of particle motion from impulsive noise sources are expected to be similar that of pressure waves in fish species (CSA Ocean Sciences Inc., 2021).

The noise produced by pile driving is dependent on the size and material of the piles as well as the hammer type used for driving (e.g. impact, cushioned impact, vibratory) (ICF Jones & Stokes & Illingworth and Rodkin Inc., 2009). Though there is limited research comparing the two, recent studies suggest pile drilling may produce less underwater noise than pile driving and pose less risk of auditory injury to marine species (Guan et al., 2022; Guan & Miner, 2020). Foundation types that don't require pile driving/drilling (i.e. floating, gravity based, or jack-up foundations) or alternative installation methods (i.e. suction caissons or anchors) are thought to generate less underwater noise , though research has been primarily qualitative at this stage (ICF Jones & Stokes & Illingworth and Rodkin Inc., 2009; Mooney et al., 2020; Nedwell et al., 2003; 2007; Nedwell & Howell, 2004).

Turbine Operation

The operation phase generates both temporary underwater noise through maintenance activities and continuous low amplitude sound generated by the turbines. The amplitude of turbine noise varies with turbine size and wind speed, but operational noise does not significantly exceed natural noise levels (Kaldellis et al., 2016; SEER, 2022a). Some studies suggest that fish may adapt to the low intensity operational turbine noise (Thomsen et al., 2006). Behavioural and physical effects to marine invertebrates, fish, sharks, and skates by the operation phase of offshore wind development is comparable to impacts from other more common anthropogenic and natural noise sources such as vessel traffic (Kaldellis et al., 2016; Verfuss et al., 2019).

Decommissioning

Decommissioning of offshore wind turbines often requires the removal of various structures from the project site. To facilitate this process, turbine piles are sometimes cut using water jets or other methods which can generate underwater noise (Hinzmann et al., 2017; Mooney et al., 2020). The underwater noise produced by such activities is likely to be similar to noise produced during the construction phase (Hinzmann et al., 2017). The noise and sound pressure generated cause either temporary or permanent behavioural changes to invertebrates, fish, sharks, and skates in the vicinity, particularly if species have aggregated around wind farms due to artificial reef effects (see Section 7.4.3.1.3. of this Report *Presence of Infrastructure* below for information on the artificial reef effects) (Kikuchi, 2010; Maxwell et al., 2022; Mooney et al., 2020).

7.4.3.1.2 Benthic disturbances and Sediment suspension

During the construction phase of offshore wind development seafloor preparation, cable burying, foundation installation, and vessel anchoring may result in benthic disturbance (ICF, 2020; SEER, 2022a). The installation of gravity foundations often requires dredging of the sea floor to level the area. This can cause significant disturbance to the seafloor and could harm or kill marine plants and invertebrates at or near the location (ICF, 2020). These activities can cause temporary, localized increases in sediment suspension within the water column, increasing turbidity (CSA Ocean Sciences Inc., 2021; ICF, 2020). Such benthic disturbance could smother sessile animals, affecting the gills and respiration of invertebrates, fish, sharks, and skate or impact foraging opportunities and habitat quality in close proximity to the site activity (Bat et al., 2013; Cordes et al., 2016; Fowler et al., 2020; Thrush et al., 2004).

The behavioural effects of sediment suspension and benthic disturbance that take place during the construction phase are expected to be temporary, with invertebrate and fish species returning to the area once activities on the sea floor cease (Bat et al., 2013; CSA Ocean Sciences Inc., 2021; Fowler et al., 2020; Thrush et al., 2004). Scour protection for fixed turbine platforms, inter-array cables, and offshore substation-link cable protection can cause wake-effects that may alter soft-bottom habitat and structural relief throughout the lifetime of the turbine (CSA Ocean Sciences Inc., 2021). The removal of foundations, cables, anchors, and other structures during decommissioning are likely to have comparative effects to the construction phase activities.

7.4.3.1.3 Presence of Infrastructure

Developing an offshore wind farm requires introducing new structures into the marine environment. Newly introduced subsea structures, when present over an extended period of time, can provide new hard substrate in soft substrate environments or additional surface area in hard substrate environments (CSA Ocean Sciences Inc., 2021; DFO, 2004b; ICF, 2020; Whitehouse et al., 2011). Subsea infrastructure can also obstruct and impact pre-existing turbulence and mixing, surface wave energy, sediment dynamics, biogeochemistry, and if extensive, mesoscale flows, upwelling and downwelling, and meteorology (Farr et al., 2021). Such effects may cause changes in invertebrate, fish, eggs, and larvae distributions, abundance, and behaviour through a variety of mechanisms (CSA Ocean Sciences Inc., 2021; DFO, 2004b; English et al., 2017; Farr et al., 2021; ICF, 2020).

Newly introduced structures may also create hospitable conditions for non-native/invasive species to colonize and spread by acting as 'stepping stones' and allowing non-native/invasive species access new regions (De Mesel et al., 2015; Degraer et al., 2020; ICF, 2020; NYSERDA, 2017g). The spread of invasive species through the presence of new infrastructure may be further exacerbated by the increase in vessel traffic, as ships can carry non-native and invasive species in their ballast and introduce them to the environment when releasing their ballast water (Hewitt et al., 2009; Watson et al., 2024). There is limited research on the spread of non-native species on floating offshore wind farms, but a recent study observed an absence of non-native species on floating offshore wind structures potentially indicating they may contribute to less invasive species spread than fixed-bottom offshore wind structures (Karlsson et al., 2022).

The introduction or spread of non-native and invasive species can proliferate disease, cause disruptions to food-web dynamics, and threaten the biodiversity of an ecosystem (Degraer et al., 2020). Changes to the species composition of an area by non-native and invasive species can eliminate essential food sources for predators or disrupt existing predator/prey relationships (Watson et al., 2024).invasive species of particular concern for Newfoundland and Labrador that already exist within the region include the Coffin Box Bryozoan, European Green Crab, Violet Tunicates, and Golden Star Tunicates (DFO, 2012a; Mouland, 2008). These invasive species are described further in Section 7.4.2.6 of this Report.

Newly introduced subsea structures, can provide new habitat for native species and are shown to be rapidly colonized by epifaunal organisms (organisms that attach to hard submerged surfaces) such as alga, molluscs, and other invertebrates (Bat et al., 2013; Bray et al., 2016; ICF, 2020). During the operation phase, this new habitat can cause artificial reef effects by attracting other invertebrates, fish, sharks and skates, introducing new communities of organisms to an area, and increasing biodiversity (Glarou et al., 2020; ICF, 2020; SEER, 2022a). The behavioural changes associated with artificial reef effects are species-specific. For example, some species such as cod may show an increase in abundance on site while others, such as herring, show no behavioural changes (HDR, 2018; SEER, 2022a; Svendsen et al., 2022).

Changes in the abundance and biomass of invertebrate and fish species in one location can affect distribution and behaviour of predators in the surrounding area (Bergström et al., 2013; ICF, 2020; Lindeboom et al., 2011; Reubens, Degraer, et al., 2014; Svendsen et al., 2022). Artificial reef effects have been observed to expand beyond the boundaries of an offshore wind project into the surrounding area (Dannheim et al., 2020). Turbine foundations with larger surface areas and volumes may have greater beneficial effects compared to smaller foundations. Monopile, jacket, tripod, tri-pile, jack-up, suction bucket, and gravity foundation types with similar surface areas, and volumes may have comparative effects. Floating foundations have less underwater structure surface area and volume and may have less attraction effects overall (ICF, 2020).

In cases where offshore farm projects exclude fishing activities and vessel traffic, shelter effects may also occur and attract fish and invertebrates to the project area (Causon & Gill, 2018). Increased prey abundance and foraging opportunities may result from the exclusion of fisheries from the offshore farm area (Bergström et al., 2013; Hammar et al., 2015).

If offshore wind foundations result in artificial reef effects, the removal of underwater structures during the decommissioning phase may cause masking, displacement, physiological stress, and other behavioural or ecosystem impacts (CSA Ocean Sciences Inc., 2021). Partial, rather than complete removal, of offshore wind structures may have environmental and economic benefits, especially if habitat created on the structures has conservation or commercial value (Smyth et al., 2015). However, few offshore wind farms have been decommissioned to date and evidence of positive effects from partial removal of offshore wind structures is currently very limited.

7.4.3.1.4 Presence of Electromagnetic fields

There are both naturally occurring EMFs and those with anthropogenic origin such as subsea electric cables (Normandeau et al., 2011).

Turbines are connected using subsea power cables (inter-array cables) during the operation phase which are often buried in the seabed (>1 m is preferred), protected with a cover, or covered with a concrete mattress. Subsea power cables are also used to send the power to shore (export cables). Both types of cables can emit EMF. The length and capacity of cables, as well as current strengths used for offshore wind farms, increases with distance from shore (CMACS, 2003; OSPAR Commission, 2012; U.K. BIS, 2008). Power cables used for floating offshore wind developments can exist throughout the water column and may require additional protection to reduce EMF emissions (Marcollo & Efthimiou, 2024; Taninoki et al., 2017). The EMF frequency produced by subsea cables can vary depending on current type (AC vs. DC), voltage, current, cable design, and other construction factors. In combination these techniques and other mitigation measures can eliminate most of the EMF emissions from subsea cables (CMACS, 2003; CSA Ocean Sciences Inc. & Exponent, 2019). AC cables generally carry lower power levels and generate weaker magnetic fields than DC cables, making the magnetic fields from AC cables less likely to be detected by marine species (Normandeau et al., 2011; NYSERDA, 2017g; i; Taormina et al., 2020). However, the interactions between naturally occurring

EMF in the oceans and cable-induced EMF are not well understood (Hermans et al., 2022). There is currently little evidence that EMF emissions produced from offshore wind subsea cables impact individual animals or populations (Stantec Consulting Limited, 2022; Taormina et al., 2020).

EMF can affect electrosensitive animals such as some elasmobranchs (sharks, skates, and rays) and bony fishes as well as magnetosensitive animals such as some elasmobranchs and invertebrates (Bat et al., 2013). EMF may interfere with the detection of naturally occurring electric/or magnetic fields in the ocean, affecting functions such as navigation and prey/predator detection (NYSERDA, 2017g; Taormina et al., 2020).

While most research to date involves impacts on adults, new studies show EMF emissions may also affect the egg and larval stages of development (Scott et al., 2018; 2021). Not all animals with the ability to detect EMF will respond or be affected by EMF and effects are thought to be restricted to the immediate area of the cable (≤ 20 m) (Scott et al., 2018; 2021; SEER, 2022a; Taormina et al., 2020).

7.4.3.1.5 Entanglement

The mooring line and cable diameters currently used in offshore wind farms are large, and the lines and cables themselves are heavy, reducing the risk of primary entanglement. However, secondary entanglement caused by marine debris (e.g. derelict fishing gear) can become snagged in floating offshore wind farm mooring lines and cable systems. This poses a threat to a variety of marine species (Maxwell et al., 2022; Taormina et al., 2020). Large migratory species, particularly species at risk in Newfoundland and Labrador, such as the endangered Basking Shark are at a greater risk of entanglement (Maxwell et al., 2022; SEER, 2022a). Entanglement can result in acute tissue damage, asphyxiation or respiratory distress, mobility issues, reduced foraging capacity, and population growth problems (SEER, 2022a). Predators may also be attracted to entangled marine debris if prey species are caught within it (Maxwell et al., 2022).

7.4.3.1.6 Vessel Collisions

The mechanism and nature of vessel collisions are briefly described in Section 7.5.2.1.5 of this Report. Marine species that spend more time near the surface such as the endangered Basking Shark are at higher risk of vessel collisions (NYSERDA, 2017i; Schoeman et al., 2020). However, for most marine fish and shark species the risk of vessel collision is low due to size and lack of time spent at or near the surface.

7.4.3.1.7 Artificial light

Offshore wind farms produce varying degrees of artificial light throughout all phases from equipment, vessels, and turbines (Orr et al., 2013). The response of fish and invertebrate species to artificial lighting are not well studied, but may include behavioural responses such as startling, attraction, or avoidance (NYSERDA, 2017g; Stantec Consulting Limited, 2022).

7.4.3.1.8 Presence of HVDC

Both AC and DC can be used to transport energy for an offshore wind farm. In some cases, a HVDC system is used to convert AC to DC to transport energy from offshore wind farms to shore (Middleton & Barnhart, 2022). This conversion process generates enough heat that cooling mechanisms are required for the HVDC system. There are different types of cooling mechanisms for HVDC systems, but open-loop systems release heated water back into the ocean which may have impacts on the ecosystem immediately surrounding the stations (Middleton & Barnhart, 2022). Though there is little research on the impacts of heated water discharge from HVDC systems, some studies show that temporary localized effects such as avoidance or attraction to the change in water temperature may occur. Attraction of invertebrates and forage fish species may affect the foraging behaviours of some larger marine species (Middleton & Barnhart, 2022). However, HVDC effects are generally accepted as minimal due to the ability of the surrounding ocean mass to absorb and transition any warm water output to an ambient temperature (Middleton & Barnhart, 2022). There is evidence to suggest there may be some loss of larval species when they are filtered through the intake pipes for some HVDC systems (Middleton & Barnhart, 2022).

7.4.3.2 Indirect Effects of Planned Offshore Wind Activities

Invertebrates, fish, skate, sharks, and fish habitat that occur within the Focus Area are culturally, economically, and ecologically important for a variety of Indigenous groups, communities, industries, and other plant and animal species. Changes to habitat, invertebrates, fish, sharks, and skates' health, abundance, distribution, feeding, reproduction, migration, and behaviours may have indirect effects on these groups and species, and on their activities (Table 7.4.13).

Large changes in species and habitat could affect predator-prey interactions, in turn affecting species occurrence and abundance. The displacement of invertebrates and fish or changes to their abundance and distribution could also impact tourism and recreation activities, as well as the cultural heritage of local communities and Indigenous groups. Physical and behavioural impacts to invertebrates, fish, sharks, and skates as well as impacts to non-living fish habitat caused by offshore wind development may also be exacerbated by the effects of climate change which could affect the biodiversity and health of ocean ecosystems for future generations.

Table 7.4.13. Potential Indirect Effects Caused by or Affecting Marine Fish and Fish Habitat

Component	Indirect Effects	Section
Aerofauna	Impacts to ecological sustainability through changes in biodiversity, behaviours, distribution, abundance, health, and ecosystem.	7.3
Marine Mammals and Sea Turtles	Impacts to prey-predator interactions, behaviours, distribution, abundance, health, and ecosystem.	7.5
Fisheries	Impacts to commercial fishing economy through changes to prey-predator interactions (bottom-up and top-down), behaviours, distribution, abundance, health, and ecosystem of commercial species.	7.7
Other Ocean Uses	Impacts to tourism economy and location as well as recreation locations and opportunities.	7.8
Physical and Cultural Heritage	Impacts to cultural important species for Indigenous groups and communities.	7.11

Table Description: This table summarizes the potential indirect effects to other components (i.e. Marine Mammals and Sea Turtles, Fisheries and Other Ocean Uses etc.) if marine fish and fish habitat are affected by offshore wind development.

Sources: Christian et al., 2010; CSA Ocean Sciences Inc., 2021; Dannheim et al., 2020; DFO, 2005; Lindeboom et al., 2011; Marine Management Organisation, 2013; Veit & Harrison, 2017.

7.4.4 Mitigation and Other Measures

Projects proposed in the U.S. along the Atlantic coast and existing farms in the North Sea provide a number of mitigation measures for the potential impacts of offshore wind development on fish and fish habitat (BOEM, 2024; Degraer et al., 2020; Minerals Management Service, 2007). Table 7.4.14 outlines a variety of these measures.

Table 7.4.14. Common Mitigation Measures for Impacts to Marine Fish and Fish Habitat

Mitigation Measures	Description
Project Siting	• Avoid areas that are important to impacted species such as breeding, spawning, migration, and feeding areas. Avoid EBSAs, MPAs, critical habitats, and other protected areas. ○ Offshore wind developments should be avoided in sensitive and productive fish habitats, such as natural and artificial reefs. • Conduct baseline survey work for at least two to three years prior to construction to identify critical habitat areas, BACI designs, seasonal species distributions, efficient monitoring protocols, and other physical and ecological data (e.g. oceanographic conditions, acoustics, migration routes etc.). • Engage fishers, Indigenous groups, the public, and other stakeholders early in planning and decision-making processes (collaborative approach) to help identify specific impacts and mitigation measures relevant to the area in question and help provide insight into what kind of turbine foundations, mooring systems and inter-array and export cable design would be best. • Perform pre-installation or construction seabed assessment surveys including ground truthing of modelled habitats maps, mapping in areas where substrate and biological communities are unknown and updating biological surveys where they have been previously done to determine locations with sensitive habitat.
Underwater Noise and Vibration*	• Plan and coordinate pre-construction, construction, and decommissioning activities that produce noise such that they are completed efficiently and minimize noise duration. • Plan seismic surveys that use the minimum energy required. • Use foundation types or installation methods that do not require or minimize the amount of pile driving. • Conduct sound field verification measurements of pile-driving noise to determine the adequacy of certain mitigation and monitoring procedures. • Implement ramp up/soft start for seismic activities and pile driving at reduced energy over several waiting periods to deter species that may be in the area. • Avoid or restrict pile driving and other pre-construction and construction activities that generate significant underwater noise at sensitive times of year important to impacted species such as during feeding, spawning, migration, and nursing windows. • Use trained protected species observers to maintain an exclusion buffer zone (Safety Zone) around pile driving and air source array (500 m) activities. Shut down or delay pile driving activities if protected species are seen entering or within the buffer zone. • Implement quieting technologies such as bubble curtains, vibratory pile drivers, isolation casings, cofferdams, and hydro sound dampeners.

Mitigation Measures	Description
	• Shut down any energy sources when active surveying or construction activities cease (e.g., active sonar, seismic air source arrays, acoustic deterrent devices, etc.). Any vessel traffic associated with the project should use acoustic reducing technologies. • Exclude non-essential vessel traffic from the project area during the operation phase. • Pre-fabricate parts onshore when possible, to reduce the introduction of noise to the marine environment.
Benthic Disturbance and Suspension of Sediment	• Avoid sensitive sea floor habitats and areas that are important to impacted species such as breeding, spawning, and feeding areas. • Avoid burying cable at times of year important to impacted species such as during feeding, spawning, and reproduction windows. • Plan cable burial process efficiently to require fewer steps when possible. • Reduce the amount of cable required by building closer to shore and reducing distance between turbines. • Use burial techniques that reduce resuspension of sediment such as horizontal direction drilling, dynamic vessel positioning, and ploughing. • Backfill material displaced by cable material to reduce the potential for sediment remobilization and to enable recovery of benthic organisms. • Remove vegetation prior to installation where sensitive habitats are present along a cable route and replant/enhance after installation. • Reduce speed of cable burial. • Bundle new cables with existing cables and pipelines when possible. • Minimize the number of cable/pipeline crossings and crossing structures. • In shallow waters conduct cable burial at low tide. • Repair project-related degradation or damage to ecosystem and biodiversity features that cannot be entirely avoided and/or minimized (e.g. restoring coastal intertidal habitats disturbed during export cable installation). • Reducing the overall footprint of the turbine matrix and cable array • Use tenders to lift anchors rather than dragging them across the seabed. • Use designated or directed anchoring. • Shorten mooring chain lengths to reduce scouring at floating offshore wind facilities.

Mitigation Measures	Description
Presence of Infrastructure	• Repair project-related degradation or damage to ecosystem and biodiversity features that cannot be entirely avoided and/or minimized (e.g. restoring coastal intertidal habitats disturbed during export cable installation). • If possible, consider leaving infrastructure in place if there is an artificial reef effect associated with foundations/scour protection that provides biodiversity/ecosystem benefits. • To maximize fish habitat, developments should consider nature-inclusive designs. • Reducing the overall footprint of the turbine matrix and cable array. • Develop guidance for offshore wind project developers regarding invasive species monitoring and prevention measures.
Entanglement	• Adhere to federal, provincial, and international waste management procedures to prevent build-up of debris. • Implement underwater cameras, vessel mounted sensors, and ROVs to monitor mooring and line loads or motion and remove debris. • Ensure Plow cables/umbilicals are always under constant tension.
Vessel Collisions	• Establish designated traffic lanes. • Minimize changes in vessel traffic where species at risk are likely to occur. • Maintain the mandatory distance from sharks when observed, in particular species at risk. • Enforce speed restrictions during certain times of year (e.g. spawning, breeding). • Establish vessel exclusion zones or areas of avoidance. • Use trained protected species observers to monitor. • Conduct aerial surveys to monitor shark species. • Implement real-time vessel-based reporting to share sightings amongst vessels. • Reduce vessel traffic during construction and decommissioning. • Use helicopters and/or drones rather than vessels for maintenance when possible, to reduce vessel traffic.
Artificial Light	• Limit lighting during offshore operations to the minimum required by regulation and for safety, minimizing the potential for any light driven attraction.

Mitigation Measures	Description
Subsea Power Cables and EMF Emissions	• Use sediment as a physical barrier by burying cables that emit the strongest magnetic and induced electrical fields at a depth of 1.5 - 2 m • Implement effective armour and sheath material as well as efficient proximity/bundling of conductors to create a barrier to sensitive species. • Implement cable technologies that reduce EMF emissions such as helically twisted three-core AC cables. • Add additional protective layer around cables installed on top of the seafloor. • Arrange HVDC cables side by side with adequate burial depth. • Install cables in areas that have minimal impact on benthic habitats. • Include cable removal as part of the decommissioning plan. • Whenever possible, align dynamic cables within shared corridors to reduce the overall footprint.

Table Description: This table describes the mitigation measures that could be implemented to mitigate or enhance the effects of offshore wind development and fill in data and knowledge gaps.

* All mitigation measures listed in the "*Statement off Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment"* (2007), should be implement when conducting activities that produce seismic sound.

Sources: Bennun et al., 2021; BOEM, 2022a; Carroll et al., 2017; Causon & Gill, 2018; Copping & Hemery, 2020; CSA Ocean Sciences Inc. & Exponent, 2019; Dannheim et al., 2020; Degraer et al., 2020; DFO, 2004b; 2020e; Fowler et al., 2020; Hammar et al., 2015; Hawkins & Popper, 2017; Lüdeke, 2017; Maxwell et al., 2022; NOAA, 2008; NYSERDA, 2017d; 2021; OSPAR Commission, 2012; Perry & Heyman, 2020; Raoux et al., 2017; SEER, 2022a; Stantec Consulting Limited, 2022; Svendsen et al., 2022; Taormina et al., 2020; U.K. BIS, 2008; Verfuss et al., 2019; Watson et al., 2024.

7.4.5Engagement Outcomes

Participants expressed general concerns about how offshore wind development will affect marine species and their habitats and a need for more long-term studies and research. Through a request for input on the draft effects tables to the advisory groups and in-person public engagement sessions, the Committee received additional references for use and suggestions for work to include that are incorporated throughout the Report. Information on the distribution or areas of importance for some species was also provided through engagement and incorporated into the Report where applicable. General concerns about what the potential effects of various phases and activities of offshore wind development may be and how they would impact fish habitat (with emphasis on eel grass), invertebrates, fish, sharks, and skates were expressed frequently through public engagement, advisory group input, and Indigenous engagement. Some of these effects include the production of anthropogenic noise, pollution, erosion, habitat degradation, generation of non-natural EMFs, changes to water quality, and disruption of migration routes. The potential disruption of migration routes for Atlantic Salmon are of particular concern to some Indigenous groups and members of the public.

QFN identified American Lobster as a species that supports a culturally significant fishery and noted specific concern with disturbance to lobster habitat and feeding grounds during the construction phase.

MFN identified Atlantic Salmon, American Eel, cod, whelk, sea cucumber, and other fish, shellfish, groundfish, and pelagic species as important to their culture, diet, and way of life. MFN also expressed concern for the well being and protection of eelgrass meadows in their response to the Interim Report.

Kwilmu’kw Maw-klusuaqn identified American Lobster, Atlantic Salmon, American Eel and trout as culturally significant species and noted concern regarding how they would be affected by offshore wind development.

Benoit First Nation Inc. expressed concern that offshore wind development would damage habitat for their cod, lobster, and halibut fisheries.

The Flat Bay Band Inc. identified the importance of fish and eel to their culture, diet and way of life, as well as expressed concerns about the potential impacts of noise pollution and the presence of infrastructure on fish and other marine life.

The Port au Port Indian Band identified Port au Port Bay and Bay St. George as important for migration, fish spawning grounds, sensitive benthic habitat, and as having high ecological significance. In their submission on August 23, 2024, a member of Port au Port Indian Band indicated they are concerned for the impact of offshore wind development to all species at risk such as wolffish. Another member raised concerns that offshore wind turbine development activities, such as construction or operation, may generate excessive noise and light pollution (at distances as great as 80 km), which can disturb local wildlife populations such as, wolffish and disrupt their natural behaviors. Additionally, the concern

regarding bait fish species and the decline in their populations was raised during in-person engagement.

7.4.6 Data Gaps and Limitations

Data on oceanographic conditions, fish habitat, invertebrates, fish, sharks, and skates are collected through federal government surveys, from existing fisheries data, or through opportunistic sightings. However, much of the data collected for such species is conducted for fisheries or the oil and gas industry and tend to be focused on areas relevant to such industries resulting in data gaps in other areas, including the Focus Area. For areas that have been studied, no life-cycle analyses have been conducted in Canadian waters for offshore wind farms and assessing ecological impacts across differing spatial and temporal scales poses a challenge given the available data.

Furthermore, climate change is anticipated to affect the abundance and distribution of many invertebrates, fish, sharks, and skates as well as important components of their habitat in the Northwest Atlantic due to changes in oceanographic conditions and prey distribution or abundance. There is a need to better understand the effects of climate change on invertebrate, fish, sharks, and skate species as well as how it may change their distributions.

Limitations such as these are the cause of the existing data gaps with respect to oceanographic conditions, fish habitat, and marine species within the Focus Area. Detailed descriptions of data and knowledge gaps are described in the relevant sections below. Cumulative effects, which are important to consider when assessing the potential impacts to marine fish and fish habitat, are best performed when there is sufficient data for analysis. The data and knowledge gaps for marine fish and fish habitat, particularly when considering publicly available information, limit the assessment of cumulative effects within the Focus Area. Section 8 discusses potential cumulative effects on marine fish and fish habitat.

7.4.6.1.1 Oceanographic Conditions and Fish Habitat

Data collection for sea floor geology mapping poses a challenge within the Focus Area due to the deep waters surrounding Newfoundland and Labrador. Mapping at greater depths can require significant effort and funding and is often driven by interest from industry or for the preservation of certain important species or habitats. With recent technology advances sea floor geology mapping as well as habitat mapping is improving and becoming more accessible. However, some regions within the Focus Area are not well mapped, particularly regions of great depth or that are very shallow (< 30 m). With the interest in the potential for offshore wind development off the east coast of Canada, the Geological Survey of Canada has initiated assessments of the subsea geology in several areas of the east coast, including much of the Regional Assessment Focus Area (Tang & Kilpatrick, 2021). Other government authorities are also in the process of conducting geoscientific research in Atlantic Canada to fill these data and knowledge gaps.

Additionally, most of the Focus Area is considered data poor with regards to physical oceanographic data, since data is primarily restricted to transects (DFO, 2023ee). Seasonality of oceanographic conditions is also important to the functioning of the ecosystem and not well understood in the Focus Area as measurements are monitored infrequently (2 - 4 times a year) (DFO, 2023ee).

Mapping of particular habitat types or components is also important for assessing the overall health of the Focus Area and how species are distributed within it. There is a lack of information on where kelp forests are present within the Focus Area.

7.4.6.1.2 Invertebrates

Data on corals and sponges comes mainly from multi-species bottom trawl surveys (Bernier et al., 2023; DFO, 2023g). These surveys avoid rough grounds such as rocky outcrops and deep, muddy areas and, as such, may leave other coral and sponge grounds unidentified (Bernier et al., 2023; DFO, 2023g). In particular, there is a lack of coral and sponge survey data in both coastal and deep-water areas (1,500 m depth) (Bernier et al., 2023; DFO, 2023g). Advances in technology have permitted the use of ROVs to assess areas outside “trawlable” habitats but are usually used in smaller areas and the existing data does not cover all parts of the Focus Area (Bernier et al., 2023; DFO, 2023g).

Data for the invertebrates found within the Focus Area primarily comes from fishery related surveys or catch information (Bernier et al., 2023; Christian et al., 2010; DFO, 2023h). This results in data gaps for species that are not fished or harvested as well as unequal effort across the Focus Area with higher-density areas having greater surveying effort and fisheries related data (Bernier et al., 2023; Christian et al., 2010; DFO, 2023h).

The data available for non-commercially fished species often comes from bycatch numbers and is then extrapolated to the wider region. Some of the data available for species with low abundance or in difficult to survey areas (deep benthic habitat) often does not provide information at the seasonal or even annual level regarding changes in distribution (Bernier et al., 2023; Christian et al., 2010; DFO, 2023h).

The current limitations in surveying and data collection have resulted in data and knowledge gaps for many invertebrate species. These data and knowledge gaps include missing data on population abundance, distribution, and important areas for various life stages.

7.4.6.1.3 Fish, Sharks, and Skates

Data collection for pelagic species of fish and sharks is a challenge due to their vast distribution in the world’s oceans. The occurrence, abundance, migration routes and life histories of several fish, skate, and shark species, especially diadromous species such as American Eel and Atlantic Salmon and species that are not commercially important, are not well identified. Data for the fish, sharks, and skates found within the Focus Area primarily comes from fishery related surveys or catch information. Bottom trawl surveys, the primary tool of DFO research, are not useful for large pelagic species and new

technology should be considered. Both Atlantic Salmon and American Eel have status under COSEWIC and are significant in Indigenous cultures.

The lack of data and knowledge on fish, shark, and skate movements also creates challenges for habitat modelling. As such, habitat modeling has not been done for any shark species at the scale of the Focus Area and there is little information on spawning and pupping for most of the species of shark in Canadian waters (Druon et al., 2022 in DFO, 2023ii).

The data available often does not provide information at the seasonal or even annual level regarding changes in distribution. Seasonal information on fish, sharks, and skate abundance, distribution, and spawning time/areas would help plan work at sea, such as construction of offshore wind facilities.

The current limitations in surveying and data collection have resulted in data and knowledge gaps for many fish shark, and skate species. These data and knowledge gaps include missing data on population abundance, distribution, migration, spawning, and habitat use relative to prey density.

7.4.6.1.4 Invasive Species in the Focus Area

Understanding how invasive species spread is essential to preventing or slowing their spread into new regions. Currently, the information on how invasive species spread through supply vessels is limited for the Newfoundland and Labrador region and further research is required to develop improved mitigation and prevention measures (DFO, 2023bb). More studies and surveys are also required to assess the current abundance and associated numbers for control for some invasive species in the Focus Area in order to direct mitigation measures to prevent impacts to fisheries and the environment (DFO, 2023bb). The method, manner, and speed of invasive species spread artificial offshore structures is also an important data gap for Newfoundland and Labrador, particularly in relation to the installation of offshore wind farms (DFO, 2023bb).

7.4.6.1.5 Underwater Noise

There remain considerable gaps in the understanding of anthropogenic sound on fish and invertebrates (Carroll et al., 2017; Hawkins, Pembroke, et al., 2015; Hawkins & Popper, 2017; Popper et al., 2019; Popper & Hastings, 2009; Weilgart, 2018). In particular, information on effects of underwater sound on eggs, larvae and other early developmental stages of invertebrates, fish, shark, and skates is sparse. While underwater noise is produced by a myriad of sources during offshore wind development, the noise levels produced during cable burial are not well understood and require further study (OSPAR Commission, 2012). Data and information available on anthropogenic sound made during the installation of various turbine types focus primarily on structures that require pile driving. Additional research on the underwater noise generated by non-pile foundations is required.

7.4.6.1.6 Species Behaviour and Movement

Behaviour, movement, and interactions with and around offshore wind farms are not well understood for some invertebrate, fish, shark, and skate species. Further research is required to gain a better understanding of how to mitigate negative effects and ensure positive effects (such as the potential for new habitat provided through scour protection and cable burial or how entanglement contributes to ecosystem effects). Information on movement and behaviour would also improve the ability to identify high-risk offshore wind development areas and improve monitoring efforts. Existing data on vessel collisions focus on large marine mammals and there is limited information for smaller species. Displacement of fish, shark, and skates by vessels also requires further research to collect quantitative movement and behavioural data (Copping & Hemery, 2020; Fowler et al., 2020; Hawkins & Popper, 2017).

7.4.6.1.7 Decommissioning and Artificial Reef Effect

The formation and effects of artificial reefs on offshore wind structures requires further research to discern appropriate baseline monitoring techniques to assess changes in biomass, density, behaviour, and ecosystem level trophic shifts (Perry & Heyman, 2020).

Due to the complexity of artificial reef ecosystems, the effects of turbine removal and other activities during decommissioning are not well understood. There have also been few offshore wind farms decommissioned to date, further reducing the available research for consideration. Further research on the indirect effects of decommissioning is required. The effects of decommissioning when offshore wind farms act as fisheries exclusion zones and potentially provide shelter effects to various marine fish, shark, and skate species is also not well documented.

7.4.6.1.8 Anthropogenic habitat creation

Cable burying methods including burial with rock or other substrates may have species or community level effects which are not currently well understood. The cumulative impacts of habitat creation in areas of potential EMF exposure requires further research (Copping & Hemery, 2020). The cable burying methods and stabilization through rock armor should be further studied to address interactions with species on community scales.

7.4.6.1.9 Acute and Cumulative EMF Exposure

The effects of EMF caused by offshore wind farms are not clearly understood and further research, is required both in- and ex-situ (Hermans et al., 2022; OSPAR Commission, 2012). Additionally, there are some species and development stages (egg, hatching, larvae) for which research on the effects of EMF exposure has not been conducted and should be completed to adequately assess the impacts to the species present within the Focus Area (Copping & Hemery, 2020; Taormina et al., 2020). Cumulative effects of EMF exposure on other species is also important for considerations of impacts (Copping & Hemery, 2020).

7.4.6.1.10 HVDC Exposure

The effects of heated water discharges from HVDC outtake pipes and its impact on species is not well documented or understood. Further research is required to assess if HVDC poses a significant risk to marine fish and fish habitat.

7.4.7 Committee Conclusions and Recommendations

The oceans waters around Newfoundland and Labrador are changing rapidly as are some of the historical marine communities (Bernier et al., 2023; Bourdages et al., 2023; DFO 2024c). The historical and on-going multi species trawl surveys and oceanographic surveys through DFO's work, have not had a focus on the information relevant to the potential new ocean use for offshore wind development. As an outcome of preparing the Regional Assessment, several recommendations to address data and information important to considering offshore wind development are made:

- Federal agencies (e.g., DFO, ECCC) begin a sustained series of surveys and programs to develop the basic information regarding the marine physical and biological environment in the Focus Area, including the areas identified for earlier potential offshore wind development, up to 80 m depth (Figure 6.12). Support should be provided to the Regional Marine data Collection Campaigns under NRCan's Offshore Wind Predevelopment Program which aims to help conduct the research required to fill these data gaps.
- Research and survey effort should include identification of migratory routes and/or important areas for all species at risk, fish and sharks. Specifically, a program of surveys in the Focus Area to collect information on sharks regarding species occurrence and abundance. Proponents should directly or indirectly (through a collective fund such as the Environmental Studies Research Fund (ESRF)), fund these research and survey programs. A range of technologies and data gathering should be considered, including protocols for observations by ocean users, eDNA, and autonomous underwater vehicles (AUVs).
- Project specific impact assessments should be conducted by proponents based on a minimum of 2 years or longer if a high level of variability is found, of site-specific surveys and should also include long-term monitoring and follow-up programs. Research should be conducted by proponents or through programs similar to the ESRF.

7.5 Marine Mammals and Sea Turtles

7.5.1 Legislative Background

Under the IAA, project-level impact assessments must take into account changes to the environment that are likely to be caused by carrying out the project (*IAA,* 2019, c.28, s. 22(1)). This may include changes to the atmosphere, soil, wetlands, marine areas, vegetation, animals, fish, and birds (IAAC, 2020b). Project determinations by the IAAC and Minister of Environment and Climate Change Canada (i.e., whether an impact assessment is required, and whether the adverse effects of a designated project are in the public interest) focus on preventing and mitigating adverse effects in areas of federal jurisdiction (*IAA*, 2019, c.28, s. 16(2), 60(1)). Regarding marine mammals and sea turtles, species at risk are within federal jurisdiction. More information on the SARA *(*2002), and its protections is under Section 7.6.1.9 of this Report. Information on marine mammal and sea turtle species at risk in the Focus Area is under Section 7.5.2.5 of this Report.

The federal *Fisheries Act* (1985), and the associated Marine Mammal Regulations, (1993) protect most marine mammals from fishing and hunting without licences anywhere they are found in Canada as well as restricts their treatment regarding other ocean activities (i.e. research, tourism, shipping, recreation, etc.). The *Oceans Act* (1996) and its associated regulations also serve to protect and conserve marine mammal and sea turtle through the designation and regulation of marine protected areas.

Regarding provincial protections, wildlife in Newfoundland and Labrador is managed under the provincial *Wild Life Act* (1990) and its regulations. The Newfoundland and Labrador *Endangered Species Act* (2001) also protects marine mammal species at risk and their habitats. Provincial regulatory bodies like the DOECC may have additional impact assessment requirements for offshore projects in provincial waters.

Finally, several programs and strategies also aim to protect marine mammals and sea turtles. For example, the Canadian Sea Turtle Network and Ocean Wise conduct research and collect sighting data with the goal to conserve and protect endangered and declining species.

International bodies such as the International Whaling Commission and the United Nations Convention on the Law of the Sea also provide regulations and guidance on the protection and conservation of whales to participating nations such as Canada.

7.5.2 Existing Conditions

Marine mammals and sea turtles are considered ecologically, economically, culturally, and recreationally important to various groups, including government departments and agencies, Indigenous groups, and other interested parties. A variety of marine mammals, including *mysticetes* (baleen whales), *odontocetes* (toothed whales, dolphins and porpoises), and *pinnipeds* (seals), and sea turtle species occur within the Focus Area. These include several species of conservation concern.

Polar Bears (*Ursus maritimus**)*** are also occasional visitors to the Island of Newfoundland in proximity to the Focus Area (COSEWIC, 2018). However, Polar Bear sightings in the region are considered extra-limital observations, occurring when individuals drift on icebergs or pack-ice carried southward with the Labrador Current (COSEWIC, 2018). The rare presence of Polar Bears occurs outside the Focus Area of the Regional Assessment so they will not be considered further within the Report.

Oceanographic conditions (described in further detail under Section 7.4.2.2 of this Report) affect the distribution of marine mammals, sea turtles, and their prey.

7.5.2.1 Mysticetes

Baleen whales (mysticetes) are large cetaceans that are characterized by having plates of baleen to filter food items such as zooplankton and small schooling fish from seawater. North Atlantic Right Whales (*Eubalaena glacialis*), Common Minke Whales (*Balaenoptera acutorostrata*), Sei Whales (*Balaenoptera borealis*), Blue Whales, Fin Whales (*Balaenoptera physalus*), and Humpback Whales (*Megaptera novaeangliae*) likely occur regularly in the region (see Table 7.5.1). Baleen Whales are known to migrate seasonally over long distances from their feeding to their breeding areas (Stantec Consulting Services Inc., 2022).

In an engagement session on June 11th, 2024, in Marystown, participants mentioned observing Humpback, Minke, and Sperm Whales (*Physester macrocephalus*) in Fortune Bay.[96]

Figure 7.5.1 shows mysticete observations and incidents across the Focus Area. These findings are based on publicly available data from the At-Sea Observer Program (1990 - 2022), OBIS, and CCRI (1996 - 2007) (DFO, 2023ff; 2024f; k; OBIS, 2024). Data collection on distribution for marine mammals such as baleen whales can pose a variety of challenges (see Section 7.5.6, Data Gaps and Opportunities). The data presented in these figures is the result of limited surveys and is not a true indication of species distribution. As such, Figure 7.5.1 should be considered a qualitative representation of the species identified. Project-level assessments should be used to further evaluate the distribution and abundance of mysticete species at and around projects sites.

[96] A summary of this engagement session is available on the Registry under document reference number 385.

Figure 7.5.1. Mysticete Observations in the Focus Area

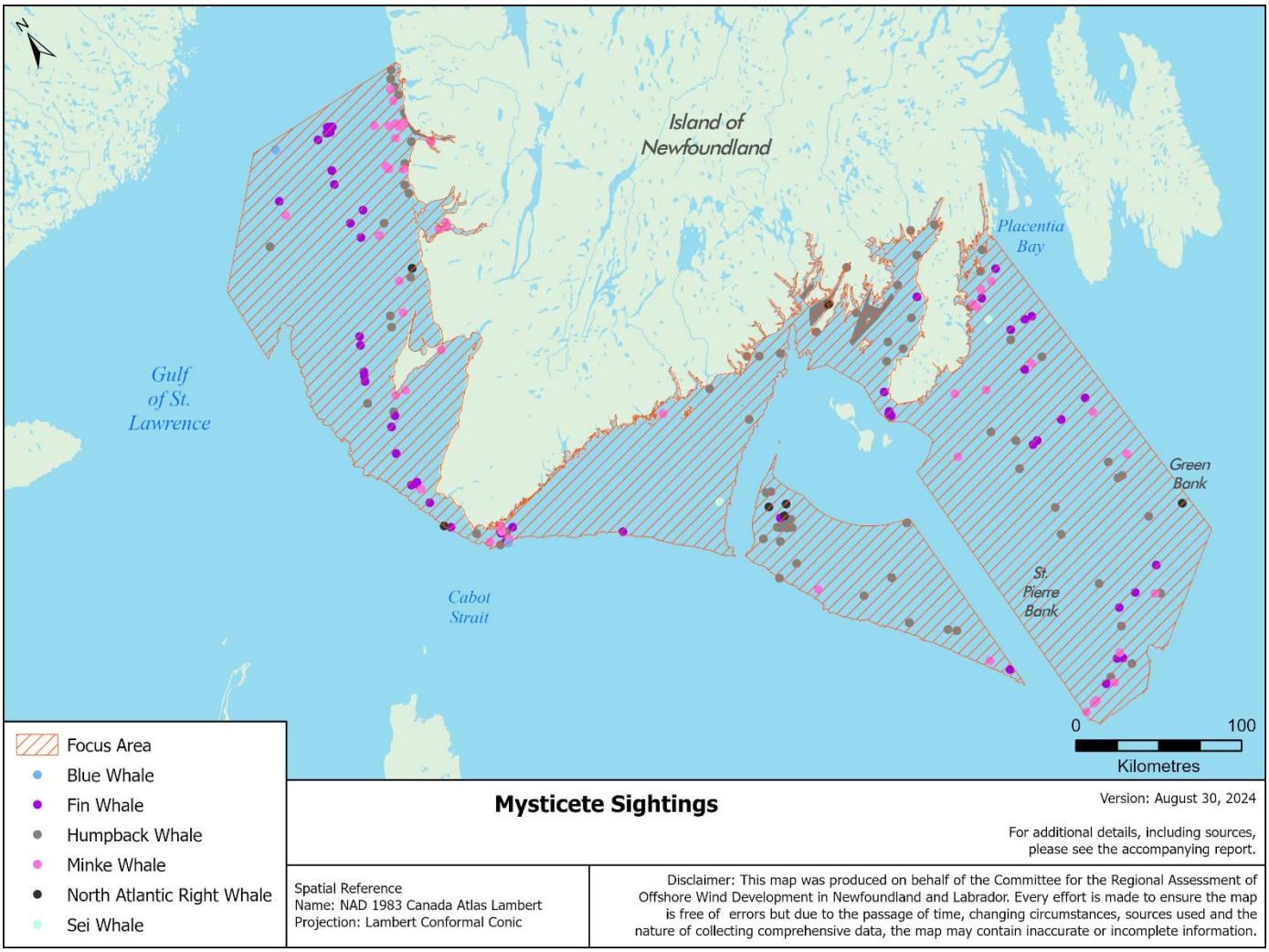


Figure Description: This map shows locations where various baleen whale species have been observed or recorded in the Focus Area.[97] The baleen whales identified include Blue Whales, Fin Whales, Humpback Whales, Common Minke Whales (Minke Whale), North Atlantic Right Whales, and Sei Whales. The highest density of whale observations in the Focus Area occurs on St. Pierre Bank and around the west coast.[98]

Data Sources: DFO, 2023ff; 2024f; k; OBIS, 2024.

For all the baleen whale species at risk in the Focus Area, the historic decline in their population was caused by whaling that occurred in Canada until the late 20th century and is still practiced in some countries (COSEWIC, 2002; 2013d; 2019a; c; 2022b). Recent data

[97] Species observations identified through the CCRI may appear as small polygons rather than points.
[98] Identified trends reflect available data and are not a quantitative representation of species distribution.

suggests declining population trends for North Atlantic Right Whales and Blue Whales, and increasing population trends for Humpback and Fin Whales (DFO, 2023ii; 2024c). Current populations trends for other mysticete species in the western North Atlantic are unknown. More recently, anthropogenic threats include increased vessel traffic (collisions), and fishing gear (entanglement) which are the leading causes of mortality for these species (AMEC, 2014; COSEWIC, 2002; 2006a; 2013d; 2019a; c; 2022b). Climate change is anticipated to affect baleen whales by changing prey availability and distribution, and by increasing ocean temperatures. Some species are sensitive to heatwaves, and increased ocean temperatures can cause those species direct harm (COSEWIC, 2002; 2022b; Lettrich et al., 2023; Tulloch et al., 2019).

Table 7.5.1. Mysticete Species that Occur in or Around the Focus Area

Type	Species	Habitat and Distribution	Presence in Focus Area*
Balaenidae – Right whales	North Atlantic Right Whale (*Eubalaena glacialis*)	• Prefers waters 100 - 200 m deep with surface temperatures between 8 and 15°C. The species occurs in shallow and deep coastal waters as well as offshore. • Distribution influenced by the presence and abundance of prey species. • Highest abundance in Atlantic Canada at the Bay of Fundy, on the Scotian shelf, and in two areas of the GSL. • Present in Atlantic Canada year-round, most abundant from summer to late fall. Pregnant cows head south to calve in the winter. • Migrate through the Focus Area in spring and winter into the southern Gulf.	Uncommon; most likely to be present in the summer to late fall.
Balaenopteridae – Rorquals	Common Minke Whale (*Balaenoptera acutorostrata*) - Atlantic population	• Prefers shallow (< 200 m) ice-free water. • Cosmopolitan distribution with a preference for colder waters. • Winter distribution may occur along the western North Atlantic, including a population of at least 5,000 around Newfoundland and Labrador. • Often alone or in small groups, occasionally form large groups for feeding.	Present; most common in the summer and fall.

Type	Species	Habitat and Distribution	Presence in Focus Area*
	Sei Whale (*Balaenoptera borealis*) - Atlantic population	• In the Northwest Atlantic, often detected in offshore, pelagic habitats and potentially associated with the continental shelf edge. • Winter migration from tropical or subtropical regions to temperate and subpolar in summer. • Not considered deep divers.	Uncommon' most likely to be present during the summer.
	Blue Whale (*Balaenoptera musculus*) - Atlantic population	• Present in coastal and pelagic waters, frequently at shelf edge where food production is high. • Critical habitat in the estuary and GSL is currently being identified for the species. • Present off the coast of southern Newfoundland in the winter and spring months for feeding. • Calving occurs late fall to mid-winter. • Distribution during feeding seasons is largely dependent on their prey.	Present in small numbers throughout the year; most common in the winter and early spring (December - April).
	Fin Whale (*Balaenoptera physalus*) - Atlantic population	• Highest densities occur in cool temperate and subpolar waters; cosmopolitan oceanic distribution. • No preference between oceanic and coastal waters. • Seasonal migrants; travel long distances to northern latitudes during the summer to feed. ○ Migrate through the Focus Area in spring and fall into the Gulf. • Distribution during feeding seasons is largely dependent on their prey. • Often alone or in pairs, occasionally form groups as large as 20 individuals for feeding.	Present year-round; most common in the summer and fall.

Type	Species	Habitat and Distribution	Presence in Focus Area*
		• Often sighted off the south coast of the Island of Newfoundland.	
	Humpback Whale (*Megaptera novaengliae*) - Western North Atlantic population	• Migrate seasonally for great distances between temperate and arctic feeding areas. ○ Migrate through the Focus Area into the Gulf. • Often alone or in small groups, occasionally form groups as large as 15 individuals for breeding and feeding. • Frequently sighted off the south coast of Newfoundland. • Parts of Newfoundland and Labrador and the GSL identified as two of four distinct feeding areas in western North Atlantic. • Known for its surface displays and breaching acrobatics.	Present.

Table Description: This table describes the habitats and movements of the baleen whale species that occur in or around the Focus Area as well as the likelihood of their presence.

* "Present" means the Focus Area is included in the species habitat range; "Uncommon" means the species does not have habitat within the Focus Area but may have habitat nearby and migrate through the Focus Area or occur there as an 'accidental visitor'.

Table adapted from Eastern Newfoundland Offshore Geophysical, Geochemical, Environmental and Geotechnical Programs 2015-2024: 2018 Environmental Assessment Update, by AMEC Foster Wheeler Environment & Infrastructure, 2018, Prepared for ExxonMobil Canada Ltd. Copyright 2018.

Sources: AMEC, 2014; 2018; COSEWIC, 2002; 2013d; 2019a; c; 2021c; 2022b; DFO, 2018c, 2023i; International Whaling Commission, 2002; Kenney, 2001; Lawson & Gosselin, 2009; Leatherwood & Reeves, 1983; Moors-Murphy et al., 2019; NOAA, 2017; Reilly et al., 2008; Stewart & Leatherwood, 1985.

7.5.2.2 Odontocetes

Toothed whales, dolphins, and porpoises (*odontocetes*) are cetaceans that are characterized by teeth that they use to feed on fish and invertebrates. Cuvier's Beaked Whales (*Ziphius cavirostris*), Sowerby's Beaked Whales (*Mesoplodon bidens*), Northern Bottlenose Whales (*Hyperoodon ampullatus*), Sperm Whales, Beluga Whales (*Delphinaptera leucas*), Harbour Porpoises (*Phocoena phocoena*), Short-beaked Dolphins (*Delphinus delphis*), Long-finned Pilot Whales (*Globicephala melas*), Risso's Dolphins (*Grampus griseus*), Atlantic White-sided Dolphins (*Lagenorhynchus acutus*), White-beaked Dolphins (*Lagenorhynchus albirostris*), Killer Whales (*Orcinus orca*), Striped Dolphins (*Stenella coeruleoalba*), and Common Bottlenose Dolphins (*Tursiops truncatus*) likely occur regularly in the region (see Table 7.5.2). These species are known to migrate over long distances in pursuit of prey, resulting in variable migration routes and distances (Stantec Consulting Services Inc., 2022). Other odontocete species, such as True's Beaked Whale (*Mesoplodon mirus*), may migrate through the Focus Area, but were not described in this Report due to having a rare occurrence in the Focus Area or a lack of publicly available information on the species.

In engagement sessions on June 3rd and 4th 2024 in Burgeo and Stephenville respectively, fish harvesters and residents mentioned that they are seeing more porpoises; fish harvesters and residents noted observing more dolphins during June 5th and 6th 2024 engagement sessions in Port aux Basques and Burgeo respectively. In an engagement session on June 11th, 2024, in Marystown, participants mentioned observing Killer Whales in Fortune Bay.[99]

Figures 7.5.2 and 7.5.3 show odontocete observations and interactions across the Focus Area. These findings are based on publicly available data from the At-Sea Observer Program (1990 - 2022), OBIS, and CCRI (1996 - 2007) (DFO, 2023ff; 2024f; k; OBIS, 2024). Data collection on distribution for marine mammals such as toothed whales, dolphins, and porpoises can pose a variety of challenges (see Section 7.5.6, Data Gaps and Opportunities). The data presented in these figures is the result of limited surveys and is not a true indication of species distribution. As such, Figures 7.5.2 and 7.5.3 should be considered a qualitative representation of the species identified. Records for Cuvier's Beaked Whale, Sowerby's Beaked Whale, Risso's Dolphin, and Striped Dolphin were not identified. Project-level assessments, should be used to further evaluate the distribution and abundance of odontocete species at and around projects sites.

[99] A summary of this engagement session is available on the Registry under document reference number 385.

Figure 7.5.2. Odontocete Observations in the Focus Area

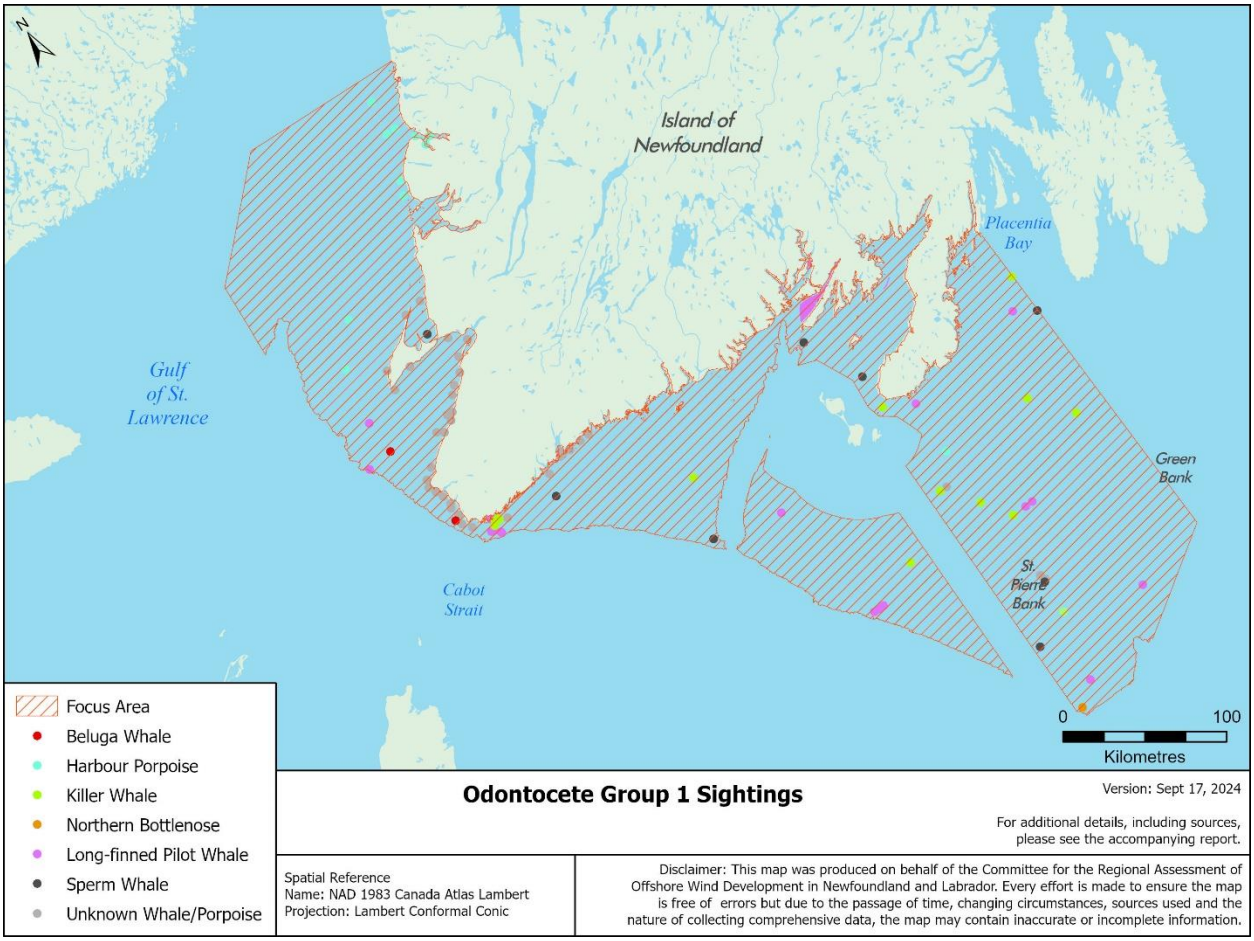


Figure Description: This map displays locations where various toothed whale, and porpoise species have been observed in the Focus Area.[100] The toothed whales, porpoises, and dolphins identified include Beluga Whales, Harbour Porpoises, Killer Whales, Northern Bottlenose Whales, Long-finned Pilot Whales, Sperm Whales, and unknown whales/porpoises.[101] The highest density of toothed whale and porpoise sightings in the Focus Area occurs along the coast of the southwest tip of the Island of Newfoundland near Port aux Basques, Cape Anguille, and Bay St. George.[102]

Data Sources: DFO, 2023ff; 2024f; k; OBIS, 2024.

[100] Species observations identified through the CCRI may appear as small polygons rather than points.
[101] The category 'Unknown Whale/Porpoise' may also include unidentified mysticete species.
[102] Identified trends reflect available data and are not a quantitative representation of species distribution.

Figure 7.5.3. Odontocete Observations in the Focus Area

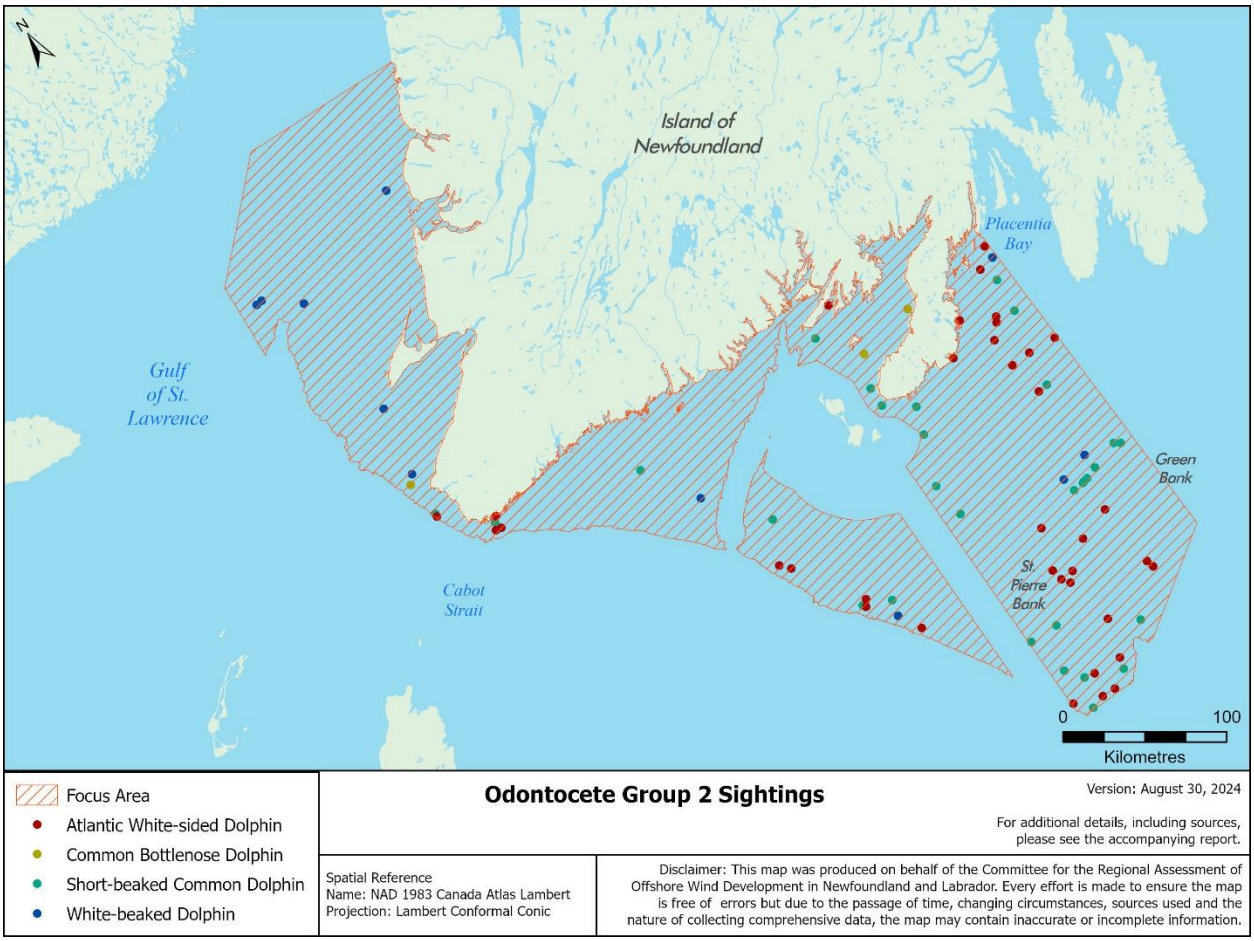


Figure Description: This map displays presence points for locations where various dolphin species have been observed in the Focus Area. The dolphins identified include Atlantic White-sided Dolphin, Common Bottlenose Dolphin, Short-beaked Common Dolphin, and White-beaked Dolphin. The highest density of dolphin sightings in the Focus Area occurs on St. Pierre Bank and around Placentia Bay.[103] DFO has indicated there is new data available for dolphins, particularly White-beaked Dolphins, in the Focus Area; the new data could not be incorporated in time for the publication of this Report.

Data Sources: DFO, 2023ff; 2024f; k; OBIS, 2024.

[103] Identified trends reflect available data and are not a quantitative representation of species distribution.

For toothed whale and porpoise species at risk, the historic decline in their population was caused by a number of anthropogenic forces including whaling (COSEWIC, 2011c), hunting (COSEWIC, 2014a; 2020), and declines in prey abundance (COSEWIC, 2008b). Recent data suggests population trends are increasing for Long-finned Pilot Whale, Risso's Dolphin, and White-beaked Dolphin, and decreasing for Beluga Whale (DFO, 2023ii; 2024c). Current populations trends for other odontocete species in the western North Atlantic are unknown. The greatest existing anthropogenic threat to toothed whales and porpoises in Newfoundland and Labrador are habitat degradation (physical and acoustic disturbances), pollution, entanglement with fishing gear, vessel collisions, and fisheries bycatch (Northern Bottlenose Whale) (COSEWIC, 2006b; 2008b; 2011c; 2014a; 2019e; 2020). The greatest existing anthropogenic threat to dolphins is fishing, fisheries bycatch, entanglement with fishing gear, habitat degradation (physical and acoustic disturbances), and pollution (NOAA, 2019a; b; d; 2020; 2021a; e; Themelis et al., 2016).

Climate change is anticipated to affect toothed whales, dolphins, and porpoises by changing prey availability and distribution (Lettrich et al., 2023; NOAA, 2019a; b; d; 2020; 2021a; e; van Weelden et al., 2021).

Table 7.5.2. Odontocete Species that Occur in or around the Focus Area

Type	Species	Habitat and Distribution	Presence in Focus Area*
Ziphiidae – Beaked whales	Cuvier's Beaked Whale (*Ziphius cavirostris*)	• Cosmopolitan distribution; found in temperate, subtropical, and tropical waters. Seasonality and migration patterns are not known. • Deep-diving species that prefer deep pelagic waters (> 1,000 m) of the continental slope and edge. • Newfoundland waters lie outside the edge of their northern range. • Typically alone or in small groups of 2 - 10 animals; have been observed in groups as large as 25 individuals.	Uncommon; present in surrounding areas year-round in small numbers.
	Sowerby's Beaked Whale (*Mesoplodon bidens*)	• Little known about social structure; thought to travel in small groups (< 10). • Seasonal movements and distribution unknown. Detected year round in the region, with the highest abundance recorded in the summer months (June - August). • Present in deep (> 1,000 m) cold offshore waters of the North Atlantic, preferring habitat along the continental shelf edge and slope. • Detections within the GSL and west coast of Newfoundland considered "extralimital" due to lack of suitable (deep) habitat.	Uncommon; present in surrounding deep-water areas year-round.
	Northern Bottlenose Whale (*Hyperoodon ampullatus*) - Davis Strait-Baffin Bay-Labrador Sea; Scotian Shelf populations	• Deep-diving species observed in waters 800 - 1500 m deep. • Can be found off the south coast of Newfoundland. • The population living in the Scotian Shelf are smaller in size on average and breed later in the year. • Davis Strait population seemingly tends to migrate north to south, although patterns are not consistent, whereas Scotian Shelf population is apparently non-migratory.	Present in in small numbers year-round; Most likely to be present in the spring and summer.

Type	Species	Habitat and Distribution	Presence in Focus Area*
		• Birthing season occurs from April – June. • Known to approach vessels.	
Physeteridae – Sperm whales	Sperm Whale (Physester macrocephalus)	• Deep divers that regularly dive > 100 m and as deep as 3,000 m on occasion. • Sperm whales have been sighted in shallow water and close to the coastline in Southern Newfoundland as well as in deeper waters around the Island. • Social structure affects distribution with adult males most likely to occur alone in higher latitudes outside breeding season while females and juveniles tend to remain in tropical and subtropical regions. • Prefer steep underwater topography where feeding behaviour can occur at depth.	Uncommon; present in surrounding deep-water areas year-round.
Phocoenidae – Porpoises	Harbour Porpoise (*Phocoena phocoena*) - Northwest Atlantic population	• Present on the continental shelves, more likely to be detected on the coastal shelf, bays and estuaries in the summer. • Highly mobile species that may remain in the same area year-round or travel long distances in pursuit of feeding opportunities. • Mating occurs late spring or early summer and most calves are born during the winter months. • Likely to be present along the south and west coasts of Newfoundland within the Focus Area. • Typically in small groups of 1 - 3 individuals, sometimes observed in groups of 10. Rarely form large groups for feeding. • Seasonal movements, behaviour and population estimates poorly known.	Present, possibly present year-round.

Type	Species	Habitat and Distribution	Presence in Focus Area*
Monodontidae – Belugas and Narwhals	Beluga Whale (*Delphinaptera leucas*) - St. Lawrence Estuary; Western Hudson Bay; Eastern Hudson Bay populations	• Coastal species travel offshore during the winter months. • There exist seven distinct populations in Canada: Eastern High Arctic-Baffin Bay, Southeast Baffin Island-Cumberland Sound, Ungava Bay, St. Lawrence River, Western Hudson Bay, Eastern Hudson Bay and Beaufort Sea-Arctic Ocean. • Individuals spotted around Newfoundland are often juvenile individuals from one of the eastern populations; only present in winter. Rarely, large groups (> 100) have been spotted around Newfoundland. • Mating occurs late winter to early spring, with calving occurring during spring and summer. • Critical habitat has been identified outside the Focus Area.	Rare presence.
Delphinidae – Dolphins	Short-beaked Common Dolphin (*Delphinus delphis*)	• Seasonal migration patterns for these species are poorly understood. • Typically found in large groups - often associate and feed with large baleen whales and are known to form mixed dolphin species group. • Prefer offshore tropical to temperate waters > 200 m but can also be present in shallower waters with high productivity. • Most likely to be found in the Focus Area in summer and autumn months.	Present; most likely found in summer and autumn.
	Long-finned Pilot Whale (*Globicephala melas*)	• Prefer cold waters, abundant throughout most of the North Atlantic. • May seasonally migrate inshore-offshore for feeding opportunities. Not known to participate in marked north-south migration. • Typically detected in deep water with steep bottom topography as observed in the GSL.	Present, most likely in late summer-autumn. The greatest abundance occurs outside the Focus Area off the continental shelf edge.

Type	Species	Habitat and Distribution	Presence in Focus Area*
		• Seasonal migrants to Canadian waters including the coastal and inshore waters of Newfoundland. Most commonly sighted in the fall, with the greatest abundance occurring off the east coast and irregular sightings on the southwestern and western coasts within the Focus Area. • Calving tends to occur in the summer months but can take place year-round.	
	Risso's Dolphin (*Grampus griseus*)	• Prefer deep offshore tropical and temperate waters > 300 m near the continental shelf edge but have been known to inhabit coastal areas. • Can dive for 30 m but very active on the surface (jumping, spy-hopping, 'porpoise' (swim forward with a rising and falling motion), and slapping the water with the flippers or tail). • Seasonal migration patterns for these species are poorly understood. • Typically in groups of 10 - 30, occasionally observed alone, in pairs, or large unrefined groups. Sometimes associate with other whales and dolphins. • Spotted in small numbers outside the Focus Area along the southern edge of the continental shelf.	Uncommon, if present, only detected in deep water habitats during the summer.
	Atlantic White-sided Dolphin (*Lagenorhynchus acutus*)	• Prefer shallow temperate to sub-polar waters < 100m on or at the edge of the continental shelf and slope. • Seasonal migration patterns for these species are poorly understood. • Typically in groups of 5 - 50, often associate and feed with large baleen whales and are known to form mixed dolphin species group.	Present.

Type	Species	Habitat and Distribution	Presence in Focus Area*
		• Frequently sighted off the south coast of Newfoundland in the Focus Area.	
	White-beaked Dolphin (Lagenorhynchus albirostris)	• Prefer shallow colder temperate and subpolar waters < 200 m. • Migrate inshore and north during summer months and south and offshore during colder winter months. • Seasonal migration patterns and population status for these species are poorly understood. • Active swimmers, this species perform surface activity including breaches, jumps, and “surfing” waves caused by vessels. • Typically in groups of 5 - 30, often associate and feed with large baleen whales and are known to form mixed dolphin species group. • Often sighted off the south coast of Newfoundland in the Focus Area.	Present.
	Killer Whale (*Orcinus orca*) - Northwest Atlantic/Eastern Arctic populations	• Prefer nearshore and pelagic environments, also often present offshore. • Cosmopolitan distribution, not known to be reliably migratory, concentrated in areas of high productivity. • Form small to medium sized (tens) close-knit matrilineal groups. • Inhabit both nearshore and pelagic environments. • Sighted nearshore within the Focus Area and along the continental shelf edge.	Present; small numbers have been observed in the area at all times of year.
	Striped Dolphin (*Stenella coeruleoalba*)	• Prefer deep warm temperate to tropical oceanic waters and convergence zones.	Uncommon; may be present year-round in deep water habitats, most likely

Type	Species	Habitat and Distribution	Presence in Focus Area*
		• Often observed in tight, cohesive groups (25 - 100), occasionally associate in larger groups of up thousands of animals; rarely associate with other whales or dolphin species. • Active swimmers, perform surface activity including breaches and jumps. Avoid vessels. • Present year-round but most likely to be spotted in the summer months. • Spotted in small numbers outside the Focus Area along the southern edge of the continental shelf.	to be present in the summer.
	Common Bottlenose Dolphin (*Tursiops truncatus*)	• Prefer temperate and tropical waters around 10°C - 32°C, can be present both offshore and in coastal waters. The species present in waters off Newfoundland are more likely to be detected offshore along the outer continental shelf and continental slope. • The Focus Area lies just outside the Northern edge of their range with most sightings occurring further south offshore in Nova Scotia. • Seasonally migratory, present in the northern range in the summer months and moving southward to warmer waters in the winter. • Typically alone or in undefined groups, more likely to form groups when resting or feeding.	Uncommon, if present, only detected in the summer.

Table Description: This table describes the habitats and movements of the toothed whale, porpoise, and dolphin species that occur in or around the Focus Area as well as the likelihood of their presence.

* "Present" means the Focus Area is included in the species distribution range; "Uncommon" means the species does not have habitat within the Focus Area but may have habitat nearby causing spillover, the northern distribution range of the species is nearby and may sometimes extend into the Focus Area due to feeding opportunities and seasonal oceanography, the species may only migrate through the Focus Area; "Rare" means the presence of the species in the area is considered 'extralimital' or an 'accidental visit'.

Table adapted from Eastern Newfoundland Offshore Geophysical, Geochemical, Environmental and Geotechnical Programs 2015-2024: 2018 Environmental Assessment Update, by AMEC Foster Wheeler Environment & Infrastructure, 2018, Prepared for ExxonMobil Canada Ltd. Copyright 2018.

Sources: Abend & Smith, 1999; AMEC, 2014; 2018, 2018a; Bernard & Reilly, 1999; Best, 1979; COSEWIC, 2006b; 2008b; 2011c; 2014a; 2019e; 2020; 2022a; DFO, 2012b; 2017a; 2018f; Ford, 2002; Jefferson et al., 2015; Kingsley & Reeves, 1998; Lesage et al., 2007; LGL Limited, 2010; MacDonald et al., 2017; NOAA, 2014; 2019a; b; 2020; 2021a; e; Olson & Reilly, 2002; Pitman & Brownell, 2020; Rice, 1989; Richard, Martin, et al., 2001; Wells & Scott, 2009; Westell et al., 2022; Whitehead & Arnbom, 1987.

7.5.2.3 Pinnipeds

Harp Seals (*Pagophilus groenlandicus*), Harbour Seals (*Phoca vitulina*), Hooded Seals (*Cystophora cristata*), and Grey Seals (*Halichoerus grypus*) likely occur regularly in the region (see Table 7.5.3).

Harp and Hooded seals share whelping locations on "the Front",[104] off the eastern coast of Labrador and in the GSL where they congregate en-masse (NOAA, 2019c; 2021d). Similarly, Grey Seals also whelp in the GSL but most of the population congregates on Sable Island (NOAA, 2021b; Stenson, 1994). Harbour Seals form large groups near their preferred haul out spots along the southern coast of Newfoundland (COSEWIC, 2007; Hamilton et al., 2023; NOAA, 2021c). In general, these seal species can occur at most times of the year.

Figure 7.5.4 shows pinniped observations and interactions across the Focus Area. These findings are based on publicly available data from the At-Sea Observer Program (1990 - 2022), OBIS, and CCRI (1996 - 2007) (DFO, 2023ff; 2024f; k; OBIS, 2024). Data collection on distribution for marine mammals such as seals can pose a variety of challenges (see Section 7.5.6, Data Gaps and Opportunities). The data presented in these figures is the result of limited surveys and is not a true indication of species distribution. As such, Figure 7.5.4 should be considered a qualitative representation of the species identified. Records for Hooded Seal were not identified. Project-level assessments should be used to further evaluate the distribution and abundance of pinniped species at and around projects sites.

[104] Pack ice (frozen sea water) floes form seasonally in the Gulf of St. Lawrence and off the coast of Labrador when air and water temperatures are low enough. When these pack ice floes eventually advance south, the leading edge is commonly referred to as "the Front".

Figure 7.5.4. Pinniped Observations in the Focus Area

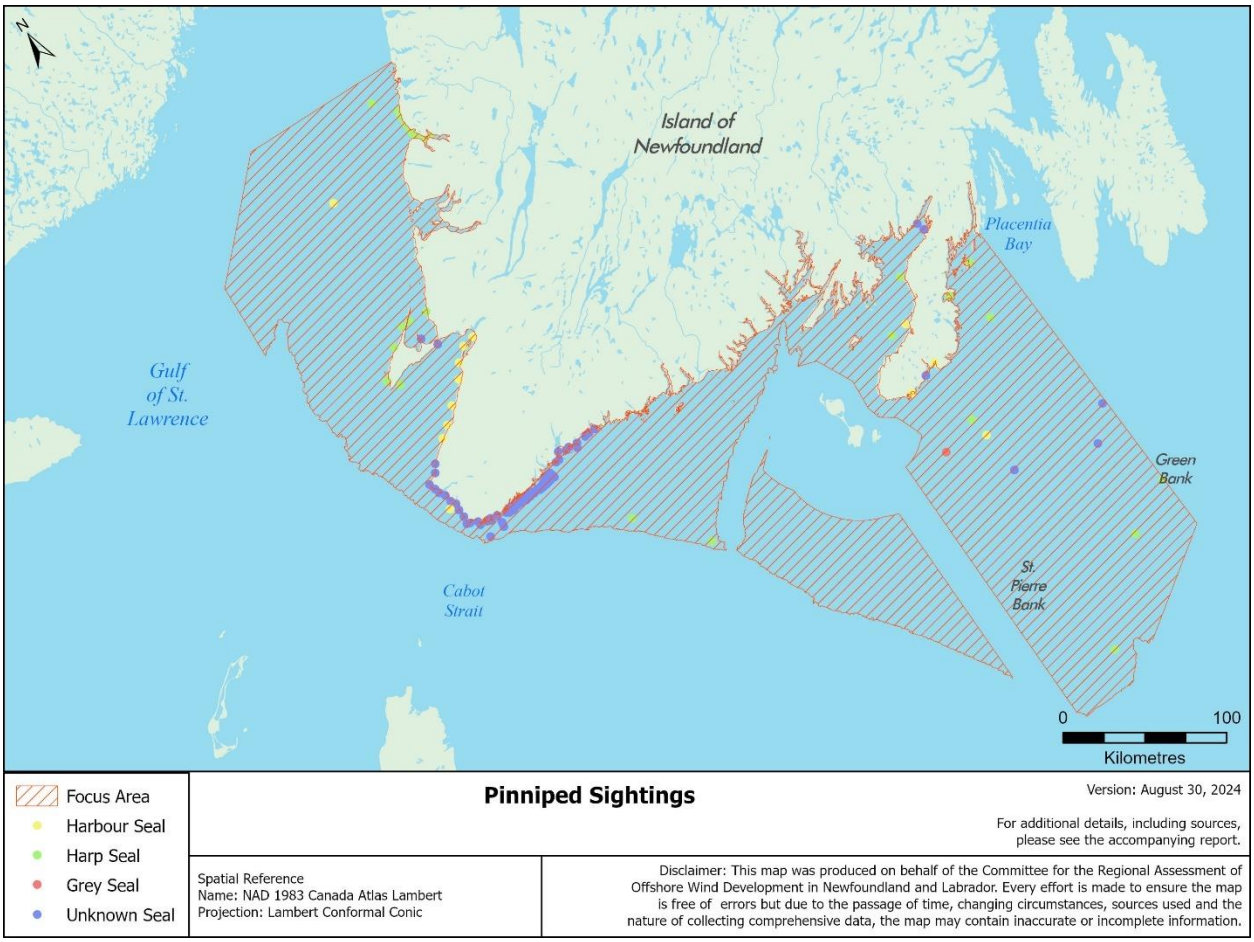


Figure Description: This map displays presence points for locations where various pinniped species have been observed in the Focus Area. The pinnipeds identified include Harbour Seals, Harp Seals, Grey Seals, and unknown seals. The highest density of pinniped sightings in the Focus Area occurs along the coast of the southwestern tip of the Island of Newfoundland near Port aux Basques, Cape Anguille, and Bay Saint George.[105]

Data Sources: DFO, 2023ff; 2024f; k; OBIS, 2024.

[105] Identified trends reflect available data and are not a quantitative representation of species distribution.

Harp, Harbour, and Grey seals were all historically hunted or had bounties and experienced associated population declines with Grey Seals nearly becoming extirpated from the area. None are currently considered species at risk by COSEWIC or SARA (COSEWIC, 2005; 2007; 2021a; DFO, 2020a). Recent trends suggest Grey- and Harp Seal populations are increasing in the NLS bioregion while populations trends for Hooded and Harbour Seals are unknown (DFO 2023ii; 2024c). Fish harvesters and residents repeatedly mentioned that seal populations are abundant or increasing during public engagement sessions held in June 2024.

Some seal species are currently hunted by Indigenous groups for subsistence purposes and Harp Seals are commercially hunted which can affect seal populations (COSEWIC, 2007; DFO, 2020a; NOAA, 2019c; 2021b; c; d). All seal species in the Focus Area can currently support these practices based on species abundance; however, improved tracking of hunting related mortalities is needed (COSEWIC, 2007; DFO, 2020a; NOAA, 2019c; 2021b; c; d). The greatest existing threats to seals in Newfoundland and Labrador are fisheries bycatch, entanglement in fishing gear, and pollution (COSEWIC, 2007; DFO, 2020a; NOAA, 2019c; 2021b; c; d). Seal species such as Harp, Hooded, and Grey seals that rely on sea ice for whelping are at risk due to the effects of climate change on such habitat (DFO, 2020a; Kovacs, 2002).

Atlantic Walrus (*Odobenus rosmarus rosmarus*) are very rarely seen on the Island of Newfoundland and their presence in the region is considered extra-limital (AMEC, 2018; COSEWIC, 2017a). Similarly, Ringed Seals (*Pusa hispida*) are occasional visitors to the Island of Newfoundland outside the Focus Area, along the northern coastline (COSEWIC, 2019b; Stenson, 1994). The rare presence of Atlantic Walrus and Ringed Seals occurs outside the Focus Area.

Table 7.5.3. Pinniped Species that Occur in or Adjacent to the Focus Area

Type	Species	Habitat and Distribution	Presence in Focus Area*
Phocidae – Earless seals	Harp Seal (*Pagophilus groenlandicus*) - Northwest Atlantic population	• Dependent on sea ice for pupping, nursing, and resting. • Prefer shallower waters on the continental shelf. • Highly migratory species; individuals head north in the summer to their feeding grounds in the Arctic and then migrate south in the autumn to their breeding grounds. The species molts in the south in late spring (April - May). • There exist two herds off the coast of Newfoundland and Labrador ("the Front") and near the Magdalen Islands in the GSL. Whelping occurs in the spring. • In the spring, some adults may be associated with pack ice that moves out of the GSL through Cabot Strait. These seals may pass through the Focus Area with the pack ice as it moves through Cabot Strait. • Large molting groups consisting of older Harp Seal occurs on the sea ice off northeastern Newfoundland and in the nGSL during late spring.	Present. Most abundant in the winter for whelping but present off the south coast of the Focus Area during the summer.
	Harbour Seal (*Phoca vitulina*) – Atlantic and Eastern Arctic subspecies	• Prefer coastal waters and commonly detected < 20 km from shore. Occur in bays, estuaries, inlets, and occasionally coastal rivers. • Shallow diver, with most dives occurring at depths < 4 m. • Use both aquatic and terrestrial habitat, dependent on permanent open water. • Sedentary species, loyal to known haul-out locations. Long-distance journeys do occur, mostly by pups. • Pupping occurs in spring (May - June). • Adults are present year-round with permanent populations near Burgeo, Pass Island, Placentia Bay, Point May, and St. Pierre and Miquelon, some of which occur in the Focus Area.	Present year-round.

Type	Species	Habitat and Distribution	Presence in Focus Area*
	Hooded Seal (*Cystophora cristata*)	• Dependent on sea ice for pupping, nursing, and resting. • Prefer deeper water further offshore. • Highly pelagic, often seen outside their normal range, and as far south as Florida. • The western North Atlantic stock whelps off the east coast of Labrador (the "Front"), in the GSL, and in the Davis Straight. • Highly migratory, detected at southern range in the winter/spring on the Newfoundland continental shelf and head north to the Davis Strait to molt in summer (June - August). • Pupping and breeding occur in spring (March). • Post-breeding adults may migrate through the Cabot Straight from May - June, which lies within the Focus Area.	Present. Most abundant in the winter for whelping but present off the south coast of the Focus Area during the summer.
	Grey Seal (*Halichoerus grypus*)	• Eastern Canada has three breeding aggregations: Sable Island, GSL, and along the coast of Nova Scotia. • Inhabit cold temperate to sub-Arctic areas in North Atlantic waters over the continental shelf and in coastal waters. • Sociable when onshore, sometimes haul out near Harbour Seals. Often observed alone or in small groups at sea.[106] • Breeding occurs in the Southern Gulf of St Lawrence during the fall and whelping occurs in the winter (December – January). • Occur in greatest abundance between Burgeo Islands and Placentia Bay. • Present year round but most abundant in the summer.	Present in Focus Area year-round. Most abundant in the summer.

[106] 'Haul out' refers to when seals leave the water temporarily for land for rest, reproduction, or other land-based activities.

Table Description: This table describes the habitats and movements of the pinniped species that occur in or around the Focus Area as well as the likelihood of their presence.

* "Present" means the Focus Area is included in the species distribution range.

Table adapted from Eastern Newfoundland Offshore Geophysical, Geochemical, Environmental and Geotechnical Programs 2015-2024: 2018 Environmental Assessment Update, by AMEC Foster Wheeler Environment & Infrastructure, 2018, Prepared for ExxonMobil Canada Ltd. Copyright 2018.

Sources: AMEC, 2014; 2018; Andersen et al., 2009; Baird, 2001, 2001; Bowen et al., 2001; Breeze et al., 2002; COSEWIC, 2007; DFO, 2020a; Hall, 2002; Hamilton et al., 2023; Hammilll et al., 2012; Kovacs, 2002; Lesage et al., 2011; Lesage & Hammill, 2001; LGL Limited, 2010; NOAA, 2019c; 2021b; d; Stenson & Kavanagh, 1994**.**

7.5.2.4 Sea Turtles

Leatherback (*Dermochelys coriacea*) and Loggerhead (*Caretta caretta*) sea turtles are regularly seen in the Focus Area in the summer (AMEC, 2018; COSEWIC, 2010f; 2012d). These species are known to migrate over long distances between nesting and feeding areas, especially when juveniles (AMEC, 2018; COSEWIC, 2010f; 2012d)

In engagement sessions on June 13, 2024 in Harbour Breton participants mentioned that sea turtles were abundant in the area. Anecdotal observations of Leatherback and other sea turtles were discussed in Stephenville, Port aux Basques, and Marystown during engagement sessions on June 4th, 5th, and 11th 2024 respectively.[107]

Figure 7.5.5 shows sea turtle observations across the Focus Area. These findings are based on publicly available data from the At-Sea Observer Program (1990 - 2022), OBIS, and CCRI (1996 - 2007) (DFO, 2023ff; 2024f; k; OBIS, 2024). Data collection on distribution for sea turtles can pose a variety of challenges (see Section 7.5.6, Data Gaps and Opportunities). The publicly data available for sea turtles within the Focus Area was limited, with most observations originating from a few CCRI records and is not a true indication of species distribution. As such, Figure 7.5.5 should be considered a limited qualitative representation of the species identified. Records for Leatherback Sea Turtles were not identified. Project-level assessments should be used to further evaluate the distribution and abundance of sea turtle species at and around projects sites.

[107] A summary of this engagement session is available on the Registry under document reference number 385.

Figure 7.5.5. Sea Turtle Observations in the Focus Area

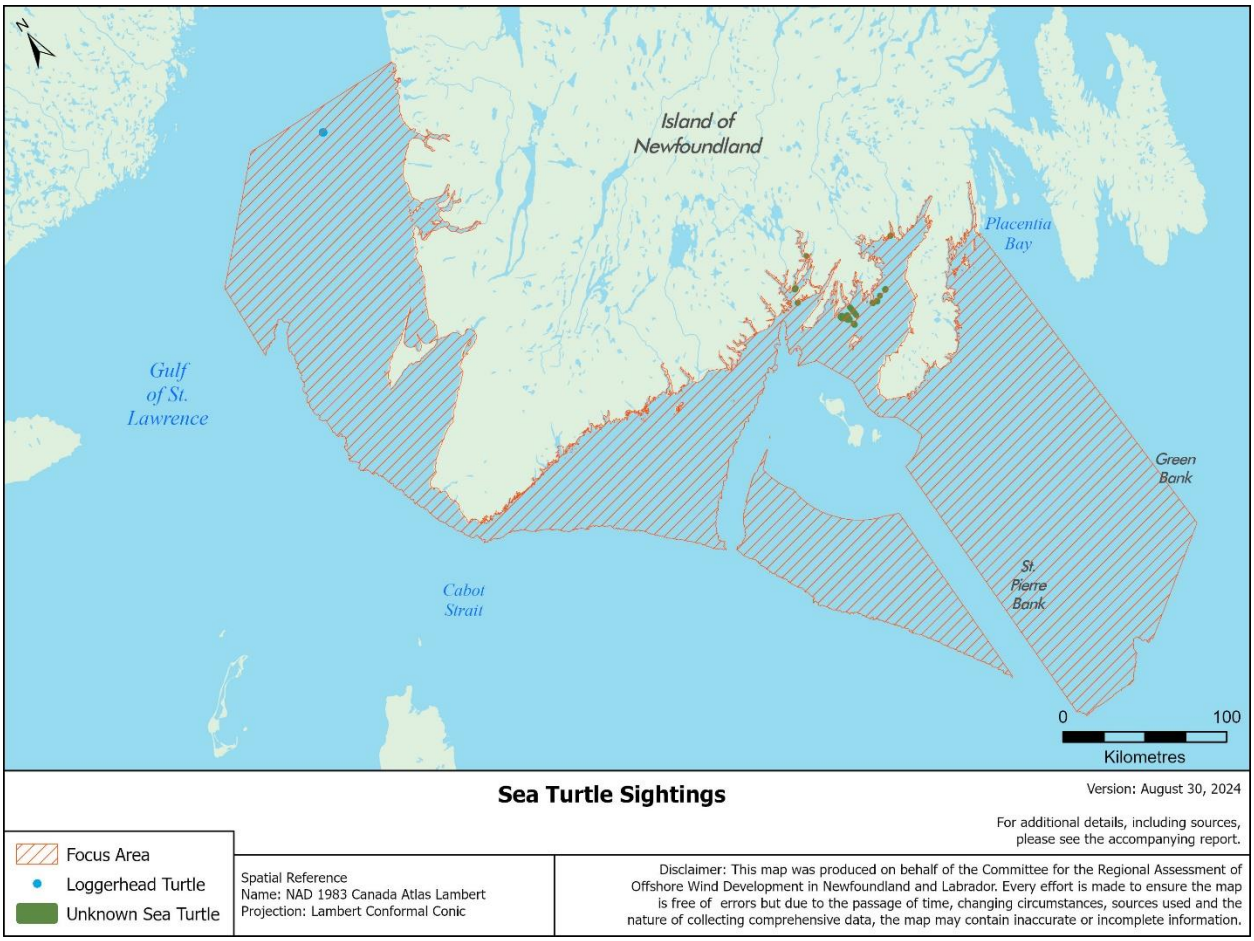


Figure Description: This map displays presence points for locations where sea turtles have been observed in the Focus Area. With the exception of Loggerhead Sea Turtles, the sea turtles observed were not identified and are recorded as unknown sea turtles. The highest density of sea turtle sightings in the Focus Area occurs around Harbour Breton in Fortune Bay.[108]

Data Sources: DFO, 2023ff; 2024f; k; OBIS, 2024

[108] Identified trends reflect available data and are not a quantitative representation of species distribution.

Current data on Leatherback and Loggerhead sea turtles are insufficient to determine fluctuations and trends in the population in Canada, though it is expected that both species are experiencing declines in population (COSEWIC, 2010f; 2012d). The greatest existing threats to sea turtles in Newfoundland and Labrador are fisheries bycatch, entanglement, habitat degradation (physical and acoustic disturbances), pollution, and vessel strikes (COSEWIC, 2010; 2012d). In an engagement session in Stephenville on June 4, 2024, residents mentioned they have not observed many sea turtles in the Bay St. George, but sea turtle presence appears to be increasing in the area with rising water temperatures.

Hawksbill, Green, and Kemp's Ridley sea turtles *(Eretmochelys imbricata*, *Chelonia mydas,* and *Lepidochelys kempii*) prefer tropical and subtropical waters but are sometimes detected near the Focus Area in summer months (AMEC, 2018). These turtles are known to migrate long distances between nesting and foraging areas and their occurrence in or near the Focus Area are considered to be caused by being lost or displaced by the Gulf Stream (AMEC, 2014; NOAA, n.d.; 2024e; Seminoff et al., 2015). As accidental visitors, these species are unlikely to be present in the Focus Area of the Regional Assessment so they will not be considered further within the Report.

Table 7.5.4. Overview of Sea Turtles that Occur in or Adjacent to the Focus Area

Type	Species	Habitat and Movement	Presence in Focus Area*
Dermochelyidae – Leatherback turtle	Leatherback Sea Turtle (*Dermochelys coriacea*)	• Typically present in coastal shelf waters with depths of < 200 m. • Ranges from tropical to sub-polar regions and undertakes extensive migrations between feeding areas and tropical nesting areas. • Present in Atlantic Canadian waters from April - December with peak times from July - September. • To date, critical habitat has not been identified. • DFO observed three high use feeding areas in Canadian waters, none of which exist within the Focus Area.	Present in small numbers from April - December. Placentia-Bay area is a high use habitat for the species.
Cheloniidae – Sea turtles	Loggerhead Sea Turtle (*Caretta caretta*)	• Present in oceanic (> 200 m) and near-shore zones (< 200 m) of temperate and tropical Atlantic, Pacific and Indian Oceans, and nest on beaches in subtropical and tropical climates. • Sightings in Atlantic Canadian waters are most likely to consist of juveniles making trans-oceanic migrations. • Habitat and movements for mature adults are relatively known, particularly for males. • In Atlantic Canada, most abundant in spring to fall, and generally associated with the Gulf Stream. • There are no nesting sites in Canada.	Uncommon. Most likely to be present in small numbers during the spring and summer months.

Table Description: This table describes the habitats and movements of the sea turtle species that occur in or around the Focus Area as well as the likelihood of their presence.

* "Present" means the Focus Area is in the species distribution range. "Uncommon" means the species does not have habitat within the Focus Area but may have habitat nearby causing spillover, the northern distribution range of the species is nearby and may sometimes extend into the Focus Area due to feeding opportunities and seasonal oceanography, the species may only migrate through the Focus Area.

Table adapted from Eastern Newfoundland Offshore Geophysical, Geochemical, Environmental and Geotechnical Programs 2015-2024: 2018 Environmental Assessment Update, by AMEC Foster Wheeler Environment & Infrastructure, 2018, Prepared for ExxonMobil Canada Ltd. Copyright 2018.

Sources: AMEC, 2014; 2018; COSEWIC, 2010f; 2012d; DFO, 2012a; Dow Piniak et al., 2012; Eckert et al., 2012; Martin, Alessi, et al., 2012; NMFS, 2020; Schofield et al., 2007; Templeman, 2007; Wallace et al., 2019; Wyneken & Lohmann, 2013.

7.5.2.5 Species at Risk and of Concern

There are several species of conservation concern, including species at risk, that may occur in the Regional Assessment Focus Area. These species are identified and protected through provincial, federal, and international legislation or initiatives (see Section 7.5.1). The primary mechanisms for identifying and protecting marine mammals and sea turtles in Canada are *SARA* (2002) and COSEWIC which are described in Section 7.6.1.1.

Four species of baleen whales (*mysticetes*) present in the Focus Area are designated species at risk under Schedule 1 of *SARA*. The greatest existing threat to baleen whales in Newfoundland and Labrador are entanglement with fishing gear, vessel collisions, and underwater noise (COSEWIC, 2002; 2013d; 2019a; c). Five species of toothed whales (*odontocetes*) present in the Focus are designated species at risk under Schedule 1 of *SARA*. The greatest existing threat to toothed whales in Newfoundland and Labrador are habitat degradation (physical and acoustic disturbances), pollution, entanglement with fishing gear, vessel collisions, and fisheries bycatch (Northern Bottlenose Whale) (COSEWIC, 2006b; 2008b; 2011c; 2014a; 2019e; 2020).

Two species of sea turtles present in the Focus Area are designated species at risk under Schedule 1 of SARA. The greatest existing threat to sea turtles in Newfoundland and Labrador are fisheries bycatch, entanglement, habitat degradation (physical and acoustic disturbances), pollution, and vessel strikes (COSEWIC, 2010f; 2012d).

Table 7.5.5. Species at Risk in or Adjacent to the Focus Area and their Federal 'At Risk' Status

Species	Population	Population Trend	NL Region Status	Current *SARA*	COSEWIC Status	Anthropogenic threats
North Atlantic Right Whale (*Eubalaena glacialis*)		Decreasing (COSEWIC)	At-Risk	EN	EN	Entanglement and vessel collisions.
Sei Whale (*Balaenoptera borealis*)	Atlantic	Stable/ Unknown (COSEWIC)	None	NAR	EN	Habitat degradation (acoustic), vessel strikes, and pollution.
Blue Whale (*Balaenoptera musculus*)	Atlantic	Stable/ Decreasing (COSEWIC)	At-Risk	EN	EN	Vessel collisions, vessel traffic, entanglement, and pollution.
Fin Whale (*Balaenoptera physalus*)	Atlantic	Stable/ Increasing (COSEWIC)	At-Risk	SC	SC	Habitat degradation (acoustic), vessel collisions, entanglement, and pollution
Killer Whale (*Orcinus orca*)	Northwest Atlantic/ Eastern Arctic	Unknown (IUCN)	At-Risk	NAR	SC	Habitat degradation (physical and acoustic) and pollution.
Harbour Porpoise (*Phocoena phocoena*)	Northwest Atlantic	Decreasing/ Unknown (IUCN)	At-Risk	NAR	SC	Bycatch, habitat degradation (acoustic), pollution, and prey depletion.
Beluga Whale (*Delphinaptera leucas*)	St. Lawrence Estuary	Decreasing (COSEWIC)	None	EN	EN	Pollution, habitat degradation (physical and acoustic), and prey depletion.
Sowerby's Beaked Whale (*Mesoplodon bidens*)		Unknown (COSEWIC)	At-Risk	SC	SC	Habitat degradation (acoustic), vessel collisions, entanglement, and pollution.
Northern Bottlenose Whale (*Hyperoodon ampullatus*)	Davis Strait-Baffin Bay-Labrador Sea	Unknown (COSEWIC)	At-Risk	NAR	SC	Entanglement and habitat degradation (acoustic).
	Scotian Shelf	Increasing (COSEWIC)	At-Risk	EN	EN	

Species	Population	Population Trend	NL Region Status	Current *SARA*	COSEWIC Status	Anthropogenic threats
Leatherback Sea Turtle (*Dermochelys coriacea*)		Decreasing (COSEWIC)	None	EN	EN	Fisheries bycatch, entanglement, habitat degradation (acoustic), pollution, and vessel strikes.
Loggerhead Sea Turtle (*Caretta caretta*)	Atlantic	Decreasing (IUCN)	At-Risk	EN	EN	

Table Description: This table identifies species listed under Schedule 1 of the SARA which may occur offshore Newfoundland and Labrador. Species which may become listed (e.g., recently assessed by COSEWIC) or that have 'at-risk' status in the region of Newfoundland and Labrador are also identified. COSEWIC was established under SARA as an independent body of experts responsible for identifying and assessing wildlife species considered to be at risk. This is the first step towards protecting wildlife species at risk. Where population trends were not identified for a species through COSEWIC Assessments, IUCN trends were used. IUCN is a system for classifying species at high risk of global extinction. The anthropogenic threats listed for each species were identified through COSEWIC assessments.

'Current SARA' means the current or most recent designation for a species under Schedule 1 of the SARA. SARA categories include NAR (not at risk), SC (special concern), TH (threatened), and EN (endangered). COSEWIC categories include NAR (not at risk), SC (special concern), TH (threatened), and EN (endangered).

Blank cells indicate the information in not applicable for the species (e.g., no population-specific COSEWIC assessment or SARA designation, no population trend data, etc.,).

Table adapted from Eastern Newfoundland Offshore Geophysical, Geochemical, Environmental and Geotechnical Programs 2015-2024: 2018 Environmental Assessment Update, by AMEC Foster Wheeler Environment & Infrastructure, 2018, Prepared for ExxonMobil Canada Ltd. Copyright 2018.

Sources: AMEC, 2014; 2018; COSEWIC, 2002; 2005; 2006a; b; 2007; 2008b; 2010f; 2011c; 2012d; 2013d; 2014a; 2019a; b; c; e; 2020; 2021a; c; 2022a; b; Hammond et al., 2008.

7.5.2.6 Key Areas and Times

Many of the marine mammals and sea turtles within the Focus Area are seasonal migrants. The region contains important feeding grounds and acts as a thoroughfare between the Atlantic Ocean and the GSL. Prey abundance is highest in the Focus Area in the summer providing feeding opportunities for whales, dolphins, porpoises, and sea turtles that pass through the region.

Though some baleen whales, toothed whales, dolphins, and porpoises can occur in the Focus Area year-round, *mysticete* and *odontocete* presence is most likely during summer months (April - August). Beluga Whales, Minke Whales, and Blue Whales are more likely to be in the Focus Area during the winter months (DFO, 2023i; Richard et al., Heide-Jørgensen, et al., 2001; Richard, Martin, et al., 2001; Stewart & Leatherwood, 1985). Adult seals can occur year-round. Winter and spring are when Harp and Hooded seals are most abundant due to whelping whereas Grey Seals are most abundant in summer (DFO, 2020a; Hamilton et al., 2023; Lesage et al., 2007; Stenson & Kavanagh, 1994). Harbour Seals reside along the south coast of the Island of Newfoundland year-round (Hamilton et al., 2023). Permanent populations of Harbour Seals exist near Burgeo, Pass Island, Placentia Bay, Point May, and St. Pierre and Miquelon, some of which occur in the Focus Area (Hamilton et al., 2023; LGL Limited, 2010). Sea turtles only occur in the Focus Area during the summer (COSEWIC, 2010f; 2012d).

In 2010, a Recovery Strategy for the Endangered Blue Whale was published in which, data gaps precluded the identification of Critical Habitat. Instead, the Recovery Strategy included a Schedule of Studies that, when completed, would allow Critical Habitat to be identified (Beauchamp et al., 2009). In 2016, DFO Science held a CSAS process to provide science advice to the Species at Risk Program on available information and the current state of knowledge about the habitat of Blue Whales in the northwest Atlantic. The resulting report identified six habitat areas that are considered important for the survival and recovery of blue whales from the western North Atlantic population (DFO, 2018c). One of these areas is southern and southwestern Newfoundland and Labrador, which overlaps with the area of the regional assessment (DFO, 2023i). Important areas have also been identified for Leatherback Sea Turtles near the southeastern GSL, in waters off eastern Cape Breton Island, and in waters south and east of the Burin Peninsula, some of which occur in the Focus Area (COSEWIC, 2012d; Lesage et al., 2007). These areas have been used to inform EBSAs and may be used to inform delineation of future critical habitats (Wells et al., 2019).

DFO or the UNCBD has identified, evaluated, and selected five EBSAs within or near the Focus Area based, in part, on the areas importance to marine mammals and sea turtles. The areas importance for these taxa relates to their biodiversity and density in the area, and the importance of the area for reproduction and survival (West and South Coasts of Newfoundland, Laurentian Channel, Placentia Bay, and St. Mary's Bay) (Templeman, 2007; UNCBD, 2019). EBSAs are described further in Section 7.6.1.3 of this Report and depicted in Figure 7.6.3.

7.5.3 Potential Effects

Marine mammals and sea turtles may be impacted by a variety of activities during all phases of offshore wind development. These activities are described in Section 4 of this Report. Table 7.5.6 summarizes potential impact pathways and effects during each project phase. Effects are predominately caused by the production of underwater noise and vibration, physical alteration to the environment through the presence of structures, and increased vessel activity.

Any impact on marine mammals and sea turtles could have direct or indirect effects on other components (e.g. Fisheries and Other Ocean Users, Aerofauna, Marine Fish and Fish Habitat etc.,). Section 7.5.3.2 of this Report briefly describes potential indirect effects of offshore wind development activities. Cumulative effects are described in Section 8 of this Report.

7.5.3.1 Effects of Planned Offshore Wind Activities

Depending on the project phase, offshore wind development may impact marine mammals and sea turtles through underwater noise and vibration, benthic disturbance, presence of infrastructure, entanglement, vessel collisions, artificial lighting, EMF emissions, and HVDC emissions (Table 7.5.6). These are described in the subsections below.

Table 7.5.6. Potential Impact Pathways and Effects of Offshore Wind Development on Marine Mammals and Sea Turtles

Project Phase	Effects
Underwater Noise	
Construction	• Temporary or permanent behavioural changes (e.g., increased activity, change in swimming direction, avoidance, habitat abandonment, habituation, attraction, disorientation). • Temporary changes to communication. • Temporary or permanent changes in foraging efficiency. • Temporary or permanent changes in predator avoidance success. • Temporary or permanent psychological changes (increased stress). • Temporary (TTS) or permanent auditory injury (PTS).
Operation and Decommissioning	• Temporary or permanent behavioural changes (e.g., avoidance, habituation, displacement, attraction, disorientation). • Temporary or permanent psychological changes (increased stress).
Sediment Suspension	
Construction and Decommissioning	• Temporary or permanent behavioural changes (e.g., avoidance or attraction). • Temporary or permanent changes in feeding efficiency.
Presence of Infrastructure	
Construction and Operation	• Temporary or permanent changes in foraging behaviour due to prey habitat alterations and reef effect. • Temporary or permanent behavioural changes (e.g., avoidance, habituation, displacement, attraction, disorientation). • Temporary or permanent changes in feeding efficiency. • Temporary or permanent increased risk of collisions.

Project Phase	Effects
Decommissioning	• Temporary or permanent changes in foraging behaviour due to prey habitat alterations and removal of reef effect. • Temporary or permanent behavioural changes (e.g., avoidance, displacement, disorientation). • Temporary or permanent changes in feeding efficiency.
Entanglement	
Construction and Operation	• Temporary or permanent entanglement risk.
Vessel Collisions	
All	• Temporary or permanent increased risk of collisions.
Artificial Light	
All	• Temporary or permanent behavioural changes (e.g., avoidance). • Temporary or permanent changes in feeding efficiency. • Temporary or permanent increased risk of collisions.
Presence of EMF	
Operation	• Temporary or permanent behavioural change (e.g., attraction, avoidance). • Temporary changes to communication (e.g. navigation, and orientation).
Presence of HVDC	
Operation	• Temporary or permanent behavioural change (e.g., attraction, avoidance). • Temporary or permanent changes in foraging efficiency.

Table Description: This table summarizes the potential effects of various offshore wind development activities for different project phases (e.g. pre-construction, construction, operation, decommissioning) and identifies if the effects are likely to be temporary or permanent. See Section 4 of this Report for an overview of offshore wind development phases and activities.

Sources: Anderson, 2011; Bailey et al., 2014; Bat et al., 2013; Carstensen et al., 2006; Castellote et al., 2012; CMACS, 2003; CSA Ocean Sciences Inc., 2021; Dähne et al., 2013; Diederichs et al., 2008; Dong Energy et al., 2006; Dow Piniak et al., 2012; Erbe et al., 2019; Gordon et al., 2003; Hall et al., 2020; Heide-Jørgensen et al., 2021; ICF, 2020; Kaldellis et al., 2016; Laist et al., 2001; Lindeboom et al., 2011; Lohoefener et al., 1990; Lüdeke, 2017; Lurton & DeRuiter, 2011; Macnab et al., 2017; Madsen et al., 2006; Maxwell et al., 2022; McCauley et al., 2000; Middleton & Barnhart, 2022; Minerals Management Service, 2007; Moore et al., 2013; Moulton & Holst, n.d.; Nedwell et al., 2003; Nedwell & Howell, 2004; Nehls et al., 2015; Nelms et al., 2016; NOAA, 2008; NYSERDA, 2017c; d; h; 2021; O'Hara & Wilcox, 1990; Orr et al., 2013; Przeslawski et al., 2015; Putland et al., 2018; Raoux et al., 2017; Richardson et al., 1995b; Ridgway et al., 1969; Russell et al., 2014; Schoeman et al., 2020; SEER, 2022a; Shumchenia et al., 2012; Southall et al., 2007; Stone & Tasker, 2006; Svendsen et al., 2022; Taormina et al., 2020; Tougaard et al., 2009; Van Parijs et al., 2021; Vanderlaan & Taggart, 2007; Varghese & Curran, 2021; Verfuss et al., 2019; Weilgart, 2013; Williams et al., 2022; Wright et al., 2007a.

7.5.3.1.1 Underwater Noise and Vibration

Marine mammals rely on sound for orientation, navigation, communication, recognition, predator avoidance, feeding, mate selection, and offspring-mother bonding (DFO, 2004b; LGL Limited, 2010; Lüdeke, 2017; Madsen et al., 2006).

- Baleen whales typically live solitary lifestyles but use acoustic communication to maintain complex social structures when congregating in small groups (Erbe, 2002).
- Toothed whales, porpoises, and dolphins rely heavily on acoustic vocalizations for social communication and for navigation and feeding via echolocation (Richardson et al., 1995b; Stantec Consulting Limited, 2022).
- Seals that appear in the Focus Area also rely on acoustics for communication in-air and in-water which is of particular importance during breeding and whelping seasons for pups (van Opzeeland et al., 2008; van Opzeeland & Miksis-Olds, 2011). The extent of auditory communication among sea turtles is not well studied (Mrosovsky, 1972). Some sea turtles are known to rely on sound for navigation, foraging, and predator avoidance (Dow Piniak et al., 2012). Leatherback and Loggerhead sea turtles are not known to use underwater auditory communication, but their hearing is thought to be sensitive to anthropogenic sources (Dow Piniak et al., 2012; Martin, Alessi, et al., 2012).

Aquatic species such as marine mammals and sea turtles vary in their hearing frequency ranges and sensitivity to sound levels and pressures (Cunningham & Reichmuth, 2016; Dow Piniak et al., 2012; Erbe, 2002; NMFS, 2021). As a result, different species respond differently to underwater noise associated with offshore wind development. Factors like the type of activity/equipment generating noise, an individual's proximity to the noise source, and noise duration can also influence an individuals' response (Cunningham & Reichmuth, 2016; Dow Piniak et al., 2012; Erbe, 2002; NMFS, 2021). For example, physiological effects can range in severity from auditory masking of communication and behavioural changes (changes in habitat use, or foraging) to auditory injury (CSA Ocean Sciences Inc., 2021; DFO, 2004b; Southall et al., 2007; Varghese & Curran, 2021). Activities that increase anthropogenic noise levels in the ocean have also been linked to elevated stress levels and disturbance in marine mammals and sea turtles (CSA Ocean Sciences Inc., 2021; Dong Energy et al., 2006; Erbe et al., 2019; Gordon et al., 2003; Kaldellis et al., 2016; Maxwell et al., 2022; Nedwell et al., 2003; NYSERDA, 2017c; Richardson et al., 1995b; SEER, 2022a).

Auditory Injury

Auditory injury is often associated with a loss of hearing or hearing sensitivity caused by noise exposure over a significant period and sound pressure level (Finneran, 2016). Hearing sensitivity loss because of auditory injury is known as NITS. The injury is considered a TTS if the NITS is temporary and hearing sensitivity returns to normal. If the hearing threshold shift remains elevated it is called a PTS (Finneran, 2016).

Canada does not currently have formal guidelines or regulatory thresholds that protect marine mammals and sea turtles from the effects of underwater noise. However, thresholds used in other jurisdictions are widely accepted. These include for example, the

U.S. National Oceanic and Atmospheric Administrations (NOAA) National Marine Fisheries Service (NMFS) guidelines (NFMS, 2018). The NOAA guidelines outline hearing threshold levels for impulsive and non-impulsive peak sound pressure levels (SPL_{peak}) and 24-hour cumulative sound exposure levels (SEL_{cum}) for cetaceans and pinnipeds. They identify the sound pressure and exposure levels at which PTS and TTS may occur for low-frequency, mid-frequency, and high-frequency cetaceans as well as seals. The guidelines are based on recent scientific literature. The estimated auditory range and general hearing threshold levels for marine mammals are detailed in Table 7.5.7.

Hearing ranges, auditory injuries, and behavioural responses to underwater noise is not well understood in sea turtles (DFO, 2004b; Popper et al., 2014). However, other species thought to have similar hearing capacity (fishes) have been used to conservatively estimate the general hearing threshold levels at which sea turtles may die or experience mortal injuries (Table 7.5.8) (DFO, 2004b; Popper et al., 2014).

Quantitatively defining thresholds for underwater noise levels is challenging because specific factors influence species' and individuals' response to noise (e.g., sound types, exposure levels, age, sex, environmental conditions, source proximity). Project-level assessments, should be used to further consider effects of noise on marine mammals and sea turtles (Lurton & DeRuiter, 2011; Southall et al., 2007).

Table 7.5.7. Estimated Auditory Bandwidths for Marine Mammals

Group	Type	Estimated Auditory Bandwidth	Hearing Class	Impulsive Sound (dB SPL_{peak})*		Impulsive Sound (dB SEL_{cum})**		Non-Impulsive Sound (dB SEL_{cum})**	
				TTS	PTS	TTS	PTS	TTS	PTS
Cetaceans	*Balaenopteridae* (Rorquals) and *Balaenidae* (Right whales)	7 Hz - 35 kHz	Low Frequency Cetaceans	213	219	168	183	179	199
	Ziphiidae (Beaked whales)	50 Hz - 160 kHz	Mid-Frequency Cetaceans	224	230	170	185	178	198
	Physeterida (Sperm Whales)	150 Hz - 160 kHz							
	Monodontidae (Belugas and Narwhals)	40 kHz - 120kHz							
	Delphinidae (Dolphins)	150 Hz - 160 kHz							
	Phocoenidae (Porpoises)	200 Hz - 180 kHz	High Frequency Cetaceans	196	202	140	155	153	173
Pinnipeds (Seals)	*Phocidae* (Earless Seals)	50 Hz - 86 kHz	Underwater	212	218	170	185	181	201
			In Air	N/A	149	N/A	144	N/A	144.5

Table Description: This table provides estimated auditory bandwidths and hearing frequency classes for a variety of whale, porpoise, dolphin, and pinniped types. Estimated auditory bandwidths were averaged for groups but individual species within group types may vary.

The SPL_{peak}, and SEL_{cum} that may cause TTS or PTS in particular whale, porpoise, dolphin, and pinniped hearing classes for both impulsive and non-impulsive sources are also described. TTS is when hearing sensitivity changes return to normal while PTS is permanent damage to hearing sensitivity. dB SPL_{peak} and dB SEL_{cum} mean the noise exposure (expressed in decibels (dB)) at peak sound pressure levels and 24-hour cumulative sound exposure levels respectively.

* dB SPL_{peak} has a reference value of 1 µPa.
** 24-hour cumulative sound exposure; dB SEL_{cum} has a reference value of 1 $\mu Pa^{2\text{-}s}$ underwater and $(20\ \mu Pa)^{2\text{-}s}$ in air.

Sources: Bartol et al., 1999; Cunningham & Reichmuth, 2016; DFO, 2004b; Dow Piniak et al., 2012; Lenhardt, 2002; Lurton & DeRuiter, 2011; NMFS, 2018; 2021; Popper et al., 2014; Southall et al., 2007; Zahn et al., 2021

Table 7.5.8. Estimated Auditory Bandwidths for Sea Turtles

Group	Type	Estimated Auditory Bandwidth	Hearing Group	Impulsive Sound (dB SPL_{peak})**	Impulsive Sound (dB SEL_{cum})***	Non-Impulsive Sound (dB SEL_{cum})***
				Mortality or Mortal Injury		
Testudines (Turtles)	*Cheloniidae* and *Dermochelyidae* (Sea turtles)	100 Hz – 1,000 HZ	High Frequency*	210	>207	No quantitative threshold; risk is low for near, intermediate, and far field exposure

Table Description: This table provides estimated auditory bandwidths and hearing frequency classes for sea turtles. The SPL_{peak}, and SEL_{cum} that may cause mortality or mortal injury in sea turtles for both impulsive and non-impulsive sources are also described. dB SPL_{peak} and dB SEL_{cum} mean the noise exposure (expressed in decibels (dB)) at peak sound pressure levels and 24-hour cumulative sound exposure levels respectively.

* Sea turtles may be particularly sensitive to lower frequencies (100 - 700Hz).
** dB (decibel) SPL_{peak} has a reference value of 1 µPa.
*** 24-hour cumulative sound exposure; dB SEL_{cum} has a reference value of 1 μPa^{2-s} underwater.

Sources: Bartol et al., 1999; Cunningham & Reichmuth, 2016; DFO, 2004b; Dow Piniak et al., 2012; Lenhardt, 2002; Lurton & DeRuiter, 2011; NMFS, 2018; 2021; Popper et al., 2014; Southall et al., 2007; Zahn et al., 2021.

Noise Sources and Effects Across Project Phases

The effects and presence of underwater noise throughout offshore wind development varies. Depending on the project phase and design, sources of noise may include marine vessels, helicopters and drones; systems used to penetrate the ocean floor during site surveys; pile driving during construction; turbine operation; and water jets used to cut foundations during decommissioning.

Vessel Use throughout Development

Noise associated with marine vessel activity can have a number of impacts on marine mammals and sea turtles (CSA Ocean Sciences Inc., 2021). Underwater noise produced by vessels is described in Section 7.4.3.1.1 of this Report. The underwater sound produced by marine vessels can mask the communication signals of marine mammals, impede foraging, impair predator detection, displace species from their habitat, or cause physiological stress (CSA Ocean Sciences Inc., 2021; DFO, 2004b; Erbe et al., 2019; Weilgart, 2013).

Vessels are required during all phases of offshore wind development, and some phases require higher levels of vessel activity. Therefore, noise associated with vessel use maybe long term (i.e., for the duration of the project) with periods of elevated noise. Furthermore, effects maybe chronic (Erbe et al., 2019; Nedwell & Howell, 2004; Nolet, 2017; Richardson et al., 1995b).

Helicopters and drones may also be used to service offshore wind farms. Helicopters and drones produce noise at the sea surface and may impact marine mammal and sea turtle species that exhibit surface activities. Due to the speed and height of helicopter and drone movement as well as the short duration of some surface activities, exposure to noise from such crafts would be limited for certain species (Erbe et al., 2019; Nedwell & Howell, 2004; Nolet, 2017; Richardson et al., 1995b; c).

Pre-Construction Site Surveys

During the pre-construction phase, site surveys characterize site conditions and the seafloor (CSA Ocean Sciences Inc., 2021). Site surveying systems used to penetrate the seafloor for offshore wind development are lower energy (quieter), use intermittent short pulses, and generate noise throughout the water column (Lurton & DeRuiter, 2011). This may cause behavioural changes in some marine mammal and sea turtle species (CSA Ocean Sciences Inc., 2021). In a biological opinion published by NMFS, under the assumption that site surveying equipment was used at maximum power, estimated distance to permanent damage to hearing sensitivity (PTS) for all marine mammal and sea turtle species is 15 m. However, responses to site surveying activity can occur at varying distance depending on the method used, with some marine mammal species exhibiting behavioural responses up to 500 m away and sea turtles observed to have behavioural responses at 2 m (CSA Ocean Sciences Inc., 2021).

Pile Driving during Construction

The construction phase of offshore wind development produces high noise levels and poses the highest risk to marine mammals and sea turtles. Pile driving, which is required

for some kinds of foundations, creates a significant amount of noise at both high and low frequencies. This may cause auditory injury at close range (Kaldellis et al., 2016; Lüdeke, 2017). When the noise generated by pile driving undergoes acoustic coupling with the sea floor, such underwater impulses can propagate great distances, even in shallow waters.[109] Types of potential effects caused by different foundation types and pile driving methods effect are described in Section 7.4.3.1.1 of this Report.

Cetaceans sensitive to higher frequency noise may be at the greatest risk for behavioural changes, displacement, or noise-related injury because of the noise created during pile driving. Research suggests that pile-driving may temporarily affect pinnipeds and porpoises during the construction phase and cause behavioural changes such as avoidance (Carstensen et al., 2006; Dähne et al., 2013; Gordon et al., 2003). As seals are semi-aquatic species and spend some of their time on land, they are less vulnerable to underwater noise when compared to other marine species (Kaldellis et al., 2016; NYSERDA, 2017c). Sea turtles detect noise frequencies at levels that overlap with drilling and pile driving and may be able to detect such anthropogenic sounds over large spatial scales (Dow Piniak et al., 2012).

Turbine Operation

The operation phase generates temporary underwater noise through maintenance activities and continuous low-amplitude sound generated by the turbines. The amplitude of turbine noise varies with turbine size and wind speed, but operational noise does not significantly exceed natural noise levels (SEER, 2022a).

Operational sounds may cause behavioural impacts to marine mammals such as attraction due to better foraging opportunities and shelter (Hammar et al., 2010; Russell et al., 2014). This attraction to offshore wind farms may indicate that animals can become habituated to the turbines noise levels or that the sound is insufficient to cause behavioural changes (Teilmann & Carstensen, 2012). Behavioural and physical effects to marine mammals caused by the operation phase of offshore wind development are comparable to impacts from other more common anthropogenic and natural noise sources such as vessel traffic (Madsen et al., 2006; Verfuss et al., 2019). However, chronic exposure to long-term consequences of noise pollution by offshore wind farms could affect marine mammals by changing prey accessibility (Gordon et al., 2003). Research on the impact of operational noise on sea turtles is limited with avoidance, disruption to feeding behaviours, disorientation, or attraction behaviours depending on the species (Dow Piniak et al., 2012; Kaldellis et al., 2016; Minerals Management Service, 2007).

Decommissioning

Decommissioning of offshore wind turbines often requires the removal of turbine structures, scour protection, and cables from the project site. To facilitate this process,

[109] This information was provided by DFO in their response to the Draft Report. This submission is available on the Registry under document reference number 379, CSAS IA - NL OSW - RA Draft Report for Public Comment - DFO Science Review (2024).

turbine piles are sometimes cut using water jets or other methods which can generate underwater noise (Hinzmann et al., 2017; Mooney et al., 2020). The underwater noise produced by such activities is likely similar to noise produced during the construction phase of offshore wind development (NRCan, 2021). The noise and sound pressure generated may cause behavioural changes in marine mammals and sea turtles, particularly if species have aggregated around wind farms due to artificial reef effects (Hinzmann et al., 2017; Mooney et al., 2020; Bailey et al., 2014; Maxwell et al., 2022).

7.5.3.1.2 Benthic disturbances and Sediment suspension

During the construction phase of offshore wind development seafloor preparation, cable burying, foundation installation, and vessel anchoring may result in benthic disturbance (ICF, 2020; SEER, 2022a). The installation of gravity foundations specifically, often requires dredging of the sea floor to level the area. This can cause temporary, localized increases in sediment suspension within the water column, increasing turbidity which can limit visibility for marine mammals and sea turtles. Benthic disturbance and sediment suspensions can also cause temporary avoidance or attraction behaviours by affecting the mortality and distribution of prey species (see Section 7.4.3.1.2, for potential impacts to marine invertebrates, fish, and skates), disrupting foraging opportunities and decreasing feeding efficiency for marine mammals and sea turtles (CSA Ocean Sciences Inc., 2021; ICF, 2020; Stantec Consulting Limited, 2022; Todd et al., 2015). The removal of foundations, cables, anchors, and other structures are likely to have comparative effects to the construction phase activities.

7.5.3.1.3 Presence of Infrastructure

Section 7.4.3.1.3 of this Report describes how different foundation types may form artificial reefs, effect the food web and cause changes in predator distribution. Structures introduced to the marine environment can cause changes in plankton, invertebrate, and fish distributions such that a greater abundance and diversity of these occur near the structure. This may affect the foraging and distribution of some marine mammals and sea turtles (CSA Ocean Sciences Inc., 2021; DFO, 2004b; ICF, 2020; National Academies of Sciences, Engineering, and Medicine, 2024). For example, some studies show that Harbor Seals, Harbor Porpoises, and sea turtles are attracted to foundations to forage (ICF, 2020; Lindeboom et al., 2011; Lohoefener et al., 1990; Russell et al., 2014). This can have a positive effect on fitness by providing improved feeding opportunities.

In cases where offshore wind farm projects exclude fishing activities and vessel traffic, shelter effects may also occur and attract marine mammals to the project area. The lack of, or restricted vessel traffic reduces the underwater sound generated within the project area and may provide an area of reprieve for some species (Bergström et al., 2013; Lindeboom et al., 2011). Increased prey abundance and foraging opportunities may also result from the exclusion of fisheries from the offshore wind farm area (Bergström et al., 2013; Hammar et al., 2015).

7.5.3.1.4 Entanglement

A description of the entanglement risk posed by offshore wind development to marine species is provided in Section 7.4.3.1.5 of this Report. Secondary entanglement poses a risk to some of the migratory species at risk in Newfoundland and Labrador, including the Fin Whale, Harbour Seal, Harbour Porpoises, and Loggerhead Sea Turtle (Maxwell et al., 2022; SEER, 2022a).

7.5.3.1.5 Vessel Collisions

Offshore wind development requires vessel support and traffic can overlap with the migration routes, feeding areas, and breeding grounds of marine mammals and sea turtles. Collisions between vessels and marine mammals and/or sea turtles may occur in these areas, especially where there are high densities of marine mammals and sea turtles, (NYSERDA, 2017c; SEER, 2022a). The type and severity of injuries caused by vessel collisions depends on the size, type, and speed of the vessel and individual involved. Marine species that conduct surface-level activities (resting, foraging, nursing, migrating, and socializing) are at higher risk of vessel collisions compared to deep-diving animals. Collisions with these species often result in sharp force trauma, such as propeller injury (Laist et al., 2001; NYSERDA, 2017c; Schoeman et al., 2020; Vanderlaan & Taggart, 2007). Sharp force trauma more often occurs when sea turtles, seals, and small cetaceans collide with vessels (Moore et al., 2013; Schoeman et al., 2020; SEER, 2022a). Large vessels may pose less of a risk to marine mammal and sea turtle species that exhibit surface behaviour because the vessels are more easily detected and avoided (SEER, 2022a).

7.5.3.1.6 Artificial light

Artificial light from equipment and infrastructure during offshore wind development may attract fish or plankton resulting in new foraging opportunities for marine mammals and sea turtles (Stantec Consulting Limited, 2022). However, the overall risk associated with artificial lighting for marine mammals and sea turtles is low regardless of strobing intervals or colour as it has not been shown to disturb their behaviour (Orr et al., 2013).

7.5.3.1.7 Presence of Electromagnetic fields

Cables associated with offshore wind development. can emit EMFs (see Section 7.4.3.1.4 of this Report). This can adversely effect sea turtles by interfering with their ability to detect naturally occurring electric/or magnetic fields in the ocean and carry out essential life functions such as prey detection (NYSERDA, 2017c; Taormina et al., 2020). Though research is limited, some sea turtles are thought to be magneto-sensitive and capable of detecting higher-strength EMFs which may elicit avoidance behaviours when near subsea cables. Some sea turtles have also been observed to use their detection of geomagnetic fields to help navigate during migrations and EMFs may interfere with this orientation technique (SEER, 2022a; Stantec Consulting Limited, 2022).

7.5.3.1.8 Presence of HDVC

The mechanism of HVDC effects are described in Section 7.4.3.1.8 of this Report. HVDC effects are generally accepted as minimal due to the ability of the surrounding ocean mass

to absorb and transition any warm water output to an ambient temperature (Middleton & Barnhart, 2022). Secondary effects on marine mammals and sea turtles caused by potential changes in prey distribution and abundance is not well studied.

7.5.3.2 Indirect Effects of Planned Offshore Wind Activities

Marine mammals and sea turtles that occur within the Focus Area are culturally, economically, and ecologically important for a variety of Indigenous groups, communities, industries, and other plant and animal species. Any changes to marine mammal and sea turtle health, abundance, distribution, feeding, reproduction, migration, and behaviours may have indirect effects on these groups and species, and on their activities (Table 7.5.9).

Marine mammals and sea turtles that undergo behavioural changes and change their foraging habitat could impact fish and bird populations through predator-prey interactions. This could subsequently impact fisheries by displacing fish and/or causing changes to the food web. The displacement of marine mammals and sea turtles or changes to their population could also impact tourism and recreation activities, as well as the cultural heritage of local communities and Indigenous groups. Some Indigenous groups and public participants have expressed their concerns about the potential impacts to marine mammals and sea turtles on the Regional Assessment's Registry Page.[110] Physical, behavioural, and psychological impacts to marine mammals and sea turtles caused by offshore wind development may also be exacerbated by the effects of climate change which could affect the biodiversity and health of ocean ecosystems for future generations.

[110] The Committee's Indigenous Engagement - What We Heard Report (Appendix A) details all Indigenous engagement activities and summarizes all input received.

Table 7.5.9. Potential Indirect Effects Caused by or Affecting Marine Mammals and Sea Turtles

Component	Indirect Effects	Section
Aerofauna	Impacts to foraging opportunities and ecosystem.	7.3
Fish and Fish Habitat	Impacts to prey-predator interactions, behaviours, distribution, abundance, health, and ecosystem.	7.4
Fisheries	Impacts to commercial fishing economy through changes to prey-predator interactions (bottom-up and top-down), behaviours, distribution, abundance, health, and ecosystem of commercial species.	7.7
Other Ocean Uses	Impacts to tourism economy and locations as well as recreation locations and opportunities.	7.8
Physical and Cultural Heritage	Impacts to culturally important species for Indigenous groups and communities.	7.11
Sustainability, Climate Change, and other Considerations	Impacts to ecological sustainability through changes in biodiversity, behaviours, distribution, abundance, health, and ecosystem.	10

Table Description: This table summarizes the potential indirect effects to other components (i.e. Marine Fish and Fish Habitat, Fisheries and Other Ocean Users etc.) if marine mammals and sea turtles are affected by offshore wind development.

Sources: CSA Ocean Sciences Inc., 2021; DFO, 2005; Government of Canada, 2018; Lien, 2001; Lindeboom et al., 2011; O'Connor et al., 2009; Russell et al., 2014; Veit & Harrison, 2017.

7.5.4Mitigation and Other Measures

Projects proposed in the U.S. along the Atlantic coast and existing farms in the North Sea provide a number of mitigation measures for the potential impacts of offshore wind development on marine mammals and sea turtles (BOEM, 2024; Degraer et al., 2021; Minerals Management Service, 2007). Table 7.5.10 outlines a variety of mitigation measures for offshore wind development.

Table 7.5.10. Descriptions of Mitigation Measures for Impacts to Marine Mammals and Sea Turtles

Mitigation Measures	Description
Project Siting	• Avoid areas that are important to impacted species such as breeding, nursing, migration, and feeding areas. • Avoid EBSAs, MPAs, critical habitats, and other protected areas. • Conduct baseline survey work for at least two to three years prior to construction to identify critical habitat areas, BACI designs, seasonal species distributions, efficient monitoring protocols, and other physical and ecological data (e.g. oceanographic conditions, acoustics, migration routes etc.). • Engage Indigenous groups, the public, and other stakeholders early in planning and decision-making processes (collaborative approach) to help identify specific impacts and mitigation measures relevant to the area in question and help provide insight into what kind of turbine foundations, mooring systems and inter-array and export cable design would be best.
Underwater Noise and Vibration*	• Plan and coordinate pre-construction, construction, and decommissioning activities that produce noise such that they are completed efficiently and minimize noise duration. • Plan seismic surveys that use the minimum energy required. • Use foundation types or installation methods that do not require or minimize the amount of pile driving. • Equip passive acoustic monitoring devices prior to start-up and throughout construction to detect and track marine mammal vocalizations.[111] • Conduct Sound Field Verification measurements of pile-driving noise to determine the adequacy of certain mitigation and monitoring procedures. • Implement ramp up/soft start for seismic activities and pile driving at reduced energy over several waiting periods to deter marine mammals and sea turtles that may be in the area. • Avoid or restrict pile driving and other pre-construction and construction activities that generate significant underwater noise at sensitive times of year important to impacted species such as during feeding, breeding, migration, and nursing windows.

[111] Sea turtles do not vocalize at sea and cannot be monitored using acoustic approaches. Visual monitoring is required for sea turtle detection.

Mitigation Measures	Description
	• Use trained marine mammal or protected species observers to maintain an exclusion buffer zone (Safety Zone) around pile driving and air source array (500 m) activities for marine mammals and sea turtles. Shut down or delay pile driving activities if such animals are seen entering or within the buffer zone, particularly if it is a species at risk. • Implement acoustic deterrent devices such as pingers and Lofi tech seal scarers to deter marine mammals and sea turtles from approaching when construction is active.[112] • Implement quieting technologies such as bubble curtains, vibratory pile drivers, isolation casings, cofferdams, and hydro sound dampeners. • Shut down any associated energy sources when active surveying or constructions activities cease. • Exclude non-essential vessel traffic from the project area during the operation phase. Any vessel traffic associated with the project should use acoustic reducing technologies. • Pre-fabricate parts onshore when possible, to reduce the introduction of noise to the marine environment.
Benthic Disturbance and Suspension of Sediment	• Avoid sensitive sea floor habitats and areas that are important to impacted species such as breeding, nursing, and feeding areas. • Avoid cable burial near seal haul-out sites. • Avoid burying cable at times of year important to impacted species such as during feeding, nursing, and reproduction windows. • Plan cable burial process efficiently to require fewer steps when possible. • Reduce the amount of cable required by building closer to shore and reducing distance between turbines. • Use burial techniques that reduce resuspension of sediment such as horizontal direction drilling, dynamic vessel positioning, and ploughing. • Reduce speed of cable burial.

[112] DFO indicated acoustic deterrent devices may not work as a long-term solution as individuals may become habituated to such sounds. In addition, DFO stated acoustic deterrent devices were not an ideal solution as they can introduce loud and additional acoustic energy sources into the area, further degrading the soundscape. Their submission can be found on the Registry under document reference number 379, CSAS IA - NL OSW - RA Draft Report for Public Comment - DFO Science Review (2024).

Mitigation Measures	Description
	• Bundle new cables with existing cables and pipelines when possible. • Minimize the number of cable/pipeline crossings and crossing structures. • In shallow waters, conduct cable burial at low tide. • Repair project-related degradation or damage to ecosystem and biodiversity features that cannot be entirely avoided and/or minimized (e.g., restoring coastal intertidal habitats disturbed during export cable installation).
Presence of Infrastructure	• Repair project-related degradation or damage to ecosystem and biodiversity features that cannot be entirely avoided and/or minimized (e.g., restoring coastal intertidal habitats disturbed during export cable installation). • If possible, consider leaving infrastructure in place if there is an artificial reef effect associated with foundations/scour protection that provides biodiversity/ecosystem benefits.
Entanglement	• Adhere to federal, provincial, and international waste management procedures to prevent build-up of debris. • Implement underwater cameras, vessel mounted sensors, and ROVs to monitor mooring and line loads or motion and remove debris. • Ensure plow cables/umbilicals are always under constant tension.
Vessel Collisions	• Establish designated traffic lanes. • Minimize changes in vessel traffic where species at risk are likely to occur. • Maintain the mandatory distance from marine mammals and sea turtles when observed, in particular species at risk. • Enforce speed restrictions during certain times of year (e.g. breeding, moulting, pupping). • Establish vessel exclusion zones or areas of avoidance. • Use trained marine mammal or protected species observers to monitor and maintain exclusion zones. • Equip passive acoustic monitoring devices prior to start-up to detect and track marine mammal vocalizations when there is reduced visibility, inclement weather, or at night.

Mitigation Measures	Description
	• Conduct aerial surveys to monitor marine mammal and sea turtle species.[113] • Implement real-time vessel-based reporting to share sightings amongst vessels. • Reduce vessel traffic during construction and decommissioning. • Use helicopters rather than vessels for maintenance when possible to reduce vessel traffic.
Artificial Light	• Limit lighting during offshore operations to the minimum required by regulation and for safety, minimizing the potential for any light driven attraction of prey species.
Subsea Power Cables and EMF Emissions	• Use sediment as a physical barrier by burying cables that emit the strongest magnetic and induced electrical fields at a depth of 1.5 - 2 m. • Select highly permeable armor material, highly conductive armor and sheath material, and implement efficient proximity/bundling of conductors to create a barrier to sensitive species. • Implement cable technologies that reduce EMF emissions such as helically twisted three-core AC cables. • Add an additional protective layer around cables installed on top of the seafloor. • Arrange HVDC cables side by side with adequate burial depth. • Include cable removal as part of the decommissioning plan. • Whenever possible, align dynamic cables within shared corridors to reduce the overall footprint.

Table Description: This table describes the mitigation measures that could be implemented to mitigate or enhance the effects of offshore wind development and fill in data and knowledge gaps.

[*] All mitigation measures listed in the "*Statement off Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment"* (2007), should be implement when conducting activities that produce seismic sound.

[113] In their submission, DFO indicated that aerial monitoring may be compromised by the turbines erected for offshore wind development. Aerial surveys are often flown at 600 - 900 ft to be at a height that allows detection of smaller animals such as sea turtles and small cetaceans; large wind turbines may prevent flying at this height meaning that survey aircraft will have to fly at 1500 - 1200 ft in altitude. Flying at a higher altitude makes it more difficult to detect animals. Their submission can be found on the Registry under document reference number 379, CSAS IA - NL OSW - RA Draft Report for Public Comment - DFO Science Review (2024).

Sources: Bennun et al., 2021; BOEM, 2022a; Brandt et al., 2013; Castellote et al., 2008, 2012; CMACS, 2003; CSA Ocean Sciences Inc., 2021; DFO, 2004b; 2008b; Lüdeke, 2017; Maxwell et al., 2022; Nehls et al., 2015; NOAA, 2008; Nowacek et al., 2004; NYSERDA, 2017c; d; 2021; OSPAR Commission, 2012; SEER, 2022a; Stantec Consulting Limited, 2022; Svendsen et al., 2022; Verfuss et al., 2015; 2019; Wright et al., 2007b.

7.5.5Engagement Outcomes

Most participants expressed general concerns about how offshore wind development will affect marine species and a need for more long-term studies and research. Through the effects tables that were sent out to advisory groups and in-person public engagement sessions the Committee received additional references for use and suggestions for work to include that are incorporated throughout the Report. Information on the distribution or areas of importance for some species was also provided through engagement and incorporated into the Report where applicable. General concerns about what the potential effects of various phases and activities of offshore wind development may be and how they would impact marine mammals and sea turtles were expressed frequently through public engagement, advisory group input, and Indigenous engagement. Some of these effects include the production of anthropogenic noise, pollution, and disruption of migration routes. The potential disruption of migration routes for Blue Whales are of particular concern to some Indigenous groups and members of the public. During public engagement sessions in June 2024, Marystown residents expressed concerns about offshore wind developments in or around Fortune Bay discouraging or preventing various whale species from migrating into the bay for seasonal feeding opportunities.

One participant voiced their concerns about offshore wind farm related deaths of whales in the U.S. during a public engagement session in Stephenville in June 2024. However, the strandings and deaths in question have been shown to be unrelated to the development of offshore wind farms (NOAA, 2024e).

Some Indigenous groups and public participants have expressed concerns about the potential impacts to marine mammals and sea turtles both generally and in relation to specific impact pathways such as noise pollution, habitat disturbance, and changes in behaviour.[114]

Flat Bay Band Inc. expressed concerns about the potential impacts of noise pollution, accidental spills, and the presence of infrastructure on whales, dolphins, and other marine life.

In their submission from August 23, 2024, a member of Port au Port Indian Band shared concerns about the impact of offshore wind development to all species at risk such as Blue Whales. Another member raised concerns that offshore wind turbine development activities, such as construction or operation, may generate excessive noise and light pollution (at distances as great as 80 km), which can disturb local wildlife populations such as Blue Whales, and disrupt their natural behaviors. In addition to this, a member of the Port au Port Indian Band suggested the Committee review the YouTube channel ‘NLGhostwolf’ to observe videos of the marine life of the peninsula (Humpback Whale

[114] The Committee’s Indigenous Engagement - What We Heard Report (Appendix A) details all Indigenous engagement activities and summarizes all input received.

Madness, Humpback whales feeding on Capelin near Stephenville, Vlog#3 Whale Watching on Newfoundland's scenic west coast and more).

7.5.6 Data Gaps and Limitations

Data collection for marine mammals and sea turtles poses a particular challenge due to their vast distribution in the world's oceans. Data on marine mammals and sea turtles are collected through systematic surveys or opportunistic sightings which can be disrupted by poor weather conditions and recreational activity. Mortality estimates and marine mammal strike data often do not consider smaller whale species, seals, and sea turtles and more information is needed about vessel collisions with these smaller marine mammal species. No life-cycle analyses have been conducted in Canadian waters for offshore wind farms and assessing ecological impacts across differing spatial and temporal scales poses a challenge given the available data. Community and ecology level effects for various offshore wind development phases and activities are also poorly understood due to their complexity.

One of the methods used for data collection on cetaceans and sea turtles is Canada's At Sea Observers (ASO) program which relies on records from certified private-sector observers aboard fishing vessels to report interactions or observations (DFO, 2024k). The coverage and effort of the ASO program varies across regions and fisheries. Through the ASO program and similar initiatives that rely on public participation, observations of or interactions with species at risk may result in fisheries closures or restrictions. Reluctance to report observations and incidents for fear of such closures or harassment from peers can result in uneven distribution of effort and corresponding data gaps (DFO, 2024k). The reluctance to report marine mammal and sea turtle interactions was mentioned throughout public engagement sessions. Additionally, large turbines may compromise the detection of marine mammals and sea turtles via aerial surveys at offshore wind project sites hindering the ability to fill data gaps.

Additionally, climate change is anticipated to affect the abundance and distribution of many marine mammals and sea turtles as well as important components of their habitat in the Northwest Atlantic due to changes in oceanographic conditions and prey distribution or abundance. Due to their Endangered status under *SARA,* the unknown effect climate change may have on the North Atlantic Right Whale is of particular concern. There is a need to better understand the effects of climate change on marine species as well as how it may change their distribution.

Limitations such as these are the cause of the existing data gaps and limitations with respect to a variety of marine species within the Focus Area. Detailed descriptions of data and knowledge gaps are described in the relevant sections below. Cumulative effects, which are important to consider when assessing the potential impacts to marine mammals and sea turtles, are best performed when there is sufficient data for analysis. The data and knowledge gaps for marine mammals and sea turtles, particularly when considering publicly available information, limit the assessment of cumulative effects

within the Focus Area. Section 8 discusses potential cumulative effects on marine fish and fish habitat.

7.5.6.1.1 Cetaceans

Cetaceans (*mysticetes* and *odontocetes*) vary significantly in size, surface activity, and intervals between surface breathing causing some species to be more easily detected through visual surveys than others. Opportunistic sightings of cetaceans are also less frequent in the winter when recreational activity is low. Aerial- and vessel-based surveys conducted in the Focus Area are infrequent due to the high costs and tend to cover specific transects which are then extrapolated to a wider area. Satellite tracking of individual cetaceans provides the most complete picture of habitat use and movement patterns but has not been widely used in the area yet. The lack of data and knowledge on cetacean movements also creates challenges for habitat modelling which as a result is often based on proxy data for prey and oceanographic integration. Some potential habitats for cetaceans in the Focus Area have been identified such as the EBSAs but only a small number of species have been studied for habitat modelling (Gomez et al., 2017; 2020; Moors-Murphy et al., 2019). The habitat modelling that has been performed could be improved with more long-term data over a greater area, and a better understanding of prey species.

The current limitations in surveying and data collection have resulted in data and knowledge gaps for many cetacean species. These data and knowledge gaps include missing data on population abundance, distribution, migration, and habitat use relative to prey density for all mysticete and odontocete species present in the Focus Area. As noted for Figures 7.5.1, 7.5.2, and 7.5.3, no observation or incident data was publicly available for the Focus Area from the At-Sea-Observers program, OBIS, or CCRI for species such as Cuvier's Beaked Whale, Sowerby's Beaked Whale, Risso's Dolphin, and Striped Dolphin. Presence data for other species identified in Figures 7.5.2 and 7.5.3 was limited or an incomplete representation of the species' distribution and movement within the Focus Area.

7.5.6.1.2 Pinnipeds

The haul-out behaviour of Harbour and Grey seals has provided the opportunity to perform aerial surveys to determine population sizes in the Focus Area during the early summer. However, the migratory behaviour and lack of survey effort in the region has resulted in data gaps on seasonal distribution and habitat use for both species. Data and knowledge on when Harbour Seal breeding season may occur within the Focus Area is incomplete.

7.5.6.1.3 Sea turtles

Sea turtles vary significantly in size and their likelihood to be close to shore causing some species to be more easily detected through visual sightings than others. Citizen science contributes significantly to the available data on sea turtle sightings in Atlantic Canada such as through the Canadian Sea Turtle network or The Marine Mammal Section in DFO NL. However, this method relies on the public to report their sightings which produces variable results year-to-year or month-to-month depending on weather, recreational

activity, and effort. Aerial and vessel based systematic surveys are also conducted but can be costly and weather dependent. These tend to cover widely spaced transects that are then extrapolated to a greater area. The current limitations in surveying and data collection have resulted in data and knowledge gaps for the sea turtle species present in the Focus Area. These data and knowledge gaps include missing data on population abundance and habitat use for all sea turtle species in the Focus Area. As noted for Figure 7.5.5, no observation or incident data was publicly available for the Focus Area from the At-Sea-Observers program, OBIS, or CCRI for Leatherback Sea Turtles. Presence data for Loggerhead Sea Turtles displayed in Figure 7.5.5 was limited or an incomplete representation of the species' distribution and movement within the Focus Area.

7.5.6.1.4 Underwater Noise

More research is required on marine mammal and sea turtle hearing to understand the potential and cumulative effects of offshore wind development on their health and behaviours (Wright et al., 2023). Sea turtles in particular, have been overlooked in acoustic research compared to other marine species. While underwater noise is produced by a myriad of sources during offshore wind development, the noise levels produced during cable burial are not well understood and require further study (OSPAR Commission, 2012). Data and information available on anthropogenic sound made during the installation of various turbine types focus primarily on structures that require pile driving. Additional research on the underwater noise generated by non-pile foundations is required.

7.5.6.1.5 Species Behaviour and Movement

Behaviour, movement, and interactions with and around offshore wind farms are not well understood for some marine mammal and sea turtle species and further research is required to gain a better understanding of how to mitigate entanglement and vessel collisions. Information on movement and behaviour would also improve the ability to identify high-risk offshore wind development areas and improve monitoring efforts. Existing data on vessel collisions favour large marine mammals and there is limited information for smaller species. Displacement of marine mammals and sea turtles by vessels also requires further research to collect quantitative movement and behavioural data (Copping & Hemery, 2020; Fowler et al., 2020; Hemery et al., 2024).

7.5.6.1.6 Decommissioning and Artificial Reef Effect

Due to the complexity of artificial reef ecosystems, the effects of turbine removal and other activities during decommissioning are not well understood. There have also been few offshore wind farms decommissioned to date, further reducing the available research for consideration. Further research on the indirect effects of decommissioning is required. The effects of decommissioning when offshore wind farms act as fisheries exclusion zones and potentially provide shelter effects to various marine mammal and sea turtle species is also not well documented.

7.5.6.1.7 Acute and Cumulative EMF Exposure

Effects from EMF on sea turtles have not been well studied. Extensive research is required on both the community and species levels for acute and chronic exposure effects (OSPAR Commission, 2012).

7.5.6.1.8 HVDC Exposure

The effects of hot water from HVDC outtake pipes and its impact to prey species is not well documented or understood. Further research is required to assess if HVDC poses a significant risk to the ocean's ecosystems.

7.5.7 Committee Conclusions and Recommendations

The ocean waters around Newfoundland and Labrador are changing rapidly as are some of the historical marine communities (Bernier et al., 2023; Bourdages et al., 2023; DFO 2024c). As an outcome of preparing the Regional Assessment, several recommendations to address data and information important to considering offshore wind development are made:

- A program of surveys in the Focus Area initiated by DFO and developers to collect information on marine mammals and sea turtles regarding species occurrence and abundance. A range of technologies and data gathering should be considered, including protocols for observations by ocean users, eDNA, and AUVs.
- Research and survey effort should include identification of migratory routes and/or important areas for all species at risk, marine mammals, and sea turtles. Developers should directly or indirectly (through a collective fund such as the ESRF), fund these research and survey programs.
- Project specific impact assessments should be conducted by developers based on a minimum of 2 years or longer if a high level of variability is found, of site-specific surveys and should also include Before-After-Control-Impact (BACI) studies, long-term monitoring, and follow-up programs. Indigenous groups, fishers, other ocean users, the public, and other stakeholders should be consulted and engaged regarding monitoring efforts and outcomes.
- Enhanced data integration should be considered (aerial, satellite, real-time monitoring) to allow for adaptive management based on actual, current data rather than reliance on historic or seasonal patterns.
- Collaborative reporting standards should be considered with a standardized data format for marine mammal and sea turtle reporting, tailored to include real-time updates.
- Ongoing monitoring by NRCan, the Department of Industry, Energy and Technology for Newfoundland and Labrador, C-NLOER, developers, and other government authorities of developments in the offshore wind energy industry, in particular with regard to floating turbines as this type of facility may be suitable for Newfoundland and Labrador waters and may pose an additional risk of entanglement. Ongoing monitoring of entanglement related to other turbine and offshore wind structures should also be conducted.

7.6 Protected and Special Areas

7.6.1 Existing Conditions

Several marine and coastal areas in Newfoundland and Labrador have been designated as protected under provincial, federal, or other legislation or agreements due to their ecological, historical, or socio-cultural characteristics and importance. Other areas have been formally identified as being special or sensitive through other relevant processes and initiatives. This section identifies and describes those protected and special areas that are within and around the focus area, which in many cases have been identified because of their ecological characteristics, importance, and value, as well as associated marine uses. A general overview of relevant special areas in adjacent coastal waters will be discussed as well. Figure 7.6.1 below depicts many of the protected areas that will be discussed in the sections to follow:

Figure 7.6.1. Legislated Protected Areas Within and Adjacent to the Focus Area

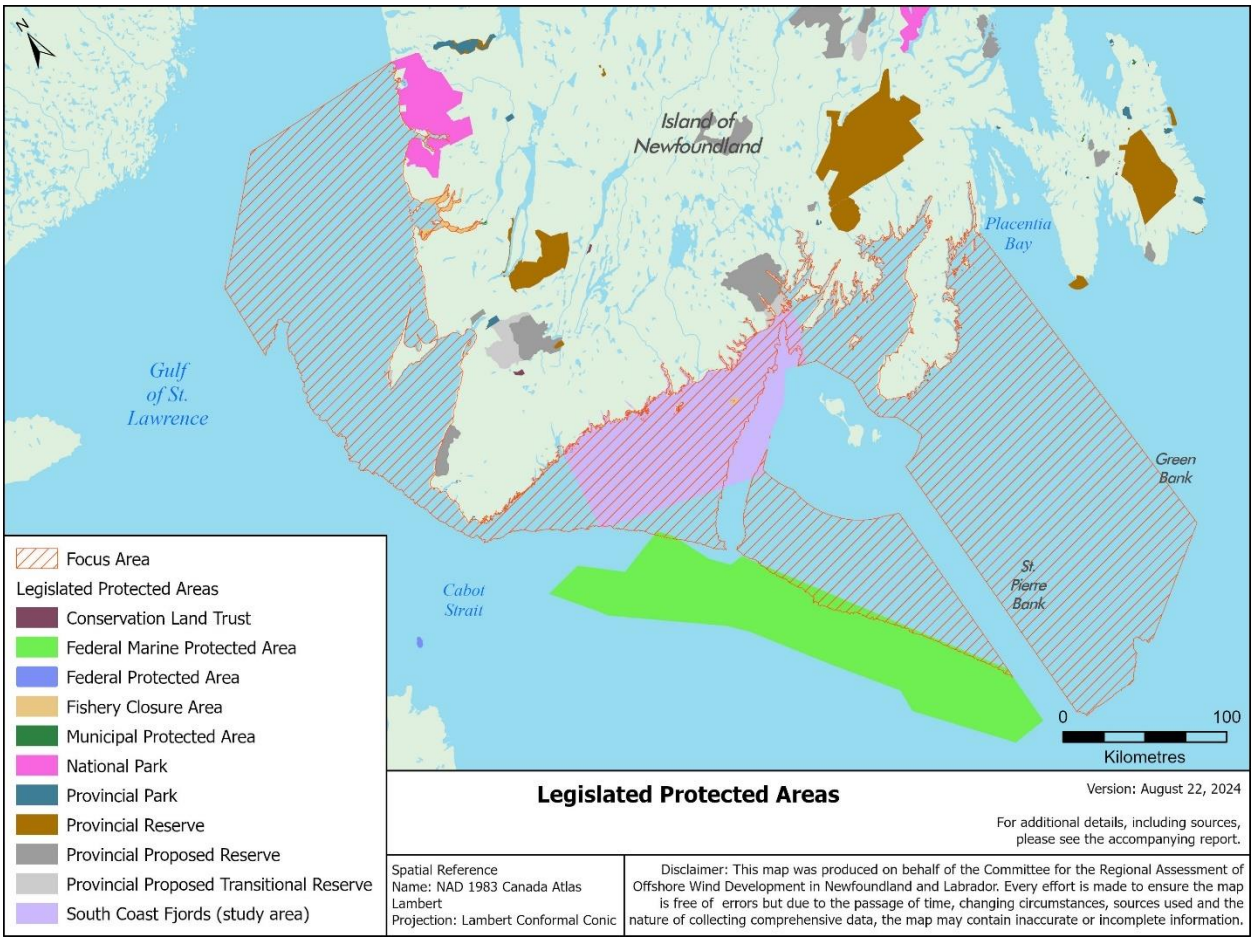


Figure Description: Map depicts protected areas under Federal and Provincial legislation that will be further discussed in subsequent sections.
Data Sources: Conservation Land Trust, Federal Marine Protected Area, Federal Protected Area, Municipal Protected Area, National Park, Provincial Park, Provincial Reserve, Provincial Proposed Reserve, Provincial Proposed Transitional Reserve: (ECCC, 2023g).
Fishery Closure Area: (DFO, 2023m)
South Coast Fjords Study Area: (Parks Canada, 2024).

7.6.1.1 Federally Designated Areas

In Canada, various pieces of legislation and other processes are used to protect and conserve marine ecosystems. The following sections discuss Canada's management framework and specific measures used to identify and protect special areas in marine and coastal locations, with the responsibilities of each falling under various federal departments and agencies. A list of federal legislation allowing for the establishment of protected and otherwise special areas, along with the lead department or agency, is provided in Table 7.6.1 below.

Table 7.6.1. Federal Legislation and Associated Special Areas

Legislation	Type of Special Area	Lead Department or Agency	Purpose
Oceans Act, 1996, c.31	MPAs	DFO	To conserve and protect fish, marine mammals, and their habitats; unique areas; areas of high productivity or biological diversity; maintaining ecological integrity of marine areas.
Fisheries Act, 1985, c.F-14	Fisheries Closure Areas; Marine Refuges	DFO	To conserve and protect fish and fish habitat; to manage inland fisheries (among other purposes).
Migratory Birds Convention Act, 1994, c. 22	Migratory Bird Sanctuary	ECCC	To conserve and protect habitat for migratory bird species.
Canada Wildlife Act, R.S.C., 1985, c.W-9	NWAs	ECCC	To conserve and protect habitat for a variety of wildlife, including migratory birds and species at risk.
Canada National Marine Conservation Areas Act, 2002, c. 18	NMCAs	Parks Canada	To conserve and protect representative examples of Canada's natural and cultural marine heritage and provide opportunities for public education and enjoyment.
Canada National Parks Act, 2000, c.32	National Park / National Park Reserve	Parks Canada	To protect representative examples of Canada's natural heritage for the benefit, education and enjoyment of Canadians.
Species at Risk Act, 2002, c.29	Critical Habitat	Parks Canada (*Canada National Parks Act* (2000*)*, or *Rouge National Urban Park Act* (2015)*)* DFO (*Oceans Act* (1996)) ECCC (*Migratory Birds Convention Act* (2002) or *Canada Wildlife Act* (1985))	To conserve wildlife by preventing extirpation or extinction, recover endangered or threatened species impacted by humans, and managing species of concern to prevent future endangerment or threats.

Table Description: Table outlining federal protective legislation from various federal agencies and the types of protected areas they support.

Source: ECCC, 2017d.

7.6.1.1.1 Bioregions

The federal government's approach to integrated resource management and marine conservation is outlined in Canada's Oceans Strategy (DFO, 2002). DFO has identified and classified 13 bioregions across the country based on oceanographic and bathymetric conditions, which are important factors for defining marine habitats and used as an ecological foundation for ocean conservation and management decisions. The coastal and marine waters of Newfoundland and Labrador fall within the two bioregions: 1) the GSL and 2) the NLS. The Focus Area falls within both regions.

The NLS region is located on a glaciated shelf, with an adjacent continental slope, which is further classified into thirteen geomorphic units. These units contain a variety of seafloor morphology, with some characteristics found nowhere else in Canada. The morphology and sediment mobility within the region aid a variety of important habitats, such as eelgrass and cold-water corals and sponges. These habitats support commercial fish stocks and marine species that are sensitive or at risk (fish, marine mammals, turtles and birds) (Shaw et al., 2023; DFO, 2009b). The NLS region is as seen in the green area in Figure 7.6.2.

Dominant oceanographic processes unify the GSL region as a distinct biogeographic unit, but there is a major division between its northern and southern parts, due to differences in the fish, plankton, and benthic communities. The southern Gulf shares similarities with the Scotian Shelf region, while the northern Gulf shows weaker similarities with the NLS region (DFO, 2009b). The GSL has some of the warmest waters in Atlantic Canada during the summer, while then also having the largest amount of sea ice during the winter. It is one of the largest and most productive estuarine/marine ecosystems in Canada (DFO, 2023z). The GSL region is as seen in the yellow area in Figure 7.6.2.

Figure 7.6.2. Bioregions Within the Focus Area

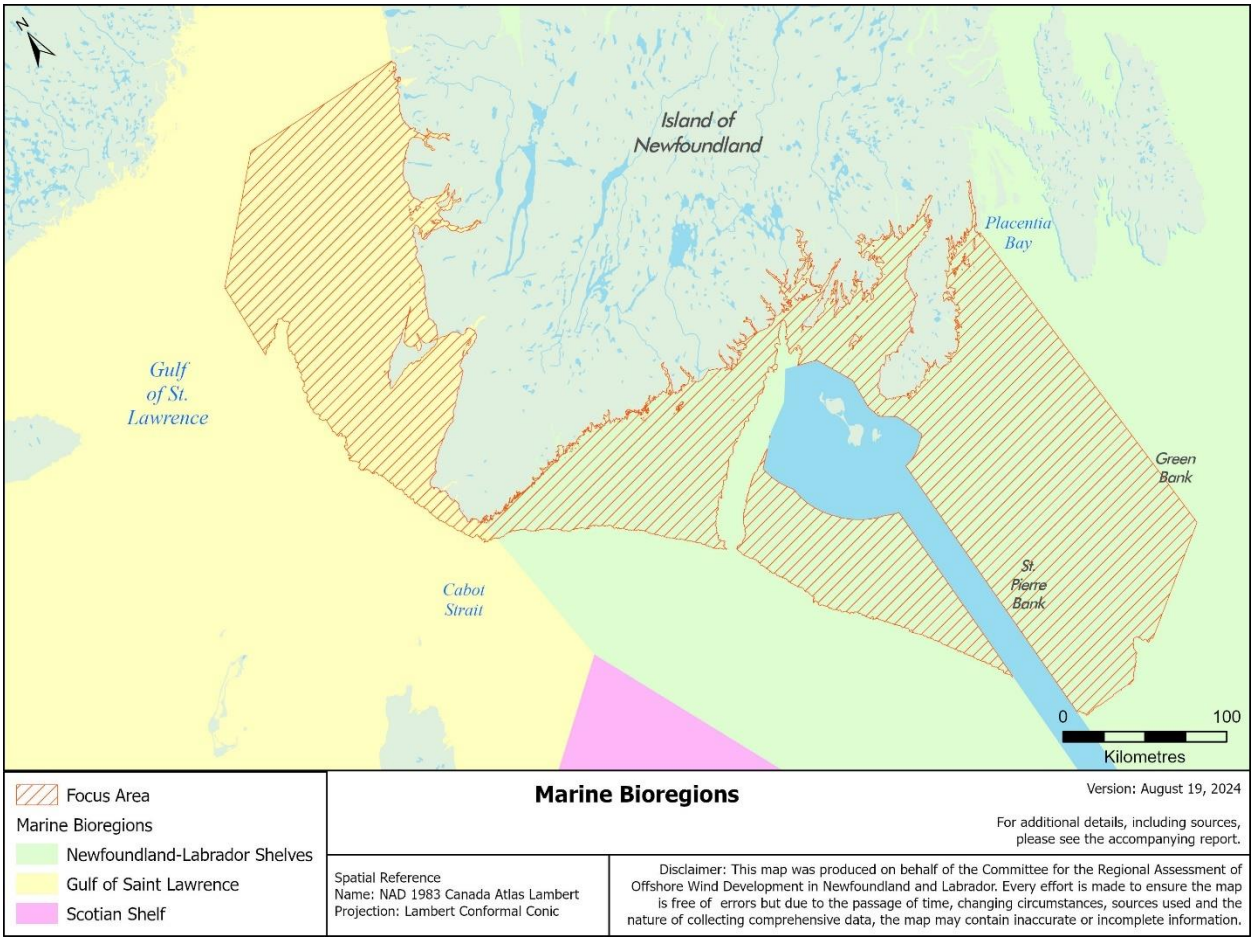


Figure Description: Map depicting bioregions that fall within the Focus Area, including the Newfoundland-Labrador Shelves and Gulf of St. Lawrence regions. The French EEZ is not denoted in the legend but can be seen as the blue shape (water) that has not been overlapped by the bioregions or Focus Area.
Data Source: NRCan, 2024a

7.6.1.1.2 Ecologically and Biologically Significant Areas

EBSAs are marine areas identified by DFO that have high ecological and/or biological significance, and that may be considered important for several marine species or ecological processes within them. While these areas have been identified as being significant, this identification does not provide legal protection through existing legislation, but rather it helps inform processes that may result in an area's management measures or future protections. The goal of the EBSA process is to "facilitate provision of a greater-than-usual degree of risk aversion in management of activities in areas of especially high ecological and biological significance" (DFO, 2004a). The process of selecting EBSAs includes compiling various data layers and obtaining expert science advice to help delineate areas. Areas are then identified using the following criteria (DFO, 2013d; DFO, 2019b; Templeman, 2007):

- Fitness Consequence: Areas where life history activities and processes take place that make an important contribution to the fitness of the current and future populations of species that use the area.
- Aggregation: Areas where most individuals of a species are aggregated for some part of the year, use the area for some important life function, and/or some structural feature or ecological process occurs with exceptionally high density.
- Uniqueness: Areas with characteristics that are unique, rare, distinct, and for which alternatives do not exist elsewhere.

While most areas have some ecological function, the EBSA process seeks to identify areas that are considered "significant" and that if the area were to be disturbed the ecological consequences (in space, in time, or outward through the food web) would likely be greater than the effect of an equal disturbance of most other areas, although it is recognized that the nature of those consequences could differ greatly among specific cases (DFO, 2004a).

To date, 29 EBSAs have been identified within the NLS Bioregion area through multiple processes (DFO, 2019b; Templeman, 2007; Wells et al., 2017) and 10 EBSAs have been identified within the Estuary and GSL bioregions (DFO, 2007b). These EBSAs have undergone further study and refinement since their initial identification, and their boundaries have been adjusted based on new data and analysis (DFO, 2016c; 2019b; Wells et al., 2017). There are currently five EBSAs that fall within the Focus Area in whole or in part.

Table 7.6.2. Ecologically and Biologically Significant Areas

Name of EBSA	Area (km^2) within or adjacent to Focus Area	Summary of Area
West Coast of Newfoundland	18,234 km^2	The main concentration area for many species of groundfish (juvenile Atlantic Cod, Redfish, American Plaice and Atlantic Wolffish), and a significant area for pelagic fish. The area has significant sections for marine mammals (Blue Whale, divers, krill eaters).
South Coast	6,869 km^2	Known important habitat for the Blue Whale and other marine mammals. Other key features include three fish functional groups, two seabird functional groups, two seal species, and sea pen and sponge sensitive benthic areas. Atlantic Cod, Redfish, and shrimp Important Areas, as well as several eelgrass beds are also found within the EBSA. Two IBAs (Grand Bay West to Cheeseman Provincial Park IBA and Big Barasway IBA) are within the EBSA as well.
Laurentian Channel	19,548 km^2	The EBSA supports a variety of species including Greenland Halibut, Witch Flounder, Blue Whale, Sea Pens and small Gorgonian Corals. It also houses key mating grounds, nursing areas and habitats for many Species at Risk (Smooth Skate, Thorny Skate, White Hake, Winter Skate, Porbeagle Shark and Blue Whale).
Placentia Bay	13,539 km^2	Overall, the EBSA boasts significant ecological importance and serves as a crucial habitat for various marine species. It has important salmon rivers, Capelin spawning beaches, eelgrass habitat, seabird colonies, and other key features such as Large Gorgonian Coral Important Areas, Soft Coral Important Areas, and Sponge Important Areas, which are found just outside the bay.
Southwest Slope	25,156 km^2	An important area for several species and taxonomic groups, including American Plaice, Atlantic Cod, Northern Wolffish, Redfish, Roundnose Grenadier, Smooth Skate, Thorny Skate, White Hake, Winter Skate and Blue Whale. It also harbours various fish functional groups, including small and large benthivores, planktivores, plankpiscivores and piscivores. Coral Important Areas are also included, which house Black Corals (*Antipatharia*), small and large Gorgonian Corals (*Alyconacea*), Stony Cup Corals and Sea Pens (*Pennatulacea*).

Table Description: This table summarizes the five EBSAs that fall within the Focus Area, in whole or in part: West Coast of Newfoundland, South Coast, Laurentian Channel, Placentia Bay, and Southwest Slope. It describes the amount of area covered and a summary of why the area was designated.
Sources: DFO, 2009a; 2019b.

Figure 7.6.3. Ecologically and Biologically Significant Areas Within the Focus Area

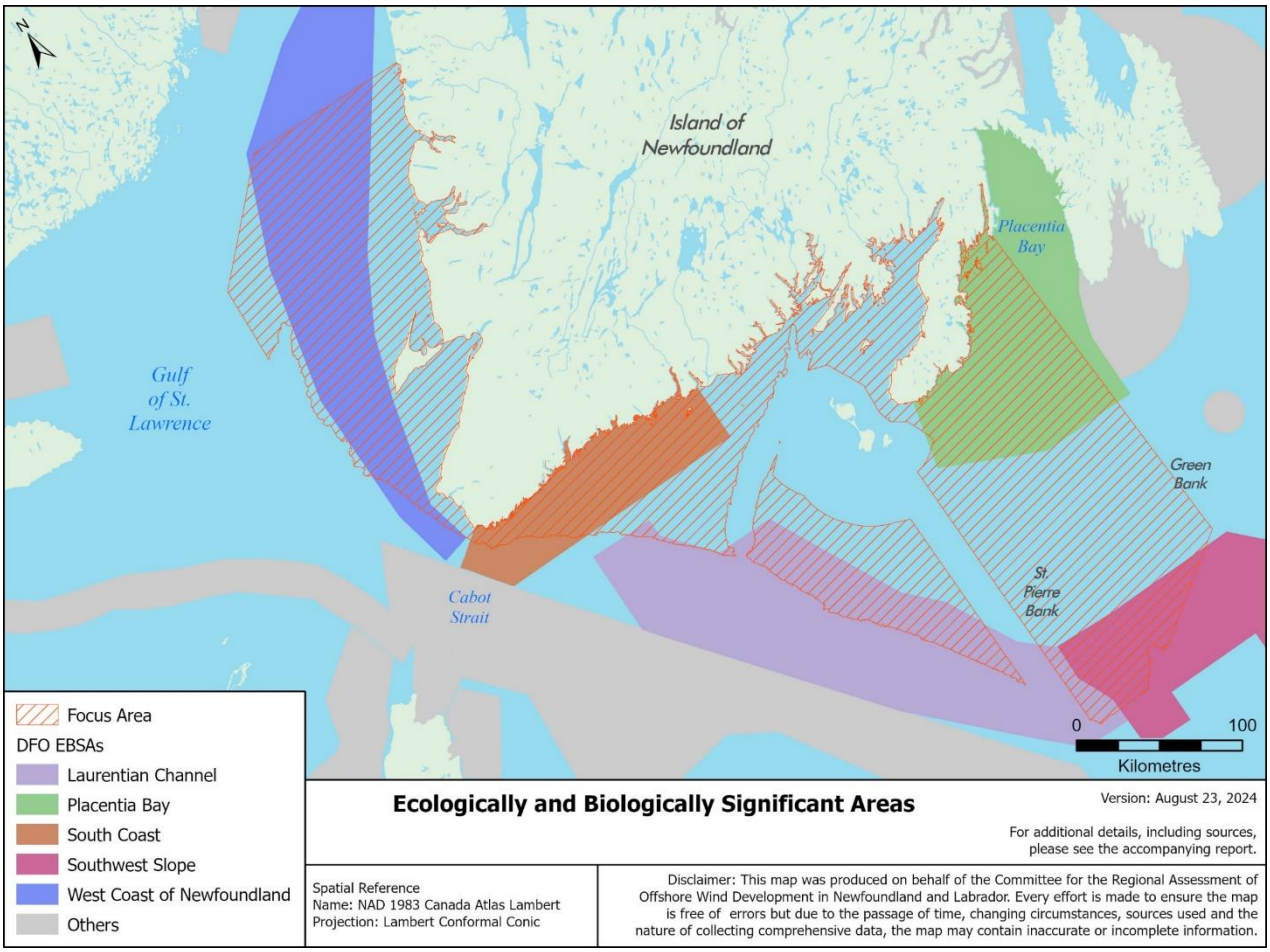


Figure Description: Map depicting EBSAs within the Focus Area. These include Laurentian Channel, Placentia Bay, South Coast, Southwest Slope and West Coast of Newfoundland.
Data Source: DFO, 2021d.

7.6.1.1.3 Significant Benthic Areas

Corals and sponges play an important ecological role in marine ecosystems where they are present, and are key components of healthy, productive marine environments. DFO has undertaken analysis of existing data to help delineate areas offshore Newfoundland and Labrador that may contain large densities or aggregations of corals and sponges. These areas are known as SBAs.

SBAs are defined in DFO's Ecological Risk Assessment Framework as "significant areas of cold-water corals and sponge dominated communities" where their significance is determined "through guidance provided by DFO-lead processes based on current knowledge of such species, communities and ecosystems" (Kenchington et al., 2016; DFO, 2017c). Such areas have been delineated using information on known observations of corals and sponges from various research programs (e.g., DFO Research Vessel surveys and individual surveys from peer-reviewed literature), along with spatial (kernel density) analysis and species distribution modelling to determine areas with relatively high known

or potential densities of these species. DFO has defined four SBA types among cold-water corals and sponges based on the dominant taxa, namely SBAs for sponges, sea pens, large gorgonian and small gorgonian corals (DFO, 2017d). These areas do not carry legal protection and there are no regulated prohibitions or restrictions of activities within them. The SBAs that occur within the Focus Area are situated primarily within the Laurentian Channel, South Coast and West Coast of Newfoundland EBSAs and include areas associated with sea pens, sponges, and large and small gorgonian corals.

Figure 7.6.4. Significant Benthic Areas Within the Focus Area

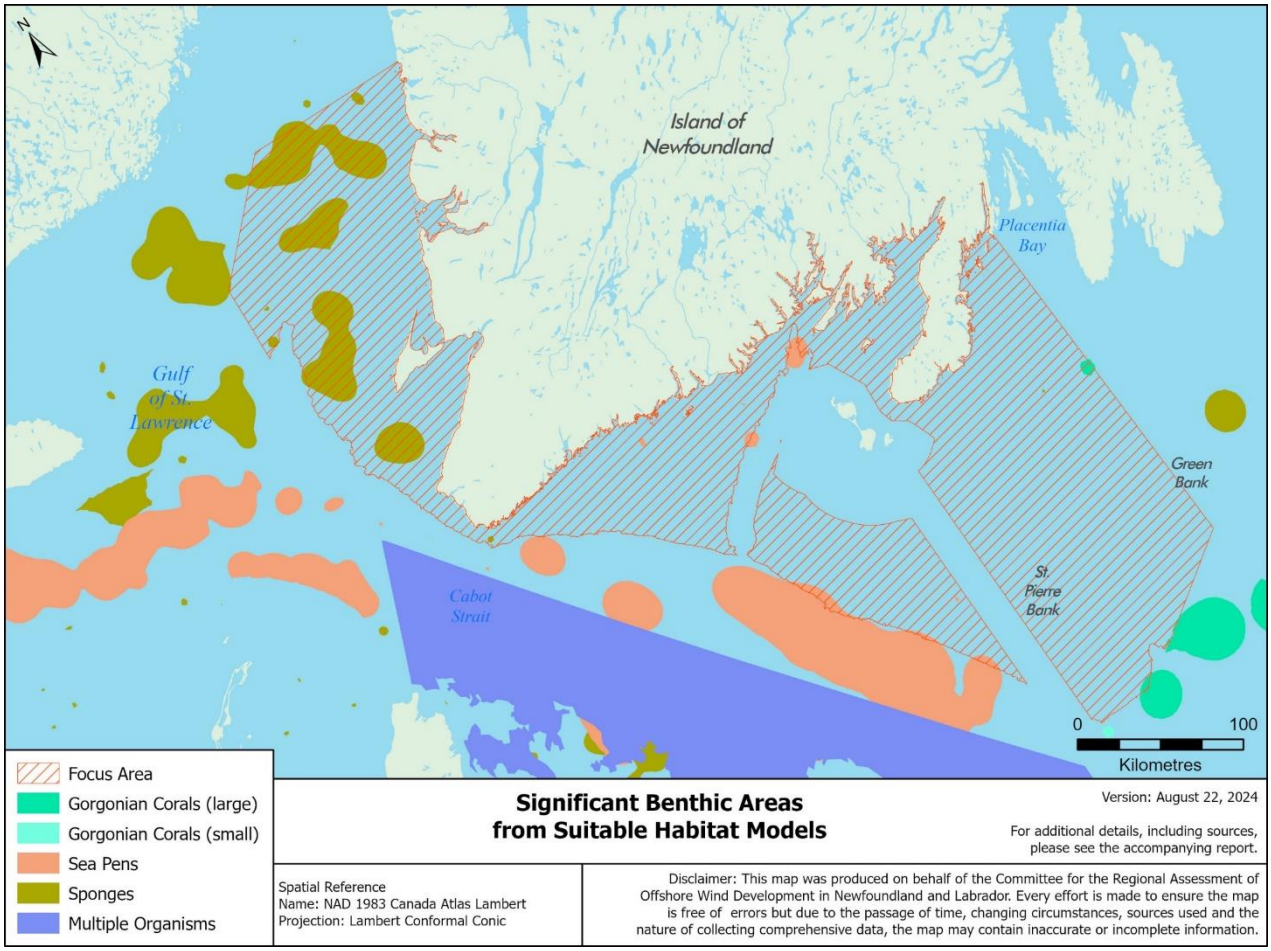


Figure Description: Map showing SBAs within the Focus Area. These include areas inhabited by large and small Gorgonian Corals, Sea Pens and Sponges.
Data Source: DFO, 2024h

7.6.1.1.4 Marine Protected Areas and Areas of Interest

The creation and establishment of MPAs in Canada is facilitated through the federal *Oceans Act* (1996), with DFO administering the process of identifying, establishing and managing such areas. Designating an MPA provides legal protection for marine ecosystems and associated resources in areas that are considered important, and that may contain species or ecological processes that require special consideration and protection.

The process for creating an MPA begins with the identification of AOI within the different bioregions in Canada. This process is carried out by DFO, in collaboration with other federal departments and scientific experts. These selected AOI then undergo public engagement initiatives, along with detailed assessments for biological/ecological, socioeconomic and cultural factors. Once these analyses have been completed, a decision is made around whether to formally designate an area as an MPA. Once an area has been designated as such, specific regulations are created that dictate what activities may or may not occur within the MPA. For the existing Newfoundland and Labrador MPAs, prohibited activities include: disturbing, damaging, destroying or removing living organisms or habitat; or depositing, discharging or dumping substances that may have the same result (DFO, 2023x). Additional permissions or prohibitions for other activities are set out in the regulations specific to that area.

There are currently three MPAs located within the waters of Newfoundland and Labrador. This includes the Eastport MPA in Bonavista Bay, the Laurentian Channel MPA on the southern coast of the Island, and an MPA in Gilbert Bay along the Labrador coast. At the time of writing, the only MPA or AOI located within the Focus Area is the Laurentian Channel, which can be seen in Figure 7.6.1, along with all other legislated protected areas, in Section 7.6.1 of this Report.

The Laurentian Channel, a deep submarine valley from the intersection of the St. Lawrence and Saguenay Rivers to the edge of the continental shelf off Newfoundland, is an important habitat for a variety of marine species. It is made up of two management zones, each with various exceptions, which are outlined in Table 7.6.3 below. The main conservation objectives of this MPA includes protecting corals, Sea Pens, Black Dogfish (*Centroscyllium fabricii*), Smooth Skate and Porbeagle Sharks from human induced mortality, while also promoting the survival and recovery of Northern Wolffish and Leatherback Sea Turtles by reducing the risks of harm from human activities. While prohibited activities have exceptions, they currently do not exclude offshore wind development activities (DFO, 2019l). Although. currently under the MPA Protection Standards, permits will not be issued for disposal at sea within MPAs. In cases where the disposal of dredged material for concrete foundations and sea floor excavated to make room for underwater structures, which would be used for offshore wind development, would not be issued a permit for the dumping of fill, as it will not be allowed within a MPA (DFO, 2024q).

Table 7.6.3. MPAs Within Focus Area

Name of MPA	Area within or adjacent to Focus Area	Prohibited Activities	Exceptions
Laurentian Channel MPA	11,580 km²	Any activities that disturb, damage, destroy or remove (or is likely to do so) any living marine organism or any part of its habitat	The following activities may be carried out in the MPA: • the navigation of vessels provided that there is no anchoring in Zone 1a or 1b; • fishing, other than commercial fishing, that is authorized under the *Aboriginal Communal Fishing Licences Regulations*; • the laying, maintenance and repair of cables in Zones 2a and 2b, provided that it is not likely to destroy the habitat of any living marine organism in the MPA; • any activity that is carried out for the purpose of public safety, national defence, national security, law enforcement or responding to an emergency; and • any activity that is part of an activity plan that has been approved by the Minister

Table Description: Table describing the Laurentian Channel MPA, along with its prohibited activities and exceptions.
Source: DFO, 2019l.

7.6.1.1.5 Marine Refuges, Fisheries Closure Areas and Other Effective Area-Based Conservation Measures

The identification of Marine Refuges is another mechanism that the Government of Canada, through DFO and the *Fisheries Act* (1985), can implement legal protection and apply conservation measures to marine areas within Canadian jurisdiction. This includes closing areas to specific types of commercial or recreational fishing activity. These areas are designated to help Canada achieve its ocean protection commitments, including meeting Canada's conservation target of protecting 25% of its oceans by 2025 and 30% by 2030, as highlighted in the Fifth International Marine Protected Areas Congress (DFO, 2023y). Marine Refuges are considered by DFO as OECMs which are complementary to

MPAs to help further protect coastal and marine areas. The process for determining these areas utilizes the following criteria (DFO, 2022):

"1. The area-based measure being considered as a candidate OECM is in place for the long term. Its contribution to marine conservation coverage (i.e. meeting marine conservation targets) can only be included once, either as an OECM or as an MPA.

2. The candidate OECM is a spatially defined area and information on its BCBs is collected.

a. The boundaries, size, and depth, where necessary, are defined and documented.

b. Existing or anticipated BCBs within the candidate OECM's ecosystem are identified and documented. At a minimum, these must include:

i. a benefit for an important species AND

ii. a benefit for an important habitat AND

iii. an additional benefit

c. The governance decisions and management actions in the area that provide the BCBs are identified and documented.

d. Information on the ecosystem functions and services in the area is collected and documented.

3. The candidate OECM is governed for the long term by a lead RGA in coordination or co-led with other RGAs.

a. The RGAs have the jurisdiction to make and enforce long-term decisions with no end date.

b. The RGAs recognize and respect Aboriginal and treaty rights, and consult rights holders.

c. The RGAs take into account the views of local communities and stakeholders.

d. The governance approach is tailored to meet the candidate OECM's distinct needs and context.

4. The candidate OECM is managed for the long term by a lead RGA in coordination or co-led with other RGAs.

a. These authorities undertake long-term management actions that may be adapted, as necessary, over time.

b. Rights holders and stakeholders are encouraged to participate in the management actions.

5. The candidate OECM is governed and managed in ways that provide BCBs over the long term.

a. The OECM's governance and management system is adaptive and effectively avoids or mitigates risks from existing and foreseeable activities to the BCBs that the OECM provides.

b. Monitoring is underway or will take place over time to provide the information to determine the ongoing effectiveness of the governance and management system in providing BCBs.

c. The OECM governance and management system continues to take into account ecosystem functions and services and other relevant values as it adapts."

Once these areas are selected, they are implemented using management measures under the *Fisheries Act* (1985), such as licence conditions and variation orders. To date, DFO has designated nineteen Marine Refuge Areas within coastal and offshore areas of Newfoundland and Labrador (DFO, 2023y). Most of these areas either prohibit bottom contact fishing or have limitations on what type of fishing activity can occur in the area in an effort to conserve the existing ecological / biological functions that the area provides to the marine and benthic communities it supports. This includes the conservation of corals and sponges, as well as fish and invertebrate species that are considered ecologically, socially or commercially important (DFO, 2017g). The following table identifies the four marine refuges within or adjacent to the Focus Area, which can be seen in Figure 7.6.1, along with all other legislated protected areas, in the introduction of Section 7.6.1 of this Report.

Table 7.6.4. Marine Refuge or Fishery Closure Areas Within or Adjacent to the Focus Area

Title of Marine Refuge or Fisheries Closure Area	Area within or adjacent to the Study Area	Summary of Area	Prohibited Activities
Bay of Islands Salmon Migration closure	217.4 km²	To protect Atlantic Salmon migratory area	Prohibits all pelagic fixed gear fisheries
Lobster Area closures (Trout River)	0.65 km²	To increase lobster spawning and egg production	Prohibits all lobster fishing
Lobster Area closures (Shoal Point)	0.65 km²	To increase lobster spawning and egg production	Prohibits all lobster fishing
Lobster Area closures (Penguin Islands)	15.5 km²	To increase lobster spawning and egg production	Prohibits all lobster fishing

Table Description: This table summarizes the four marine refuges and fishery closure areas within or adjacent to the Focus Area: Bay of Islands Salmon Migration closure, Lobster Area closure (Trout River), Lobster Area closure (Shoal Point), and Lobster Area closure (Penguin Islands). The table describes the reason each refuge or closure was established and lists prohibited activities.
Source: DFO, 2023y.

Prior to the initiation of the Federal MPA network strategy and the creation of Marine Refuges, there were multiple areas of offshore Newfoundland and Labrador that were closed either voluntarily or by DFO (under the *Fisheries Act* (1985)) to certain types of fishing activity. These closures were implemented to help conserve productive fish habitat and populations for commercially important species and create a more sustainable fishery. Some of these areas are now covered by other conservation measures (such as MPAs or Marine Refuge Areas), highlighting the recognized importance of that specific area over time.

Other fisheries closures do exist within the Focus Area, which are enforced by DFO under the *Fisheries Act* (1985) through various mechanisms (such as variation orders, fishing licence conditions, etc.), based on factors such as target species, stock health and distribution, exploitation to harvest, oceanographic conditions and others. Therefore, while some closures may be enforced as a long-term measure, others may change frequently based on the available knowledge. DFO announces fisheries closures as part of their fishery notices program (DFO, 2015e).

7.6.1.1.6 National Marine Conservation Areas and Representative Marine Areas

Parks Canada, through the *National Marine Conservation Areas Act*, is responsible for the creation and management of NMCAs nationwide. The primary goal of this process is to achieve ecological sustainability while creating enjoyable experiences for visitors, promoting awareness, and understanding about conservation, and providing benefits for Indigenous peoples and coastal communities. Parks Canada has a National Marine Conservation Areas System Plan, which divides Canada's oceans and Great lakes in 29 marine regions, with the long-term goal of establishing at least one NMCA in each region. NMCAs can comprise the seabed and water column above it, and may also include wetlands, estuaries, islands, and other coastal lands. Access and use by Indigenous peoples of an NMCA pursuant to their rights will not be subject to restrictions except for conservation, public health or public safety reasons determined in consultation with Indigenous rights holders. Prohibited activities in NMCAs can include the exploration and extraction of hydrocarbons, minerals, aggregates, and other inorganic matter. One of the goals of the NMCA process is to demonstrate how protection and conservation measures can be harmonized with resource use in marine ecosystems (Parks Canada, 2023b).

The process for creating a NMCA is to first identify a Representative Marine Area (RMA), which considers various ecological, biological, and geological features. Once an RMA is selected and assessed by Parks Canada and other agencies and organizations, working groups and advisory boards may be set up, encompassing various interests and stakeholders, to evaluate the proposal for an NMCA. If the analysis demonstrates support for the area, an agreement may be signed to establish the creation and management of the NMCA (Parks Canada, 2023b).

Currently, there is no designated NMCA within Newfoundland and Labrador waters; however, Parks Canada, along with the Government of Newfoundland and Labrador, MFN, QFN, and the Town of Burgeo signed a MOU, on June 23, 2023, to assess the feasibility of creating a NMCA in the South Coast Fjords area on the southwest coast of the Island of Newfoundland and to assess the redesignation of the Sandbanks Provincial Park to a national park. The NMCA Study Area will be approximately 9,112 km^2, which includes significant coastal and marine ecosystems, key migration routes and habitat for many species. The study area for the proposed redesignation of Sandbanks Provincial Park is about 2.26 km^2, which would protect the fragile sand dunes ecosystem, the habitats of endangered and migratory birds and become an ecotourism destination (Parks Canada, 2023d). The NMCA study area can be seen in Figure 7.6.1, along with all other legislated protected areas, in the introduction of Section 7.6.1 of this Report. Parks Canada has also identified various RMAs that have the potential, after further study, analysis, and engagement, to become or contain NMCAs in the future (Parks Canada, 2023b). Although such RMAs do not have legal protection, if they were to become an NMCA they would be legally protected by Parks Canada. There are no currently identified RMAs that overlap with the Focus Area.

7.6.1.1.7 National Wildlife Areas, Marine National Wildlife Areas, and Migratory Bird Sanctuaries

NWAs and Marine National Wildlife Areas (MNWAs) are established and maintained by ECCC under the *Canada Wildlife Act* (1985). NWAs and MNWAs are created on federally owned lands with the purpose of wildlife conservation, research, and interpretation. The criteria for selecting an area as a potential NWA or MNWA include the following:

- The area supports at least one percent of the Canadian population of a species or subspecies of migratory bird or species at risk for any portion of the year, where total populations are known.
- The area supports an appreciable assemblage of species or subspecies of migratory birds or species at risk, or an appreciable number of individuals of any one or more of these species or subspecies where total populations are not known, or the assemblage represents a regionally significant area.
- The area has been identified as critical habitat for a listed migratory bird or other species at risk population, species or subspecies.
- The area is a rare or unusual wildlife habitat of a specific type in a biogeographic region or has special value for maintaining the genetic and ecological diversity of a region because of the wide range, quality and uniqueness of its flora and fauna.
- The area possesses a high potential for restoration or enhancement, now or in the future, such that wildlife populations could be increased or managed to meet national objectives.

Currently, there are no NWAs or MNWAs located within Newfoundland and Labrador and therefore none within or adjacent to the Focus Area.

MBS are areas designated under the *Migratory Birds Convention Act* (1994) and regulated under the associated Migratory Bird Sanctuary Regulations (2019), to protect marine and migratory bird species that use these areas for breeding, feeding, and other important life processes. MBSs can occur on private, provincial, federal, or territorial lands. The MBS process involves selecting a candidate area, and then comparing it against the set of criteria outlined below, that are used to determine if the area can be classified as an MBS (ECCC, 2017b):

- Whether the area supports populations that are concentrated, for any part of the year, in order to meet one or several essential needs;
- The area is vulnerable to area-specific threats. This may include hunting, exploration, development, etc. that have the ability to affect significant portions of the population;
- The area supports populations that occupy habitats of restricted geographical area and that are vulnerable to human disturbance. Listed species under SARA (2002) or COSEWIC are examples of this; and
- The area regularly supports at least one percent of a population of one species or subspecies.

Once an MBS is established, regulations are created outlining what activities are allowed and/or prohibited within its boundaries. Although some activities may be permitted within an MBS, these are typically limited to low-impact recreation and other activities that may be considered compatible with the conservation objectives of the area (ECCC, 2017c).

Permits are required to undertake other activities that are otherwise restricted within an MBS.

Currently, there are three MBSs within Newfoundland and Labrador, all located on the Island of Newfoundland. This includes an MBS adjacent to Terra Nova National Park, along with Ile aux Canes and Shepherd Island on the Northern Peninsula. These three MBSs are not located within the current Focus Area.

While there are NWAs, MNWAs and MBSs outside the Focus Area, this does not negate the possibility of migration routes for the species that occupy these areas to fly through the Focus Area.

7.6.1.1.8 Critical Habitat

Every species at risk (Schedule 1) under *SARA* has a recovery strategy and a corresponding action plan which identifies threats and describes how to address and mitigate them to ensure the species recovery. As part of the SARA recovery strategy, critical habitats are sometimes identified for species listed as Endangered or Threatened and defined as *"the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in a recovery strategy or in an action plan for the species"* (SARA, 2002). Critical habitats are protected under *SARA* (SARA, 2002). COSEWIC also provides an assessment report detailing the 'at risk' status and I information on the species. Other international (e.g. IUCN Red List, Northwest Atlantic Fisheries Organization), federal (e.g. *SARA* (2002), *Fisheries Act* (1985), *Oceans Act* (1996), *Canada National Parks Act* (2000), *Rouge National Urban Park Act* (2015), *Migratory Birds Convention Act* (1994) or *Canada Wildlife Act* (1985)) and provincial (e.g. Newfoundland and Labrador *Endangered Species Act* (2001), Newfoundland and Labrador *Wild Life Act* (1990)) policies contribute to "at-risk" designations and conservation efforts. For additional information on critical habitats found within the Focus Area, see Section 7.3 for areas related to aerofauna, Section 7.4 for areas related to fish species, and Section 7.5 for areas related to marine mammals and Sea Turtles.

7.6.1.1.9 National Parks and Historic Sites

National Parks are established and managed by Parks Canada through the *National Parks Act* (2000) and represent a cross-country network of representative natural areas of national significance (Parks Canada, 2023c). There are currently three national parks and one national park reserve in Newfoundland and Labrador. GMNP and Terra Nova National Park are located on the Island of Newfoundland, and the Torngat Mountains National Park and the Akami-Uapishk^{U}-KakKasuak Mealy Mountains National Park Reserve are found in Labrador. Currently, Gros Morne is the only National Park that borders the Focus Area, which can be seen in Figure 7.6.1, along with all other legislated protected areas, in the introduction of Section 7.6.1 of this Report.

National Historic Sites are established through the *Historic Sites and Monuments Act* (1985), and several sites exist along the coastlines of Newfoundland and Labrador. Currently, there are no national historic sites located within or adjacent to the Focus Area.

7.6.1.2 Provincially Designated Areas

The Government of Newfoundland and Labrador, through various departments and divisions, establishes and manages five types of provincial protected areas. The Parks Division of the Department of Tourism, Culture, Arts and Recreation is responsible for the management, preservation, control, protection and development of the province's provincial parks (Parks NL, n.d.-a). The Department of Fisheries and Land Resources manages provincial wilderness reserves and ecological reserves, as well as wildlife reserves and a nature park in the province. The Wilderness and Ecological Reserves Advisory Council (WERAC), appointed by the provincial government has released the 'A Home for Nature: Protected Areas Plan for the Island of Newfoundland', a draft protected areas plan for the Island portion of the province in 2020 and in 2021, a 'WERAC Recommendation Report: Foundation for a Home for Nature' for the government on recommendations for building a comprehensive network of protected areas for the province to guide future establishments of protected areas (DOECC, n.d.-a). The following provides an overview of provincially designated special areas.

Table 7.6.5. Provincial Legislation for Protected and Associated Special Areas

Legislation	Type of Special Area	Lead Department or Agency	Purpose
Provincial Parks Act (RSNL 1990)	Provincial Parks	Parks Division of Tourism, Culture, Arts and Recreation Department	To facilitate camping and outdoor recreation, scientific research and monitoring, outdoor education, and sustainable tourism activities
WER Act (RSNL 1990)	Wilderness Reserve	Department of Environment and Climate Change	Areas subject to no or little human activity to preserve large areas of the environment for the survival of particular species, areas with primitive or extraordinary characteristics, or for the use of people to hunt, fish and otherwise experience the environment.
	Ecological Reserve		Areas that contain a representative or unique ecosystem, species or natural phenomena: To provide scientific research and educational purposes of the natural environment, standards against which the effects of development and other activities may be measured and opportunities to study the recovery of ecosystems from human modifications To preserve the habitat of an animal or plant species that is rare or endangered, rare botanical, zoological, geological or geographical characteristics, distinct ecosystems or organisms in their natural habitat to preserve their gene pools.
Wild Life Act (RSNL 1990)	Wildlife Reserve	Department of Fisheries, Forestry and Agriculture	Established to protect habitat and specific species.
	Nature Park		Established to promote stewardship of wilderness and wildlife.

Table Description: Table describing different provincial legislations for protected areas.
Source: Parks NL, n.d.-a, DOECC, n.d.-b, FFA, n.d.-c; -d; *Wild Life Act*, 1990.

7.6.1.2.1 Wilderness and Ecological Reserves

Wilderness and ecological reserves are established in Newfoundland and Labrador through the *WER Act* (1990), the purpose of which is to protect and conserve wildlife, biodiversity, and provide outdoor venues for learning, research, and enjoyment throughout the province. Since the *WER Act* was passed in 1980, twenty wilderness and ecological reserves have been established within the province (DOECC, n.d.-d). Management plans for each protected area are unique, depending on the extent of protection required to protect the ecological integrity of the area, as well as accommodate existing uses of local users that align with the conservation in the area. The following outlines the typical approach of activity management within these reserves:

- Large scale commercial forestry, mining and aquaculture are not permitted within a reserve, unless it is a transitional reserve, where new mineral claims or issuance of new petroleum licences can continue for four years after the time of establishment. For a maximum of 10 years from the time of establishment, mineral and petroleum exploration and/or development is permitted. After this time the site would be transitioned as a normal reserve.
- Hunting and fishing are permitted if they do not conflict with why the reserve was established or negatively affect sensitive features. Berry and mushroom picking are usually permitted in all reserves, unless there are restrictions regarding sensitive features like rare plants.
- Camping is generally permitted unless an area is too sensitive to withstand that extent of human activity. Boil-ups and campfires may be permitted, provided there is no conflict with the purpose of the reserve's establishment.
- Cutting firewood in existing permitted areas can be grandfathered into a new reserve, with the activity being phased out over time. New domestic firewood blocks would not be established, but the collection of firewood for campfires and boil-ups can be permitted, provided no conflict with the purpose of the reserve.
- Cabins that are on private land will be excluded from reserves, while owners on Crown lands with a valid Licence to Occupy will still be able to maintain or improve their cabin, if they do not increase the overall footprint of the structure.
- Outfitters currently located within a reserve at the time of establishment would be permitted to continue operations and would need to apply for an annual commercial operator permit. They would also be limited in increasing their overall footprint and could be made to exclude outfitting buildings from the reserve. New operators with low impact, nature-based tourism operations could be permitted, but their associated structures would have to be outside of the reserve.
- Motorized vehicles are generally not permitted within reserves, unless access took place prior to the reserve being established, legislation can allow for the continuation of this activity. Efforts to exclude current roads will be made at establishment, while no new roads will be developed within a reserve. ATV use is not permitted due to the damage they cause to the wetlands and ground vegetation. Recommendations on existing trails and boundaries can be excluded from a reserve subject to public engagement.
- Snowmobiling may be permitted depending on if it took place prior to the establishment of the reserve and should not conflict with the purpose of establishment.

- Motorized boating is permitted where it does not conflict with the purpose of the reserve's establishment, while non-motorized boats (canoes or kayaks) are usually permitted.
- Scientific research and education tours or commercial operations may be conducted under a permit from the Land Management Division from the Department of Fisheries and Land Resources (WERAC, 2020).

Currently, are four ecological or wilderness reserves adjacent to the Focus Area: Cape St. Mary's Ecological Reserve, Lawn Bay Ecological Reserve, Fortune Head Ecological Reserve and Bay du Nord Wilderness Reserve, which can be seen in Figure 7.6.1, along with all other legislated protected areas, in the introduction of Section 7.6.1 of this Report.

Table 7.6.6. Ecological Reserves Within or Adjacent to the Focus Area

Title of Ecological Wilderness Reserve	Area within or adjacent to Focus Area	Key Features	Rules of the Reserve
Cape St. Mary's Ecological Reserve	64 km^2 (54 km^2 is marine based)	• Home to 30,000 Northern Gannets, 20,000 Black-legged Kittiwakes, 20,000 Common Murres and 2,000 Thick-billed Murres. Also home to more than 100 pairs of Razorbills, 60 pairs of Black Guillemots, while Double-crested, Great Cormorant and Northern Fulmars also nest there. • Established as an ecological reserve in 1983. • Biodiversity protection and habitat conservation are the key purposes of the reserve.	• No disturbing, destroying, removing and/or introducing any natural items. • No forestry, mining (including exploration), hydro development, agriculture, new roads, tracks or buildings. • No off-road vehicles (including ATVs). • No pets (service animals are allowed but has to be kept under control at all times). • No hunting. • No motorized boats or non-motorized boats within 100 m and 20 m of the cliffs, respectively, containing nesting birds during breeding season (April 1 – October 30).
Lawn Bay Ecological Reserve	3.846 km^2 (3.707 km^2 is marine based)	• An important habitat for thousands of nesting seabirds (i.e., Leach's Storm-petrels, Great Black-backed Gulls, Herring Gulls, Black Guillemots, Black Legged Kittiwakes, Common Murres, and Arctic and Common Terns). • Reserve established primarily to protect Manx Shearwater (the only known colony in North America).	• No disturbing, destroying, removing and/or introducing any natural items. • No forestry, mining (including exploration), hydro development, agriculture, new roads, tracks or buildings. • No off-road vehicles (including ATVs). • No hunting • No motorized boats or non-motorized boats within 100 m of the islands during the breeding season (March 15 – October 30). No distance restrictions during the rest of the year.

Title of Ecological Wilderness Reserve	Area within or adjacent to Focus Area	Key Features	Rules of the Reserve
		• Established as a provisional reserve in 2009, gained full ecological reserve status in 2015.	• Tankers or other vessels longer than 20 m are not permitted in the marine portion of the reserve. • Restrictions apply to cruise ships and tour boat operators. • Commercial and recreational fishing is permitted in accordance with other legislation. • Aircraft cannot fly lower than 300 m, take off or land within the reserve from April 1 – October 30.
Fortune Head Ecological Reserve	2.21 km²	• Rock in the surrounding cliffs represent the geological boundary between the Precambrian Era and the Cambrian Period. • In 1992 the International Union of Geological Scientists designated the area a Global Stratotype Section and Point (GGSP). • The fossils found in the reserve mark a change in Earth's history (the first appearance of skeletal and bioturbating organisms. • Established as a provisional reserve in 1990 and gained full ecological reserve status in 1992.	• No disturbing, destroying, removing and/or introducing any natural items. • No forestry, mining (including exploration), hydro development, agriculture, new roads, tracks or buildings. • No off-road vehicles (including ATVs). • No hunting, fishing and trapping.
Bay du Nord Wilderness Reserve	2,895 km²	• Contains the largest protected river system in Newfoundland and Labrador.	• No disturbing, destroying, removing and/or introducing any natural items.

Title of Ecological Wilderness Reserve	Area within or adjacent to Focus Area	Key Features	Rules of the Reserve
		• Includes most of the 15,000-animal range of the Middle Ridge Caribou herd, which extends into the adjacent Middle Ridge Wildlife Reserve. • Home to the largest Canada Goose habitat in the province.	• No forestry, mining (including exploration), hydro development, agriculture, new roads, tracks or buildings. • No off-road vehicles (including ATVs for game retrieval). • Permit is required for entry. • Camping in one location is restricted to 10 consecutive days and you must pack out everything brought in with you. • No snowmobiling during the caribou winter range (December 15 – March 15). • Open fires may be prohibited during specific times (contact local Department of Natural Resources office to confirm). • Aircraft must be above 600 m, except during take-off and landing. • Dogs and horses are permitted as long as they are under control at all times.

Table Description: Table describing ecological and wilderness reserves within and adjacent to the Focus Area.
Source: DOECC, n.d.-d, Department of Environment and Conservation, 1994.

7.6.1.2.2 Parks and Protected Areas

The provincial government also creates and manages a network of provincial parks throughout Newfoundland and Labrador under the *Provincial Parks Act* (1990) to help protect and conserve representative natural areas of the province (Parks NL, n.d.-a). These provincial parks are intended for conservation, research, and recreational use, and harvesting activities are typically limited to fishing. Currently, there are seven provincial parks located on the coastline, adjacent to the Focus Area, which can be seen in Figure 7.6.1, along with all other legislated protected areas, in the introduction of Section 7.6.1 of this Report.

Table 7.6.7. Provincial Parks Adjacent to the Focus Area

Title of Provincial Parks	Area within or adjacent to Focus Area	Prohibited Activities
Blow Me Down Provincial Park (Camping)	2.4 km²	• Introducing and/or removing any natural items • Cutting trees • Hunting • Off-road vehicles • Snowmobiles
Barachois Pond Provincial Park (Camping)	29.6 km²	• Introducing and/or removing any natural items • Cutting trees • Hunting • Off-road vehicles • Snowmobiles
Codroy Valley Provincial Park (Day Use Area)	0.3 km²	• Introducing and/or removing any natural items • Campfires • Camping • Cutting trees • Hunting • Off-road vehicles • Snowmobiles
Jipujijkuei Kuespem (Park Reserve)	6.83 km²	• *Prohibited activities are unknown to the Committee at this time*
J.T. Cheeseman Provincial Park (Camping)	2.4 km²	• Introducing and/or removing any natural items • Cutting trees

Title of Provincial Parks	Area within or adjacent to Focus Area	Prohibited Activities
		• Hunting • Off-road vehicles • Snowmobiles
Sandbanks Provincial Park (Camping)	2.26 km²	• Introducing and/or removing any natural items • Cutting trees • Hunting • Off-road vehicles • Snowmobiles
Frenchman's Cove (Camping)	0.53 km²	• Introducing and/or removing any natural items • Cutting trees • Hunting • Off-road vehicles • Snowmobiles
The Arches (Day Use)	0.16 km²	• Introducing and/or removing any natural items • Campfires • Camping • Cutting Trees • Hunting • Off-road vehicles • Snowmobiles

Table Description: Table summarizing provincial parks and their prohibited activities that are adjacent to the Focus Area.
Source: Government of Newfoundland and Labrador, 2024a; Parks NL, n.d.-b.

7.6.1.3 Other Identified Special Areas

Canada is signatory to various international conventions, some of which identify and protect important wildlife habitats in coastal and marine areas which may then be protected in whole or in part through provincial or federal legislation. These other identified special areas that will be discussed in the subsequent sections below, can be seen in Figure 7.6.5:

Figure 7.6.5. Other Recognized Areas of International Importance

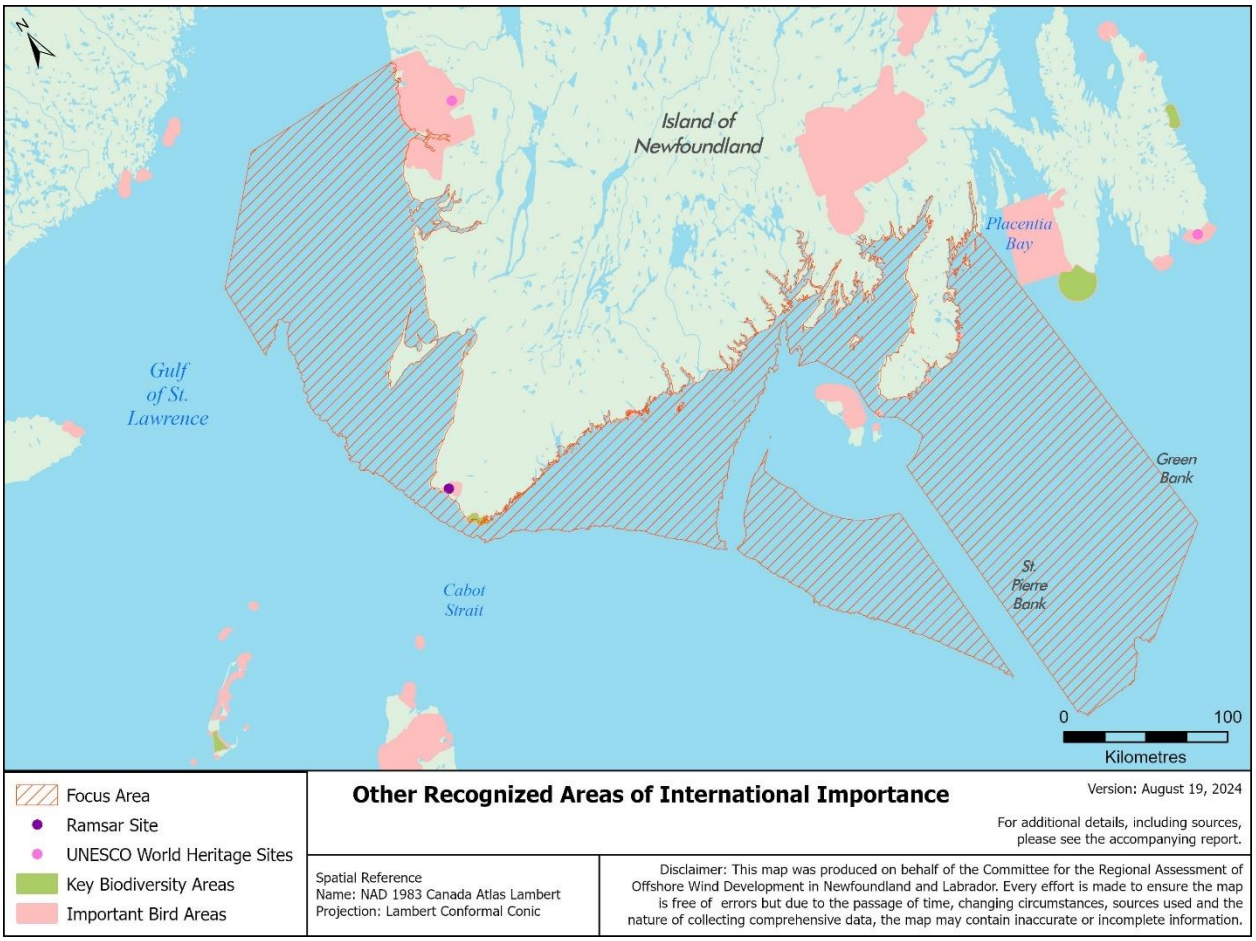


Figure Description: Map depicting protected areas of international importance, including IBAs, KBAs, UNESCO WHS, and Ramsar Sites.
Data Sources:
Ramsar Site: Ramsar Convention, 2001.UNESCO World Heritage Site: UNESCO World Heritage Centre, n.d..
KBAs: Key Biodiversity Areas Canada, 2024.
IBAs: IBA Canada, n.d.-b.

7.6.1.3.1 Important Bird Areas

Within Canada, there are a multitude of special areas designated for birds, such as Sea Duck Key Habitat Sites, Important Shore Bird Sites, KBAs and IBAs , as well as ecological reserves developed for the purpose of protecting specific species. While KBAs and IBAs

can be seen in Figure 7.6.5 above, more information on these areas and the species they protect can be found in Section 7.3.

7.6.1.3.2 World Heritage Sites

In 1972, UNESCO adopted the Convention Concerning the Protection of the World Cultural and Natural Heritage. This international convention identifies and encourages conservation of cultural and natural heritage sites considered to be of cultural or natural importance to humanity. Newfoundland and Labrador currently has four coastal UNESCO WHS that are managed by the provincial or federal governments. Currently, GMNP is the only site that is adjacent to the Focus Area, which can be seen in Figure 7.6.5, along with all other areas of international importance in Section 7.6.3 of this Report (UNESCO, 2023).

7.6.1.3.3 Convention on Wetlands of International Importance

The 1971 Convention on Wetlands of International Importance (also referred to as the Ramsar Convention) established an objective of sustaining important wetland habitats throughout its network, which includes 169 countries. Canada has been a contracting party to the Ramsar Convention since 1981. To date, Canada has identified 37 Ramsar Sites (ECCC, 2018b). The only Ramsar site identified in the province is the Grand Codroy Estuary in Western Newfoundland (Ramsar Convention, 2001), which is within the Focus Area, which can be seen in Figure 7.6.5, along with all other areas of international importance in Section 7.6.3 of this Report.

7.6.1.3.4 Western Hemisphere Shorebird Reserve Network

The WHSRN conservation strategy was established in 1986. North and South American scientists created the network to protect key habitats to sustain healthy populations of shorebirds. Of the seven identified Canadian sites, only one (Bay of Fundy) is in Atlantic Canada (WHSRN, 2019). There are therefore no WHSRN sites within or near the Focus Area.

7.6.1.3.5 The Man and Biosphere Program

Launched in 1971, UNESCO's Man and the Biosphere Programme (MAB) is an intergovernmental scientific programme that aims to establish a scientific basis for the improvement of relationships between people and their environments. MAB combines the natural and social sciences, economics and education to improve human livelihoods and the equitable sharing of benefits, and to safeguard natural and managed ecosystems, thus promoting innovative approaches to economic development that are socially and culturally appropriate, and environmentally sustainable. Its World Network of Biosphere Reserves) currently counts 701 sites in 124 countries all over the world. Canada has 19 World Network of Biosphere Reserves located in British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick and Nova Scotia (UNESCO, 2021). With no World Network of Biosphere Reserves within the province, there are none located within the Focus Area.

7.6.1.4 Indigenous Protected and Conserved Areas

The Indigenous Circle of Experts (ICE), which is comprised of Indigenous and non-Indigenous Canadian citizens, work together to provide advice and recommendations on achieving Canada Target 1: *"By 2020, at least 17% of terrestrial areas and inland water, and 10% of coastal and marine areas, are conserved through networks of protected areas and other effective area-based conservation measures"*. During their consultations to develop recommendations on protected areas in Canada to be identified and managed in partnership with Indigenous governments, they heard from diverse communities and governments on their thoughts on Indigenous Protected and Conserved Areas (IPCAs). IPCAs was a term chosen by ICE to describe areas of land or water managed primarily by Indigenous governments to safeguard ecosystems, drawing on Indigenous laws, governance and knowledge. Indigenous culture and language are center points of an IPCA. In short, IPCAs generally share three essential elements: Indigenous led, representative of long-term conservation commitments and help elevate Indigenous rights and responsibilities. Indigenous governments are responsible for IPCAs, as they set the conservation standards and design a full scope that aids in meeting each area's individual and diverse needs (Parks Canada, 2018). In July of 2024, to support MFN's commitment to conservation of its traditional waters and lands, the Little River area of Bay d'Espoir was declared an IPCA, which can be seen in Figure 7.6.6 below (Miawpukek First Nation, 2024).

Figure 7.6.6. Little River Potential IPCA

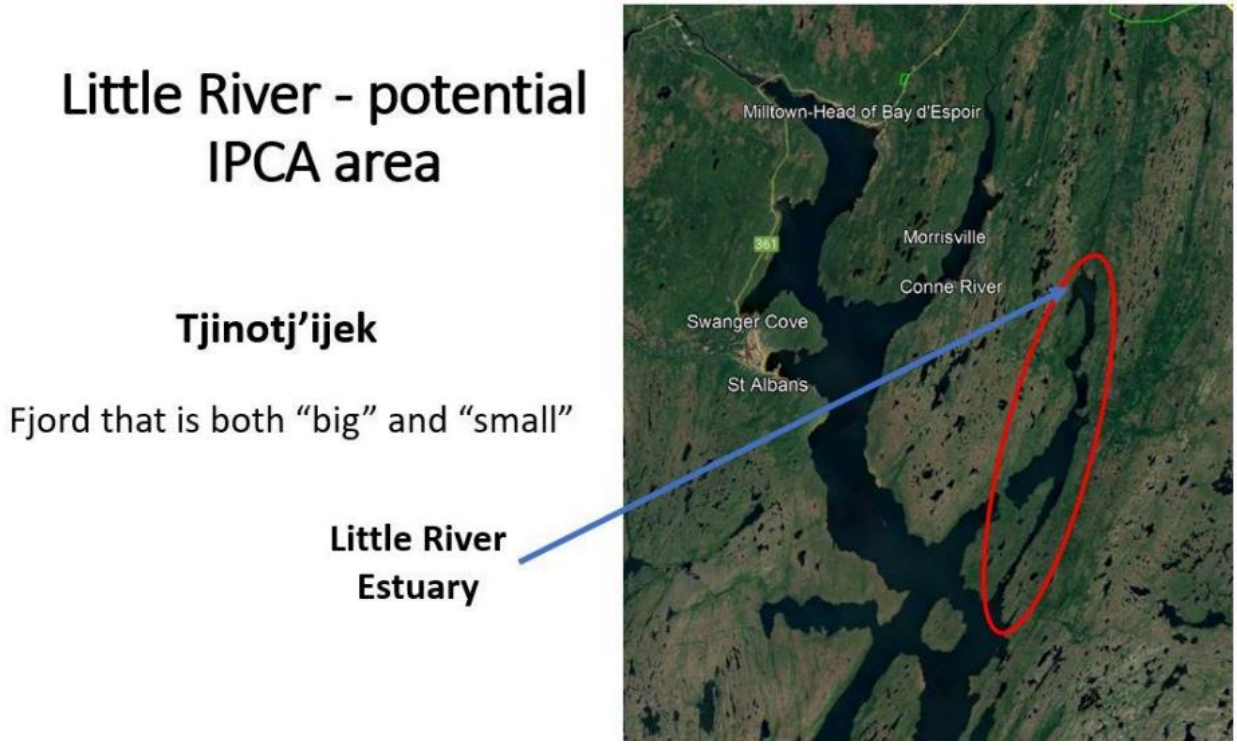


Figure Description: Zoomed in satellite image of the area surrounding Conne River, with the identification of the Little River Potential IPCA denoted by a red circle and an arrow pointing to the Little River Estuary. The Mi'kmaq name for Little River, Tjinotj'ijek (Fjord that is both "big" and "small") is also indicated on the image.
Data Source: Adapted from Miawpukek First Nation, 2024.

7.6.1 Potential Effects

The effects of offshore wind developments on protected and special areas are heavily dependent on the reasoning for protection of these areas, which have been described above in Section 7.6 of this Report. This can include, but is not limited to, the conservation or protection of:

- Fish species;
- Bird species;
- Marine mammals;
- Habitats of aforementioned species;
- Areas of high productivity or biodiversity;
- Fisheries management; or
- Natural and cultural marine heritage areas.

While the effects during each phase of offshore wind development that protected and special areas can experience will be outlined in Table 7.6.9 below, the specific effects on the purposes for establishing these areas can be found in Sections 7.3, 7.4, 7.5, 7.7, 7.9 &

7.11 of this Report, Aerofauna, Marine Fish & Fish Habitat, Marine Mammals and Sea Turtles, Fisheries, Visual Aesthetics and Viewscapes and Physical and Cultural Heritage, respectively.

Table 7.6.9. Impact Pathways and Effects of Offshore Wind Development Activities on Protected and Special Areas

Project Phase	Impact Pathways	Description of Effects
Pre-construction & Construction	• Benthic disturbance and suspension of sediment • Noise and vibration (driving, drilling and dredging operations) • Artificial lighting • EMF emissions • Vessel and equipment activity • Presence of infrastructure	○ The impact of offshore wind development on protected areas varies based on the development's location, supporting infrastructure, and the surrounding ecosystem's structure, functionality, and vulnerability. ○ Protected species such as marine mammals, sea turtles, fish, invertebrates, and aerofauna may face risks like entanglement, collisions, barriers, disturbance, displacement, noise, and electromagnetic fields due to offshore wind development. ○ Habitats in need of protection, such as sandbanks, seagrass beds, and sea sponge grounds, are highly vulnerable to the installation and operation of offshore wind developments, if located in the area of distribution or in close proximity, which would put the long-term conservation at risk for these areas. ○ The impact for floating offshore wind developments is directly related to the physical contact of the mooring or anchoring methods (i.e. heavy chains or cables), as it can cause changes to the dominant hydrodynamic regime or sedimentation rates. ○ Offshore wind developments have been noted to have large-scale effects on pelagic environments within protected areas in the North Sea, due to changes in atmospheric and oceanic dynamics. ○ Protected areas that do not have management plans in place that are adjacent to offshore wind farms, if trawling and vessel navigation is prohibited within the farm, it could hamper the conservation goals of the protected area due to the displacement of development activities into that area. ○ Offshore wind projects could alter local winds and currents, potentially affecting larval transport and ecological connectivity between MPAs, underscoring the need for further research and maintaining connectivity to mitigate climate change and human impacts. ○ Offshore wind developments can be placed in multi-use areas, in conjunction with MPAs, and could have potential benefits of being placed in an area of degradation. Some offshore wind developments in the past have shown to help restore damaged ecosystems and increase biodiversity, unintentionally working as an MPA.

Project Phase	Impact Pathways	Description of Effects
Operations and Maintenance	• Benthic disturbance and suspension of sediment • Noise and vibration • Artificial lighting • Movement of turbine blades • EMF emissions • Vessel and equipment activity • Presence of infrastructure	○ Fishing restrictions around offshore wind turbines near MPAs could offer extra refuge for certain marine fish species, effectively functioning as an additional MPA. ○ Activity of the turbines could result in changes in the atmospheric and ocean dynamics which could have large-scale effects on the primary productivity of pelagic environments within MPAs. Activities related to human impacts, such as offshore wind, can reduce conservation benefits of area-based approaches, such as MPAs, to their conservation objectives. Even if there is strict management within a protected area, they can still feel the effects if the stressor exists outside of the boundaries of the area.
Malfunctions and Accidents		*See Malfunctions and Accidents of Sections 7.3, 7.4, 7.5, 7.7, 7.9 & 7.11, of this Report, Aerofauna, Marine Fish & Fish Habitat, Marine Mammals and Sea Turtles, Fisheries, Visual Aesthetics and Viewscapes and Physical and Cultural Heritage, respectively.*
Decommissioning		*Same as Pre-construction/Construction*

Table Description: Table describing the potential effects of offshore wind development on protected areas. Additional effects pertaining to the specific conservation factors of protected areas can be found in Sections 7.3, 7.4, 7.5, 7.7, 7.9 & 7.11 of this Report, Aerofauna, Marine Fish & Fish Habitat, Marine Mammals and Sea Turtles, Fisheries, Visual Aesthetics and Viewscapes and Physical and Cultural Heritage, respectively.
Sources: Bray et al., 2016; European Marine Spatial Plan Platform, n.d.-a; Fari et al., 2021; Gusatu et al., 2021; Lloret et al., 2023.

7.6.2 Mitigation and Other Measures

As previously discussed, there are many potential impacts, both positive and negative, that can affect protected and other special designated areas. Proper siting of a project, utilizing the precautionary approach, is the primary method of mitigation, as placing turbines away from protected areas, vulnerable habitats or species reduces the overall impact to these aspects. It is also crucial for the proper legislative framework be in place prior to development occurring, including the need for marine spatial planning to ensure sustainable use of the sea by prioritizing the protection of species and spaces, harvesting wisely, reducing pollution streams and avoid increasing stressors where ecological value is considered high (Lloret et al., 2023). These primary mitigations are enforced and followed in other jurisdictions, such as in Europe. Specifically, there are directives and procedures throughout the authorizing plans of a project to ensure developers take steps to avoid significant effect in areas of conservation, mainly to the natural habitats and habitats of species the areas were designated to protect. These projects are also authorized on a case-by-case basis once an assessment of the project is completed to assess if a project compromises the conservation status of protected habitats or species or effect specific conservation areas, with additional monitoring and surveillance programs in place once developments begin (Greenhill et al., 2021; Lloret et al., 2023; Spiropoulou et al., 2014). Additional mitigation measures are outlined in Table 7.6.10 below:

Table 7.6.10. Description of Mitigation Measures in relation to Protected Areas

Mitigation/Enhancement Measure	Description
Informed Siting Utilizing Precautionary Approach	• Micro siting of turbines could help mitigate impacts on specific marine habitats. Considerations of the benthic environment and other offshore wind energy constraints for development should be evaluated alongside each other to ensure best case scenarios for the industry and surrounding environment. • Best way of minimizing negative effects of offshore wind development is to locate them away from vulnerable habitats and species in the first place. • A precautionary approach should guide offshore wind development, particularly near protected areas, due to limited knowledge about the impact of offshore wind development on vulnerable marine environments. This approach should align with conservation goals outlined in the habitats directive and the ecosystem approach, considering not only species and habitat diversity but also key ecological functions like nursery grounds, feeding areas, spawning sites, and migration corridors, as well as the ecosystem services they provide. • Avoid any connectivity loss between MPAs as a result of offshore wind developments. • Any pilot projects should be excluded from protected areas and buffer zones.
Strong and Clear Legislation and/or Marine Spatial Plans in Place	• A need for strong legislative framework at the higher government level to protect protected areas from any human activity, including offshore wind development. • To promote sustainable use of the sea, marine spatial planning that optimizes the location of offshore wind development while not compromising the integrity of surrounding protected areas.
Environmental/Impact Assessments & Ongoing Monitoring	• All projects should be subject to an assessment on its implications to the surrounding area, including any effects to nearby protected areas in relation to its conservation objectives. • Environmental monitoring programs at new developments can help analyze effects and take site specific actions since effects may be uncertain before development.

Mitigation/Enhancement Measure	Description
Utilization of Buffers	• Ideally offshore wind development should not be placed in protected areas, in their surroundings or buffer zones (if applicable). Buffer zones should be defined for each protected area and for each human activity taking place nearby (offshore wind development, fisheries, transport, etc.). • Size of buffers should not be arbitrary, but on a case-by-case basis depending on the technical characteristics of the offshore wind development and the ecological factors of the marine environment. Arbitrary buffers not specific to a protected area may be inadequate to protect the area's conservation measures.

Table Description: Table outlining mitigation measures in relation to protected areas.
Sources: Bennun et al., 2021; European Marine Spatial Plan Platform, n.d.-a; Greenhill et al, 2021; Lloret et al., 2023; Spiropoulou et al., 2014.

7.6.3 Engagement Outcomes

Throughout the Committee's engagement activities, the Committee received various suggestions on ensuring the protection of areas and reasons for protection within the Focus Area. Through their advisory group Effects and Mitigation tables and literature review exercise, the Committee received suggestions related to protected and special areas and additional supporting literature references. In the Committee's February 2024 engagement with the public, one participant suggested the Committee consider applying a buffer around MPAs, while another suggested the exclusion of the Bay of Islands to protect Atlantic salmon and other fish migratory routes from offshore wind energy licencing areas. The Committee also received a letter from MRC, in which they commented on the Committee's recommendation to apply additional buffers and setback distances to MPAs. While they recognized that buffers and setback distances could be required depending on project location and potential impacts, they recommended that any establishment of buffers be based on scientific evidence of potential impacts and not arbitrarily set. Further adding that these buffer requirements and set back distances should be developed in collaboration and engagement with offshore wind industry and other relevant parties. They also indicated concern over excluding the NMCA study area, as the timeline to assess the feasibility of creating the NMCA is unclear and that the water depths within this area could be feasible in the future for offshore wind development due to the depths ranging from 300 – 1,000 m. On EBSAs and SBAs, they were supportive of the approach given in the Interim Report and recommended that DFO provide guidance on these areas.

In their November 2023 meeting with the Committee, MFN supported the avoidance of MPAs. Throughout the Committee's meetings with the Indigenous Knowledge Advisory Group, as well as other Indigenous organizations and the Atlantic Policy Congress of First Nations Chiefs Secretariat, the importance of avoiding migratory routes for Atlantic salmon, American eel, whale and bird species from offshore wind development. The Committee noted that some EBSAs within the Focus Area do hold significance for these species, but acknowledged migratory routes are a data gap at this time. Within MFN's Comments on the Regional Assessment of Offshore Wind Development, they echoed the comments above regarding Atlantic Salmon and American Eel within their traditional use areas, as well as identified the Little River IPCA that has recently been established (Miawpukek First Nation, 2024). Within this letter and a letter from QFN posted to the Registry in September 2023, both Nations mentioned the South Coast Fjords NMCA. MFN appreciated the exclusion of the NMCA study area, while QFN highlighted the importance of due consideration should be given on the potential impacts to the proposed NMCA.

Parks Canada provided a "Recommendation Report" to the Committee, which detailed protected areas under their mandate, along with their recommendations for those areas. These recommendations included:

- Offshore wind development should not occur within 80km from the coast of GMNP and WHS.

- The South Coast Fjords NMCA should be excluded from offshore wind development areas, allowing the NMCA establishment process to proceed without the stressor of development occurring (Parks Canada, 2023a).

In response to the Committee's call for feedback on the Focus Area, DFO submitted information on protected areas under their mandate and advice (DFO, 2023f) to remove the MPA from areas being considered for offshore wind development. They noted while there is no direct reference to offshore wind development activities being prohibited in the MPA, there may be potential conflicts with the Federal Marine Protected Areas Protected Standard 2023 (DFO, 2023o). DFO also noted during the Public Comment Period that due to sedimentation effects on sensitive species (eg., Sea Pens), that they recommend that there should be a buffer of at least 2 km around the Laurentian Channel MPA (DFO, 2024q). In regard to provincially protected areas, the Government of Newfoundland and Labrador (2024a) submitted information regarding their protected areas in response to the Committee's Request for Advice #2. In this response they also noted the following recommendations and insight:

- The legislative protective measures that are currently in place for the Lawn Bay Ecological Reserve would be upheld during offshore wind development, which includes but is not limited to, tankers or other vessels longer than 20 metres not being permitted within the marine portion of the reserve and aircraft are not permitted to fly lower than 30 metres, take off or land within the reserve from April 1 – October 30.
- Cape St. Mary's Ecological Reserve, which is adjacent to the Focus Area, has protective measures that must be adhered to during offshore wind development activities. This includes but is not limited to motorized boats not being permitted within 100 m of cliffs containing nesting birds during breeding season, which occurs from April 1 – October 30.
- If the South Coast Fjords NMCA becomes established, then offshore wind developments would have to adhere to federal legislative protective measures indicated.
- Emphasized the critical importance of the Provincial Parks, both for their intrinsic and economic value.
- The Department of Fisheries, Forestry and Agriculture will require a setback from the boundary of Big Barasway Wildlife Reserve to protect the endangered aerofauna and the ecological integrity of the reserve.
- Identified that the Government of Newfoundland and Labrador, along with the Government of Canada are collaborating on marine spatial planning in the province.
- Identified the need to ensure protection of previous protected areas mentioned, as well as the Southern and Eastern Avalon Marine Conservation Planning Initiative and Southern Slope Area Marine Refuge, which are both under consideration.

7.6.4 Data Gaps and Limitations

Addressing data gaps related to offshore wind development is crucial for informed decision making and ensuring it is compatible with the conservation goals or reasons of establishment for protected areas. Due to the nature of gathering data from the marine environment, there is limited data on the specific conditions and ecological characteristics

of the marine environment at the site-specific level. Since offshore wind energy is an overall newer industry across the world, there is insufficient long-term monitoring data on the cumulative and extended effects of offshore wind development on marine ecosystems, including potential changes in biodiversity, habitat structure, and ecological processes, which could affect the currently established or areas to be established for protection. Due to the differences in establishment of protected areas, it is also uncertain of how effective certain mitigation measures may be, as no two protected areas are exactly alike and are within dynamic ocean environments. There have also been some positive effects noted on MPAs from offshore wind development, but there is limited research in this area, and should be studied further. Also, the lack of data related to climate change and its intersection with offshore wind developments and how it could affect protected areas leads to more unknowns and uncertainty of how these areas may be resilient to these changes.

7.6.5 Committee Conclusions and Recommendations

Throughout the course of the Regional Assessment, the Committee has the following recommendations related to protected and special areas:

- The Committee recommends the application of additional buffers to MPAs be considered during project-level impact assessments, as well as risk assessments be conducted for developments near any marine refuges or OECMs to ensure avoidance or effective mitigations to the biodiversity conservation benefits.
- The Committee recommends offshore wind project proponents undertaking project level impact assessments to consider, in collaboration with relevant departments (e.g., DFO, ECCC, Parks Canada, etc.), as well as Indigenous peoples, setback distances from areas important for the various species on which various protective areas conservation objectives are based.
- The Committee recommends further research and monitoring to be completed on both positive and negative effects of offshore wind on protected areas, but developments should not occur as pilots within these areas.
- The Committee recommends that for licencing areas identified within EBSAs, offshore wind project proponents assess potential impacts to key features or species identified within the specific EBSA and avoid or, where appropriate, apply mitigation measures to ensure projects are not damaging/disturbing these components.
- The Committee recommends further work in defining migratory routes within EBSAs and other protected area types prior to issuing call for bids, in collaboration with the applicable departments and Indigenous peoples.
- The Committee recommends that project-level impact assessments identify SBAs overlapping a proposed project and ensure the least amount of disturbance to those areas as possible.
- The Committee recommends that proponents collaborate with respective departments (e.g., DFO, ECCC, Parks Canada, etc.) to ensure any legislation of a protected area within or adjacent to an offshore wind development be adhered to and that protections are fully met, as well as Indigenous peoples to ensure Indigenous knowledge is incorporated and respected. The Committee recommends that a 2 km buffer be implemented around the Laurentian Channel MPA to reduce the effects to the sensitive species within that MPA

7.7 Fisheries

Newfoundland and Labrador has a strong historic connection to the ocean through its fisheries. Fisheries led to the settlement of the province, and the geographic distribution of its population along the coastline. Historically, the fishery was primarily based on groundfish, such as the iconic codfish. In the early 1990's, groundfish stocks collapsed. Other valuable commercial species, including Redfish, Haddock, American Plaice and Capelin stocks have also declined, and the fishery has been transformed into a shellfish industry. Today's fishery is based primarily on Snow Crab, with other species, such as shrimp and lobster, having regional economic importance (Rose, 2003). Fisheries are an important component of the Newfoundland and Labrador economy and social and cultural fabric of the province. They are especially important in rural coastal, Indigenous and non-Indigenous communities. In recognition of this, the Committee split the "Fisheries and Other Ocean Uses" component into two components, "Fisheries" and "Other Ocean Uses."

In 2022, the seafood industry in Newfoundland and Labrador accounted for approximately $1.4 billion dollars and 17,000 jobs. Of that total, 10,105 were registered fish harvesters, 6,350 in seafood processing, and 529 in aquaculture (Government of Newfoundland and Labrador, 2023). Jobs and income from this sector directly contribute to the overall economic health and success of coastal communities in the province. The fishing industry also has linkages to other industries within the province to further support rural communities, which includes industries such as tourism, boat building and repair, marine transportation, and harbour operations.

In addition to commercial fishing activities from Newfoundland and Labrador based vessels a limited number of commercial harvesters from other parts of Atlantic Canada and Quebec also fish within or near the Focus Area.

7.7.1 Key Sources of Data and Limitations

Key sources informing this section included:

- publicly available geospatial data on fisheries (DFO, 2023c),
- publicly available geospatial data from the CCRI (DFO 2023f; 2024f),
- scientific stock assessments and information on past fisheries management decisions to understand the current health of commercial fish species,
- reports published by the provincial Department of Fisheries, Forestry and Agriculture,
- other fisheries studies completed by non-governmental organizations.

The majority of the above information and data was provided to the Committee by DFO in response to the Committee's requests for information and advice. Outcomes from engagement with fishers, particularly through the Fisheries Advisory Group, has provided information that has contributed to understanding fishing activity within the Focus Area. This feedback and advice from fishers have been incorporated throughout this section.

7.7.1.1 Publicly Available Geospatial Data on Fisheries

This publicly available fisheries data includes information on fishing licences, as well as fishing density throughout the region. The spatial data is available publicly through the Government of Canada's Open Government Portal, and can be accessed and viewed through DFO's Atlantic Canada Marine Planning Atlas or through NRCan's Resources to Understand Potential Effects from Future Offshore Wind Development in Atlantic Canada (for those without access to a geospatial platform). The spatial data includes commercial harvesting locations and summaries of total landings by weight (kg per 10 km^2 grid) between 2012 and 2021 for a number of species and gear types. The data includes georeferenced landings from vessels greater than 35 ft and does not include international fishing vessels. As a result, there may be landings locations from other vessels that are not captured within this dataset.

Furthermore, DFO applies a confidentiality policy to its fisheries data, known as the rule of five. For a specific species, if there are less than five vessel IDs, licence IDs, and fisher IDs, then the data is privacy screened to protect the fishers' commercially sensitive information. These are represented broadly in the spatial data (i.e., by large polygons delineating an approximate area) and these are not included in summaries of total landings.

Despite these limitations, this dataset can help provide a general overview of fishing intensity and trends for species and gear types within the Focus Area.

The Focus Area is also an important area for small fishing vessels, most of which are less than 35 feet in length. Generally, positional fishing data is unavailable for these vessels, with the exception of the NAFO Unit Area that is being fished. The Committee therefore also considered Small Vessel Fishing Activity in the species' breakdowns below (DFO, 2023p).

7.7.1.2 Community-based Coastal Resource Inventory

The Committee also considered geospatial data from the CCRI. From 1996 - 2007, DFO in conjunction with other Federal and Provincial agencies created, implemented and managed the program to develop a coastal resource inventory based on local Community knowledge. They conducted interviews with people who had extensive knowledge of the geography and resources, due to loving, working or harvesting in the regions over their lifetime. An updated dataset, including additional interviews conducted more recently is forthcoming. DFO provided the Committee with geospatial groundfish data associated with this unpublished dataset, for the Committee's use in the Regional Assessment. While this data aids the Committee to address some data gaps associated with fisheries, it acknowledges that this does not provide a fulsome view of the fisheries or fully address historical fisheries.

7.7.1.3 Effects of Climate Change

Another key limitation to the information discussed is the variability of the fisheries and their future locations and sustainability, due to climate change. As the climate continues

to change, so will the marine environment. DFO noted that it would be challenging to predict how the environment may change, and what requests may come in annually for new fisheries.

The Committee also heard similar concerns from Regional Assessment participants. Participants indicated that fisheries not currently existing in areas will rebound over time. They indicated that siting industry in a location that does not currently have a fishery, may not avoid impacts to fisheries overtime.

Information presented in this section reflects a summary of information available to the Committee to date. If fisheries are not mentioned below, its omission is not intended to suggest a lack of importance nor that it does not exist.

7.7.2 Fisheries Jurisdiction and Management Regimes

DFO is the main federal authority responsible for fisheries management in Canada, including offshore Newfoundland and within the Focus Area. This jurisdiction is granted under the federal *Fisheries Act* (1985). It provides Canada (via DFO) jurisdiction over fish species within Canadian waters. It also provides for Canada's management of certain sedentary species (e.g., shellfish) on the continental shelf of Canada that is beyond the 200 nautical mile (nm) limit of Canadian waters. The Focus Area does not extend past the 200 nm limit, and therefore international fisheries are not a major focus of this section. Within the Focus Area, fisheries activities are mostly managed by the DFO Newfoundland and Labrador Region, which manages the waters around Newfoundland and Labrador. There are a few cases on the west coast of the Island where Fisheries Management Plans are executed under DFO Quebec Region, as it falls under the GSL area.

By international convention, the NAFO establishes fisheries management measures for several straddling stocks where the distribution area includes portions of both the Canadian Economic Exclusion Zone (EEZ) and the NRA. The NRA is that area outside of a country's jurisdiction to exercise fisheries management, but still within NAFO's identified Convention Area. As mentioned above, the Focus Area falls within the boundaries of Canada's EEZ and does not extend into the NRA. However, the process by which NAFO administrates and manages fisheries (i.e., quotas and total allowable catch (TAC)) is also used by DFO and helps lay out the management framework for commercial fisheries within Canadian waters (DFO, 2023k).

Figure 7.7.1. NAFO Divisions within the Focus Area

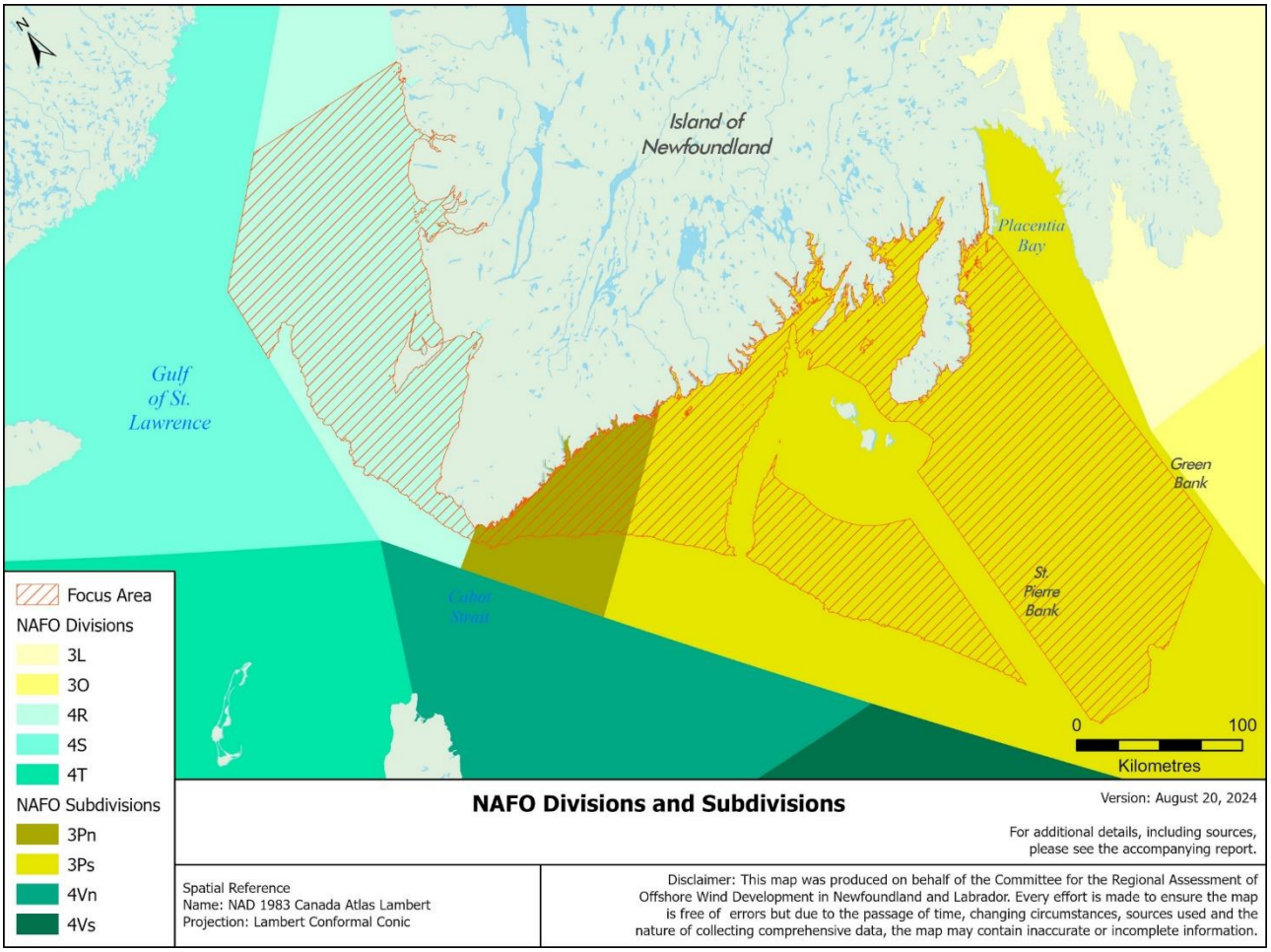


Figure Description: Map depicting NAFO Divisions (3Ps, 3Pn, and 4R) within the Focus Area. To aid with management of fisheries, the NAFO Convention Area is divided into Sub-Divisions, Divisions and unit areas. The sub-area is noted by a number, with the division and unit area following as letters (e.g., NAFO Division 3L where division L is located in Sub Area 3), and unit areas use a lower-case letter to indicate its location (e.g., NAFO Unit Area 3Lt).

Data Source: DFO, 2021g.

DFO and NAFO (through its Contracting Parties) use a TAC and quota system to manage most fisheries under their authority. These are set for most directed fisheries, and bycatch limits are typically set for species where a directed fishery is not permitted. Additional measures, depending on the species and authority, may include regulation by open/closed times, vessel size, trip limits, gear limits/specifications and geographical boundaries. Market conditions and the business strategies of individual enterprises may also affect when and where certain fisheries are undertaken, and to what extent. Most TACs and quotas are allocated based on geographical areas, such as NAFO Divisions or other designated species management areas, (e.g., Shrimp Fishing Area (SFA) or Crab Management Areas). Fish harvesting licences are issued by DFO and are listed by

Province/DFO Region and species. A complete breakdown on licensing information for fisheries in Newfoundland and Labrador is available on DFO's Atlantic Region Licences page.

Indigenous commercial fishery within Newfoundland and Labrador is a Commercial Communal Fishery under the *Fisheries Act* (1985). This allows Indigenous communities access to fisheries to generate income and employment opportunities. The accompanying framework is comprised of the *Aboriginal Communal Fishing Licences Regulations*, enacted in 1993, as well as other national and regional policies and guidelines that have been developed since. For MFN, they own Netukulimk Fisheries Limited (NFL), which, at the time of writing, operates 24 commercial enterprises (not including financial management enterprises) across 7 vessels. The species and quotas they have been allocated for 2024 will be identified in the respective species' section (Miawpukek First Nation, 2024).

7.7.3 Existing Conditions

This section is designed to provide a regional overview of the historical and existing commercial and recreational fish harvesting activities within the Focus Area.

Information on Indigenous commercial fisheries (i.e., those fisheries operating under communal-commercial licences) are also included in this section, as well as those traditional fisheries for food, social, and ceremonial purposes.

7.7.3.1 Commercial Fisheries in the Focus Area

There is a large and valuable commercial fishing industry in Newfoundland and Labrador. According to DFO, the georeferenced portion of the commercial fishing industry within the Focus Area provides a yearly average (2012-2021) of $39 million in value for just over 21,000 tonnes of catch. The non-georeferenced portion of the commercial fishery could provide an additional $43 million annually in the Focus Area, over the same period (DFO, 2023p). [115]

Table 7.7.1. & 7.7.2 below provides an overview of the number of licences by species and the number of vessels within the Region in 2022 (the most recent year publicly available), and the licences per species in 2022. Crab and lobster licences comprise the two largest number of licences for a single species, owing to the commercial importance of these species. Other notable species include groundfish, squid and herring. Table 7.7.3 provides an overview of vessels that were operating in the province within 2022.

[115] The Committee acknowledges that the stated 10-year average values may not reflect the dramatic increases in landings and landed value that has occurred over the last few years, especially for crab and lobster. These increases are further captured in subsequent pages.

Table 7.7.1. Commercial Licences within the DFO Newfoundland and Labrador Region, 2022

Province and Region	Core/ Independent Core	Non-Core	Other	Total
Newfoundland and Labrador	2,683	410	103	3,196

Table Description: Table outlining number of licence types within the province of Newfoundland and Labrador, as of 2022.

Source: DFO, 2023hh.

Table 7.7.2. Commercial Licences within DFO Newfoundland and Labrador Region, by species, 2022

Species	Newfoundland and Labrador
Groundfish	2,951
Herring	1,860
Mackerel	n/a – In 2022 the Atlantic mackerel commercial and bait fisheries were closed by DFO to allow the stock to rebuild
Tuna	39
Salmon	31
Capelin	1,465
Scallop	704
Squid	2,056
Lobster	2,173
Shrimp	234
Crab	2,354
Other	5,766
Total	**19,633**

Table Description: Table listing number of licences in Newfoundland and Labrador by species.

Source: DFO, 2023s.

Table 7.7.3. Number of Vessels by Length (Feet) in Newfoundland and Labrador, 2022

< 35’	35’-44’11”	45’-64’11”	65’-99’11”	>100’	Total
4,604	705	341	30	11	5,691

Table Description: Table listing number of vessels by size within the Newfoundland and Labrador region in 2022.

Source: DFO, 2023w.

In terms of locations of fishing activity, there is some type of harvesting activity within the majority of the Focus Area, but lower amounts of activity than in other parts of the province (e.g., Eastern Newfoundland and Grand Banks). Activity within the southwestern portion of the Focus Area includes more intense activity around the nearshore regions of the west coast of Newfoundland. This includes Bay St. George, Port au Port Bay, Bay of Islands and Bonne Bay. Harvesting activity follows along the edge of the Laurentian Channel, and more intense harvesting activity is located around Fortune Bay, St. Pierre Bank, and Green Bank. Figure 7.7.2 provides an overview of fish landings activity from 2012 - 2021 for all georeferenced species.

Figure 7.7.2. Commercial Fisheries, All Species within the Focus Area

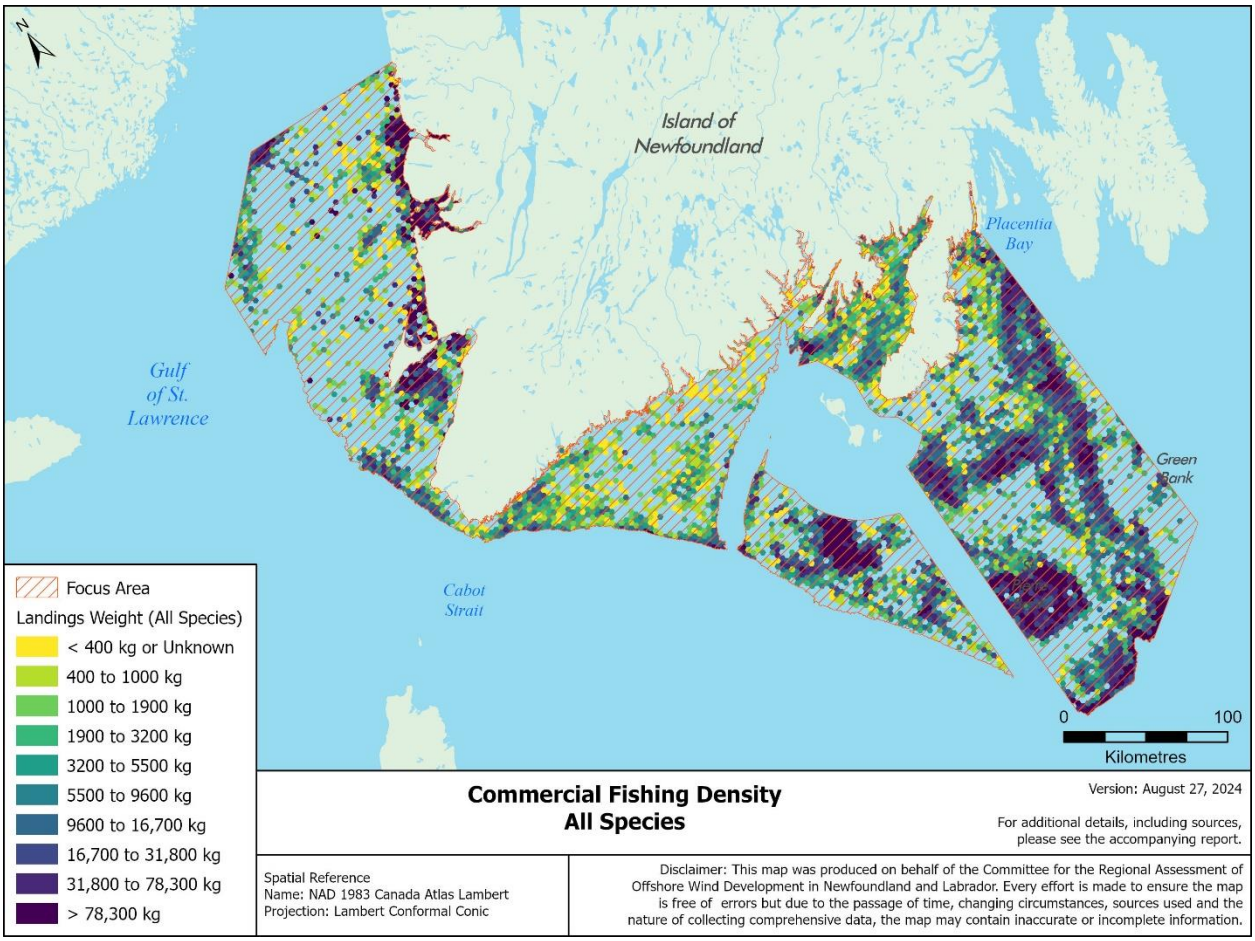


Figure Description: Map depicting commercial fishing catch density for the time period from 2012 - 2022 for all species within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries spanning large area only shown as a single location). Some species may not include all records or locations of activity due to regional differences in mapping permissions or fishery is only partially georeferenced. Locations shown give an estimation of fishing intensity and a general idea of where species/gear type fishing occurs. Any data that contains less than five vessel IDs, licences or fishers, will appear as 'Unknown' due to privacy concerns.

Data Source: DFO, 2024bj.

It should be noted that the figure above shows commercial fishing density based on catch weight for all species combined. DFO advised that variation in species size could skew the representation of this data. For example, landings where larger, heavier species are fished may appear to have higher fishing activity than areas where spaller species are fished (DFO, 2024n). Seasonality is another important consideration. While many fisheries are open year-round, the summer months are typically when the highest levels of activity occur, due to favorable weather conditions. An overview of the key georeferenced commercial species can be seen in Table 7.7.4.

Table 7.7.4. Overview of Key Georeferenced Commercial Fisheries

Species / Group	Fishing Season	Principal Gear Used	Areas of Harvest	Average Annual (2012 - 2021) Catch within Focus Area (t)	Average Landed Value (2012 - 2021) within Focus Area	2022 Landed Value for entire province
Snow Crab	April - June	Pots	3Psn 4R	2,800	$21,440,000	$756,735,000
Sea Cucumber	June - December	Drag/Dredge	3Ps	2,800	$3,563,200	$8,007,000
Scallop	August – October	Diving	3Ps	1,400	$3,141,000	N/A
	September – March	Drag/dredge	3Ps/SFA 10 (Pont Verde to Red Harbour)			
	September – December		3Ps/SFA 10 (Inner Bay (North of 47°25'North))			
	April – December		3Ps/SFA 10 (Outer Bay (South of 47°00'North))			
			3Ps/SFA 11 (Outer Bay, excluding Core Area and North Bed)			
	October – December		3Ps/SFA 11 (The areas north of a straight-line connecting Point to			

Species / Group	Fishing Season	Principal Gear Used	Areas of Harvest	Average Annual (2012 - 2021) Catch within Focus Area (t)	Average Landed Value (2012 - 2021) within Focus Area	2022 Landed Value for entire province
			the Northwest Head of Brunette Island in water depths greater than 5 fathoms.)			
Scallop (continued)	October - December	Drag/dredge	3Ps/SFA 11 (Hermitage Bay and Southwest Coast)	1,400	$3,141,000	
	May – December		3Ps/SFA 11 (Core Area – Outer Bay)			
	May – August		3Ps/SFA 11 (North Bed – Outer Bay)			
	July – December		4R/SFA 13 (Cape Ray to Cape St. Gregory in water depths greater than 5 fathoms)			
	August – December		4R/SFA 13 (Port au Port Bay, Bear Cove Brook Point to Broad Cove Point in water depths greater than 10 fathoms)			
	May – December		4R/SFA 14A North, 14A South & 14B			

Species / Group	Fishing Season	Principal Gear Used	Areas of Harvest	Average Annual (2012 - 2021) Catch within Focus Area (t)	Average Landed Value (2012 - 2021) within Focus Area	2022 Landed Value for entire province
Herring	Season closing dates vary by fleet and area; subject to quota availability/utilization April – May August - December	• Gillnet • Purse seine • Bar seine • Trap net • Tuck seine	• 3Psn • 4R	7,800	$2,410,800	$9,393,000
Whelk	May - December	Pots	• 3Psn • 4R	1,400	$2,391,200	$1,494,000
Atlantic Halibut	May – March	Longline	3Ps	200	$2,169,200	$10,868,000
	April – October		3Pn			
	June - December		4R			
Atlantic Cod	May - February	• Pots • Gillnets • Longline • Otter Trawl	3Ps	1,100	$1,663,600	$24,348,000
Capelin	May – August (Season opens based on percentage of roe bearing females)	• Trap net • Purse seine • Tuck seine	• 3Psn • 4R	1,600	$658,900	$1,773,000

Species / Group	Fishing Season	Principal Gear Used	Areas of Harvest	Average Annual (2012 - 2021) Catch within Focus Area (t)	Average Landed Value (2012 - 2021) within Focus Area	2022 Landed Value for entire province
Mackerel	Moratorium (2022 – Present), N/A until fishery reopens	• Bar seine • Gillnet • Purse seine • Trap net • Tuck seine	• 3Psn • 4R	800	$458,100	$0
Redfish	Year-round (subject to closure provisions)	• Otter trawl • Midwater trawl	• 4R • 3Pn	1,400*	$1,381,000	$5,434,000
	July 1 – March 31	• Otter trawl • Gillnet	3Ps	1,400	$1,381,000	$5,434,000
Witch Flounder	April – March	Danish Seine	3Ps			
	May - December		4R			
Northern Shrimp	Year-round but more prominent during summer months (subject to closure provisions)	Otter trawl	4R (led by Quebec Region)			$125,570,000
	July - December	Beam Trawl	3Ps			

Species / Group	Fishing Season	Principal Gear Used	Areas of Harvest	Average Annual (2012 - 2021) Catch within Focus Area (t)	Average Landed Value (2012 - 2021) within Focus Area	2022 Landed Value for entire province
Turbot (Greenland Halibut)	Year-round	• Bottom Trawls • Longline	4R			$53,625,000
Lobster	April – June	Traps	• 3Psb • 4Rc • 4Rd • 4Rb		$34,000,000 (non-georeferenced)	$105,015,000

Table Description: Table providing an overview of the key fisheries within the Focus Area. It gives a breakdown by species and includes the fishing season, principal gear type, areas of harvest, average annual catch and landed values (based on georeferenced vessels, unless otherwise indicated) for the Focus Area (DFO, 2023p) and provincial landed values (Government of Newfoundland and Labrador, 2023), where possible.

* Within DFO's submission in response to the Committee's Request for Advice, in the table outlining the average annual Focus Area catch and landed value by Species, 2012-2021, Redfish, Witch Flounder, shrimp, turbot and haddock values were noted as a non-exhaustive list of species within the 'Other' category.

Sources: DFO, 2023p; Government of Newfoundland and Labrador, 2023.

7.7.3.2 Gear Associated with Commercial Fisheries

Several types of fishing gear are used within the Focus Area. In some fisheries, one specific gear type is used, such as crab pots or lobster traps. In other fisheries, such as those for groundfish, several different gear types can be used. Similarly, one or multiple types of gear can be used to harvest specific species. In general, gear types can be classified into either fixed or mobile gear. The following non-comprehensive list identifies some gear types:

Table 7.7.5. Fishing Gear Types

Fixed	Mobile
Pots	Shrimp trawls
Traps	Bottom (otter) trawls
Gillnets	Seines (various designs)
Handlines	Longlines
Harpoon and spear methods	

Table Description: Table classifies gear into two categories, fixed and mobile.

Source: Royal Commission on Environnemental Pollution, 2004.

From 2012 - 2021, 56% of catch volume within the Focus Area resulted from the use of mobile gear, while 80% of the total landed value was a result from the use of fixed gear, while the highest average annual landed value comes from the use of pots (DFO, 2023p). Mostly all gear types are used throughout the Focus Area, with some types being used less often, such as purse seines and Sea Cucumber drags are only used within certain NAFO Unit Areas, dependent on the location of specific fisheries they are utilized for. Section 7.7.4 further outlines the potential effects of offshore wind developments on certain gear types, but it is well understood that mobile gear types is less compatible within developments. Table 7.7.6 outlines the average annual catch and landed value for each gear type:

Table 7.7.6. Average Annual Catch and Landed Value by Gear Type within the Focus Area, 2012 - 2021

Gear Type	Average Annual Catch (tonnes)	Average Annual Landed Value
Pot	4,200	$23,832,000
Purse Seine	2,800	$3,548,800
Sea Cucumber Drag	1,400	$3,164,000
Dredge (boat)	9,100	$3,122,700
Longline	400	$2,284,000

Gear Type	Average Annual Catch (tonnes)	Average Annual Landed Value
Bottom Otter Trawl (stern)	900	$1,263,700
Gillnet (set or fixed)	1,000	$1,194,300
Tuck Seine	900	$368,700
Danish Seine	400*	$532,800
Shrimp Trawl		
Beach Seine		
Bar Seine		
Troller Line		

Table Description: Table outlining the annual average catch and landed value for each gear type within the Focus Area.

* Danish seine, shrimp trawl, beach seine, bar seine and troller line were combined to form a non-exhaustive list under the 'Other' category in the source table.

Source: DFO, 2023p.

Figures 7.7.3 – 7.7.19 below outlines some of the identified locations for both fixed and mobile gear harvesting locations, based on commercial fisheries landings data from 2012-2021. While both fixed and mobile gear are used throughout the Focus Area, fixed gear is used primarily in the southern portion of the Focus Area around the St. Pierre Bank, and mobile gear is used more along the west coast of Newfoundland.

Figure 7.7.3. All Mobile Commercial Fishing Gear Density within the Focus Area

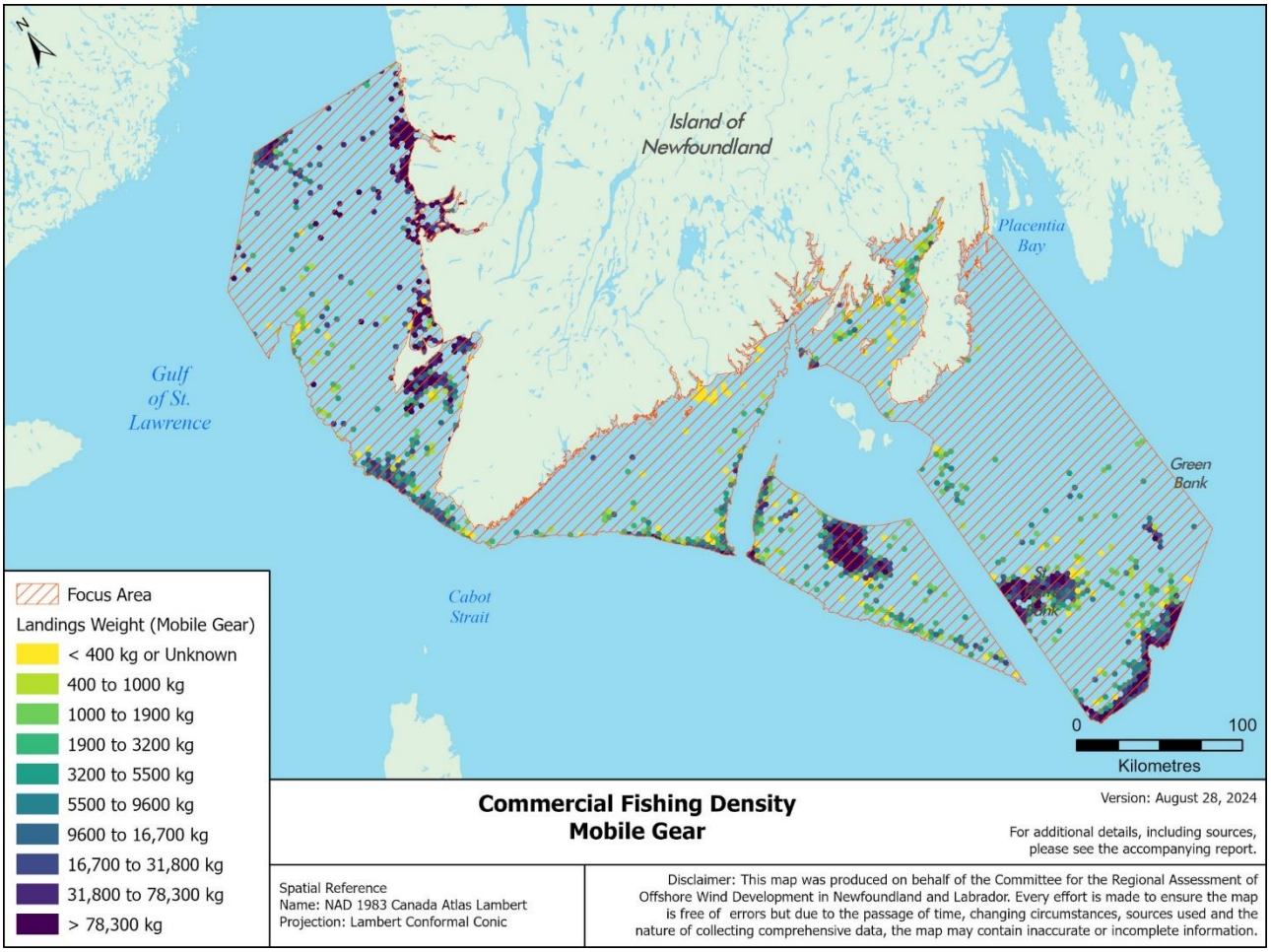


Figure Description: Map depicting all mobile commercial fishing gear density for the time period from 2012 - 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries spanning large area only shown as a single location). Some species may not include all records or locations of activity due to regional differences in mapping permissions or fishery is only partially georeferenced. Locations shown give an estimation of fishing intensity and a general idea of where species/gear type fishing occurs. Any data that contains less than five vessel IDs, licences or fishers, will appear as 'Unknown' due to privacy concerns.

Data Source: DFO, 2024j.

Figure 7.7.4. All Fixed Commercial Fishing Gear Density within the Focus Area

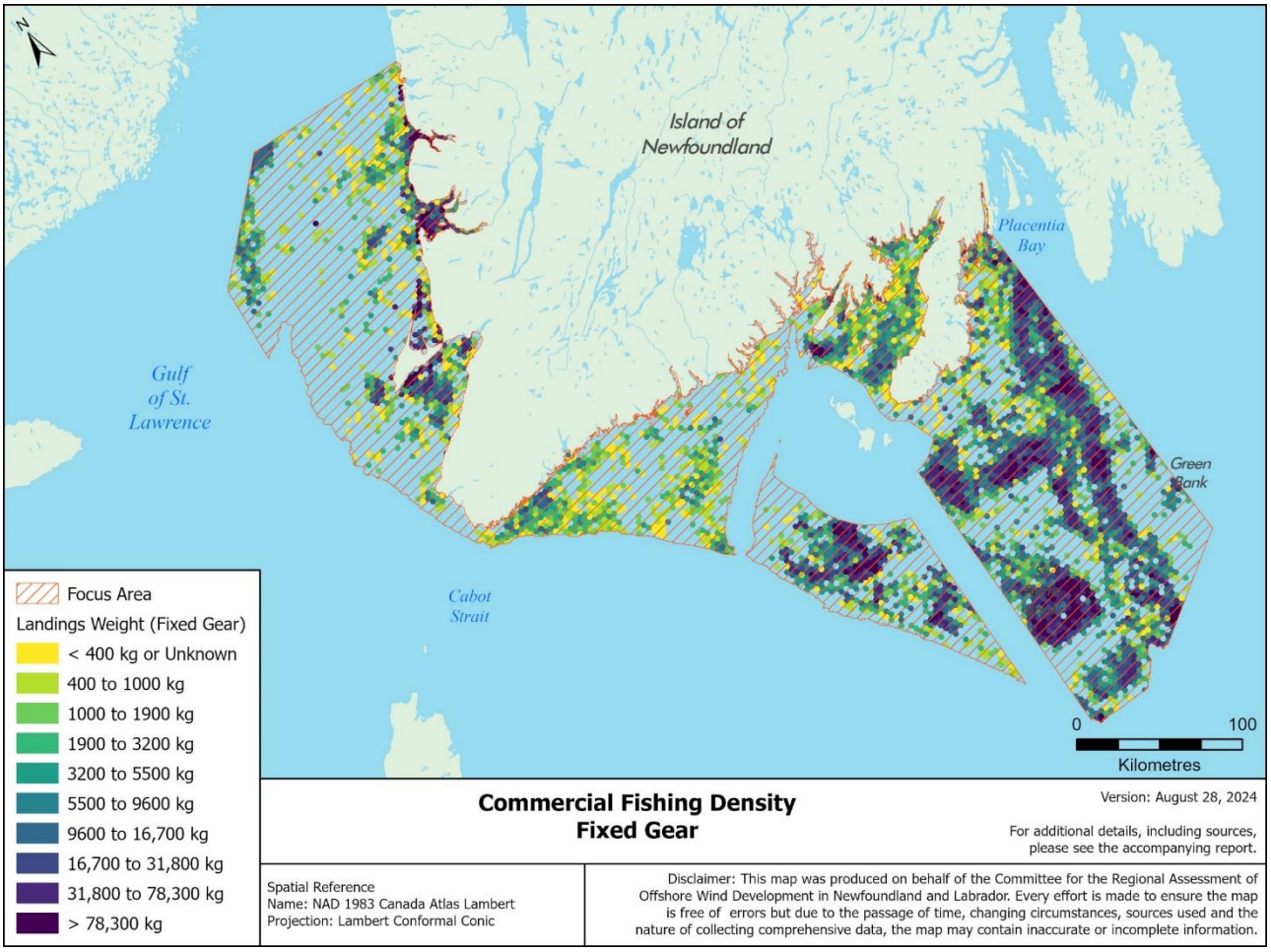


Figure Description: Map depicting all fixed commercial fishing gear density for the time period from 2012 - 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries spanning large area only shown as a single location). Some species may not include all records or locations of activity due to regional differences in mapping permissions or fishery is only partially georeferenced. Locations shown give an estimation of fishing intensity and a general idea of where species/gear type fishing occurs. Any data that contains less than five vessel IDs, licences or fishers, will appear as 'Unknown' due to privacy concerns.

Data Source: DFO, 2024j.

Figure 7.7.5. Angling/Rod and Reel Commercial Fishing Density within the Focus Area

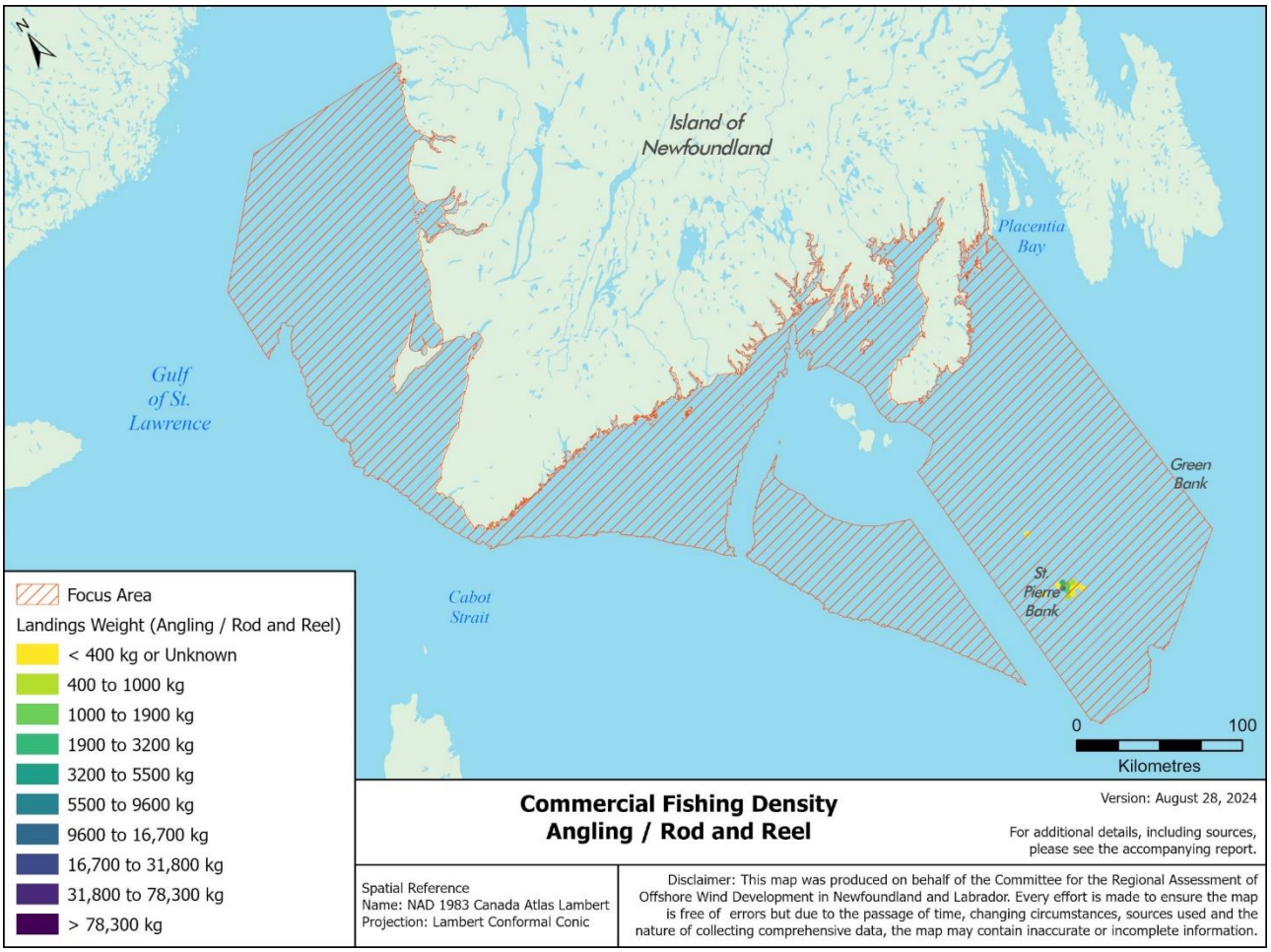


Figure Description: Map depicting angling/rod and reel commercial fishing density for the time period from 2012 - 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries spanning large area only shown as a single location). Some species may not include all records or locations of activity due to regional differences in mapping permissions or fishery is only partially georeferenced. Locations shown give an estimation of fishing intensity and a general idea of where species/gear type fishing occurs. Any data that contains less than five vessel IDs, licences or fishers, will appear as 'Unknown' due to privacy concerns.

Data Source: DFO, 2024j.

Figure 7.7.6. Beach and Bar Seine Commercial Fishing Density within the Focus Area

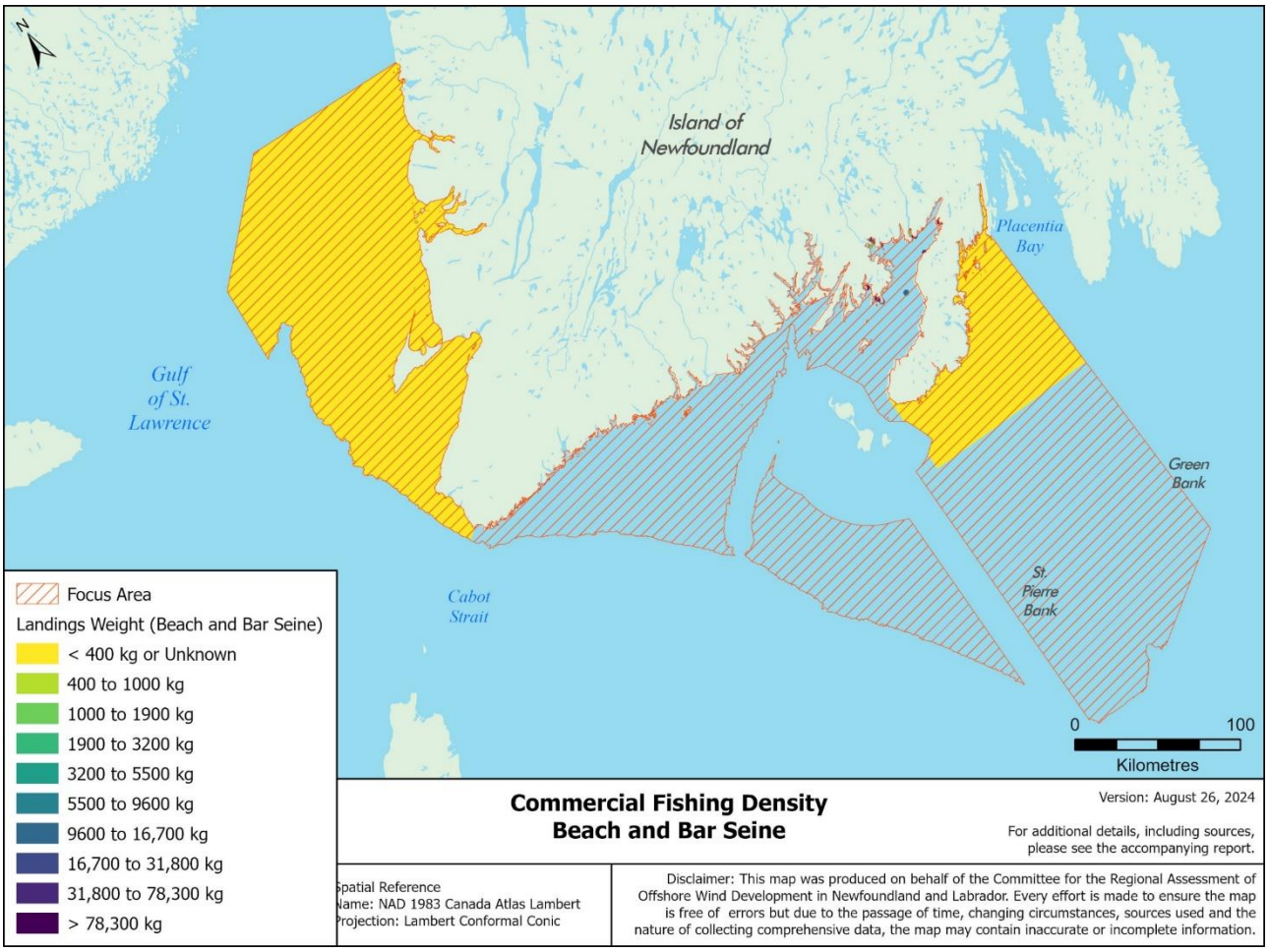


Figure Description: Map depicting beach and bar seine commercial fishing density for the time period from 2012 - 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries spanning large area only shown as a single location). Some species may not include all records or locations of activity due to regional differences in mapping permissions or fishery is only partially georeferenced. Locations shown give an estimation of fishing intensity and a general idea of where species/gear type fishing occurs. Any data that contains less than five vessel IDs, licences or fishers, will appear as 'Unknown' due to privacy concerns.

Data Source: DFO, 2024j.

Figure 7.7.7. Danish or Scottish Seine Commercial Fishing Density within the Focus Area

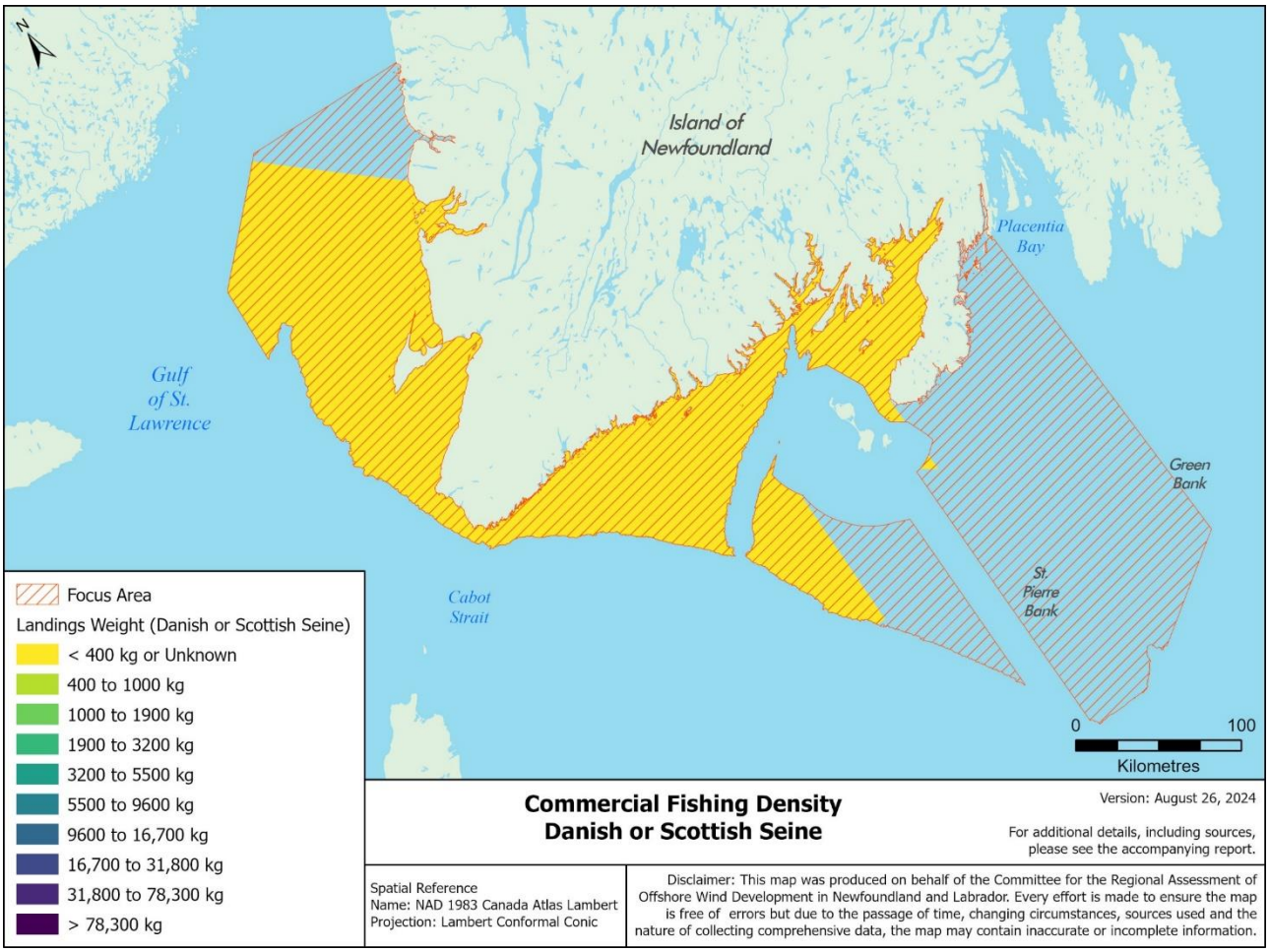


Figure Description: Map depicting Danish or Scottish seine commercial fishing density for the time period from 2012 - 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries spanning large area only shown as a single location). Some species may not include all records or locations of activity due to regional differences in mapping permissions or fishery is only partially georeferenced. Locations shown give an estimation of fishing intensity and a general idea of where species/gear type fishing occurs. Any data that contains less than five vessel IDs, licences or fishers, will appear as 'Unknown' due to privacy concerns.

Data Source: DFO, 2024j.

Figure 7.7.8. Dredge (boat) Commercial Fishing Density within the Focus Area

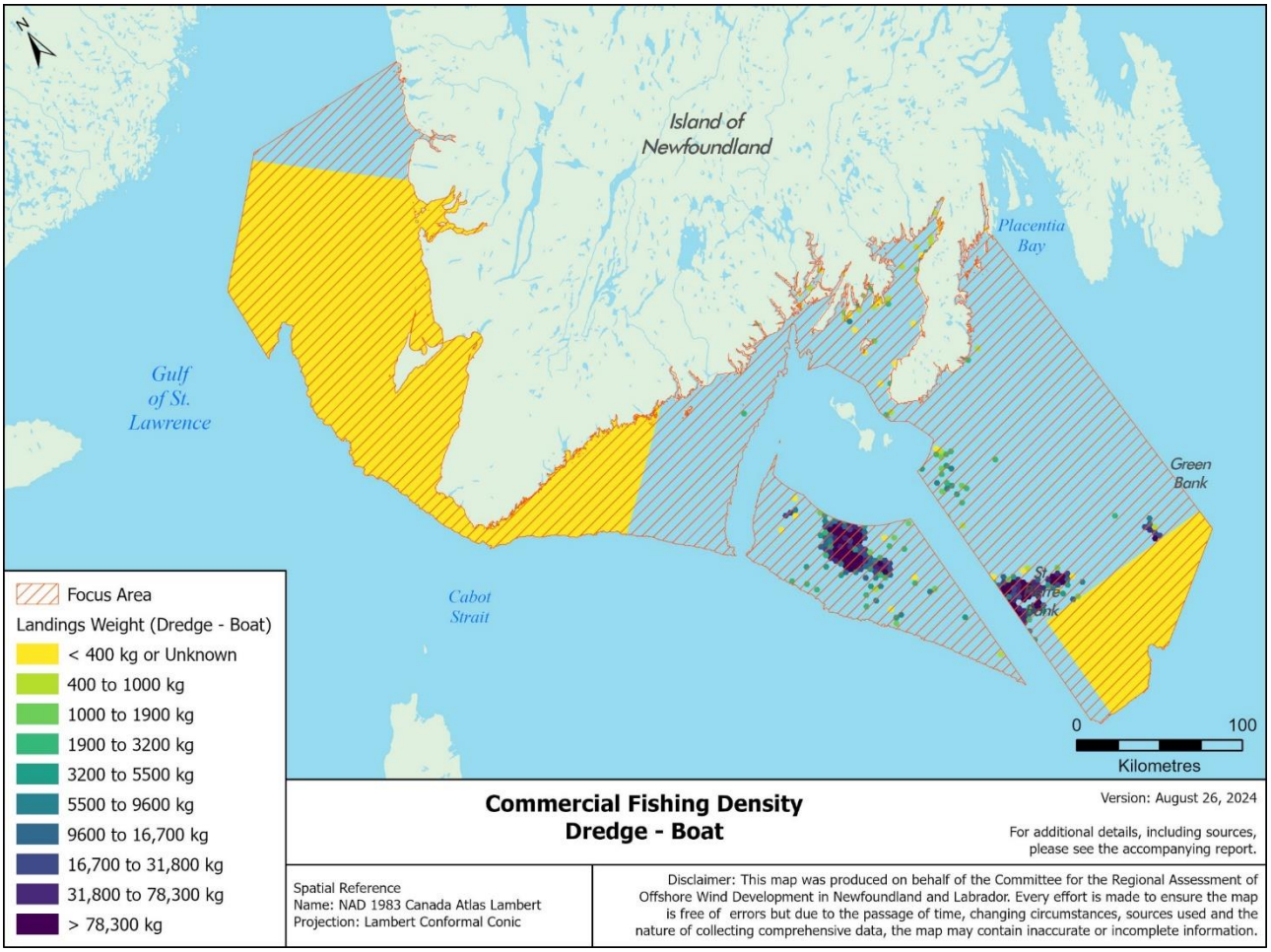


Figure Description: Map depicting dredge (boat) commercial fishing density for the time period from 2012 - 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries spanning large area only shown as a single location). Some species may not include all records or locations of activity due to regional differences in mapping permissions or fishery is only partially georeferenced. Locations shown give an estimation of fishing intensity and a general idea of where species/gear type fishing occurs. Any data that contains less than five vessel IDs, licences or fishers, will appear as 'Unknown' due to privacy concerns.

Data Source: DFO, 2024j.

Figure 7.7.9. Gillnet Commercial Fishing Density within the Focus Area

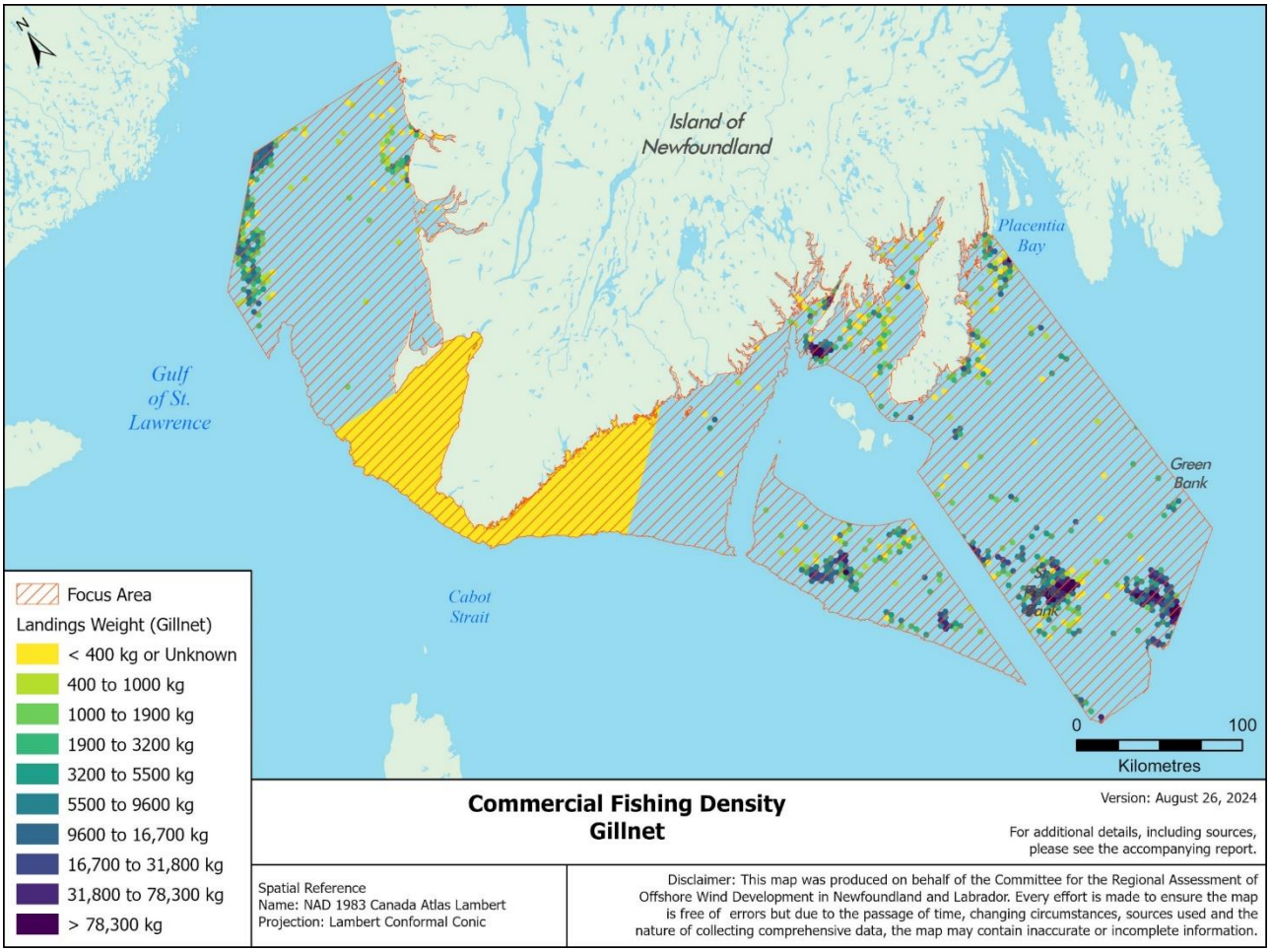


Figure Description: Map depicting gillnet commercial fishing density for the time period from 2012 - 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries spanning large area only shown as a single location). Some species may not include all records or locations of activity due to regional differences in mapping permissions or fishery is only partially georeferenced. Locations shown give an estimation of fishing intensity and a general idea of where species/gear type fishing occurs. Any data that contains less than five vessel IDs, licences or fishers, will appear as 'Unknown' due to privacy concerns.

Data Source: DFO, 2024j.

Figure 7.7.10. Hand Line (baited) Commercial Fishing Density within the Focus Area

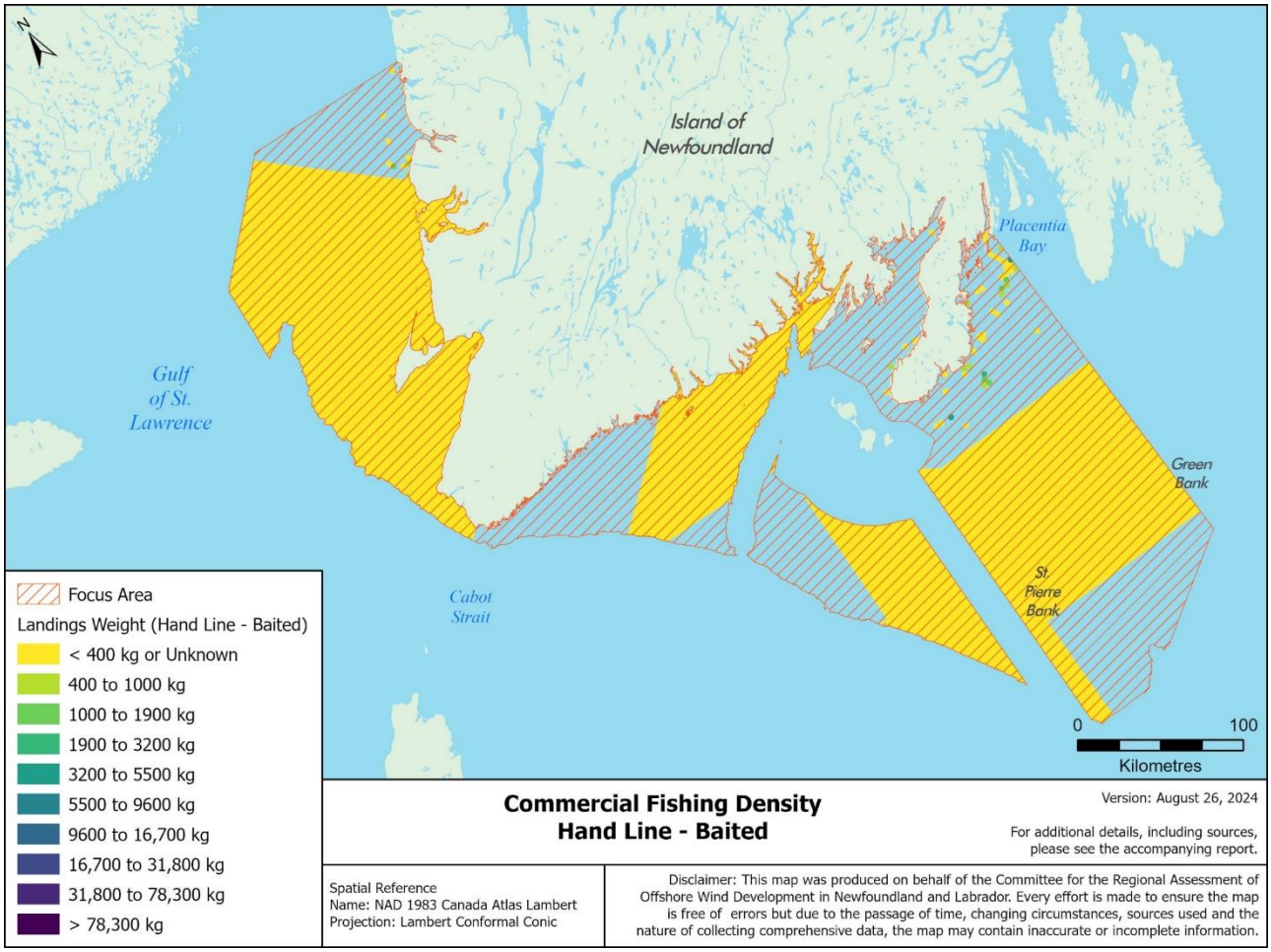


Figure Description: Map depicting hand line (baited) commercial fishing density for the time period from 2012 - 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries spanning large area only shown as a single location). Some species may not include all records or locations of activity due to regional differences in mapping permissions or fishery is only partially georeferenced. Locations shown give an estimation of fishing intensity and a general idea of where species/gear type fishing occurs. Any data that contains less than five vessel IDs, licences or fishers, will appear as 'Unknown' due to privacy concerns.

Data Source: DFO, 2024j.

Figure 7.7.11. Harpoon and Spear Commercial Fishing Density within the Focus Area

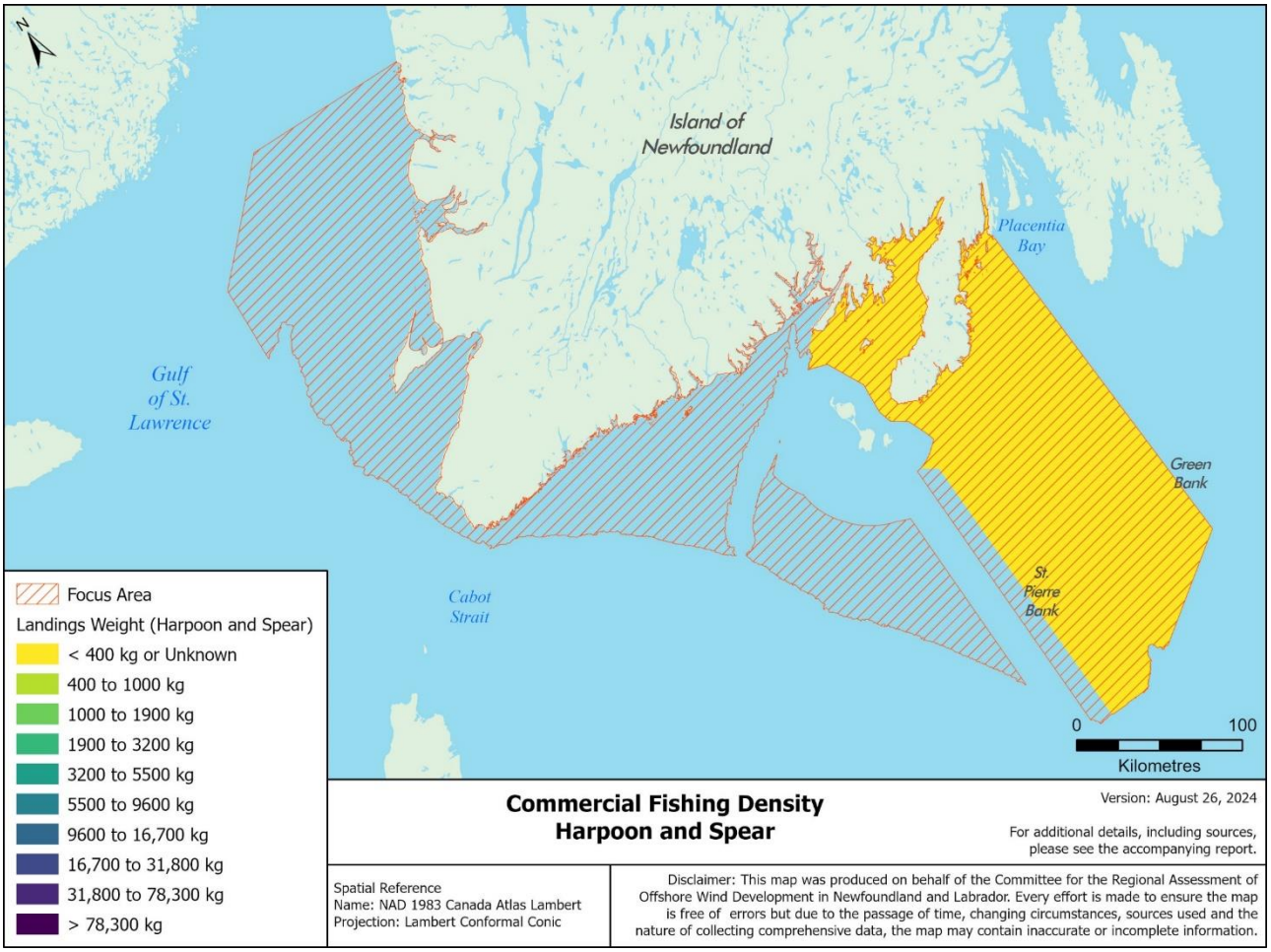


Figure Description: Map depicting harpoon and spear commercial fishing density for the time period from 2012 - 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries spanning large area only shown as a single location). Some species may not include all records or locations of activity due to regional differences in mapping permissions or fishery is only partially georeferenced. Locations shown give an estimation of fishing intensity and a general idea of where species/gear type fishing occurs. Any data that contains less than five vessel IDs, licences or fishers, will appear as 'Unknown' due to privacy concerns.

Data Source: DFO, 2024j.

Figure 7.7.12. Longline (groundfish) Commercial Fishing Density within the Focus Area

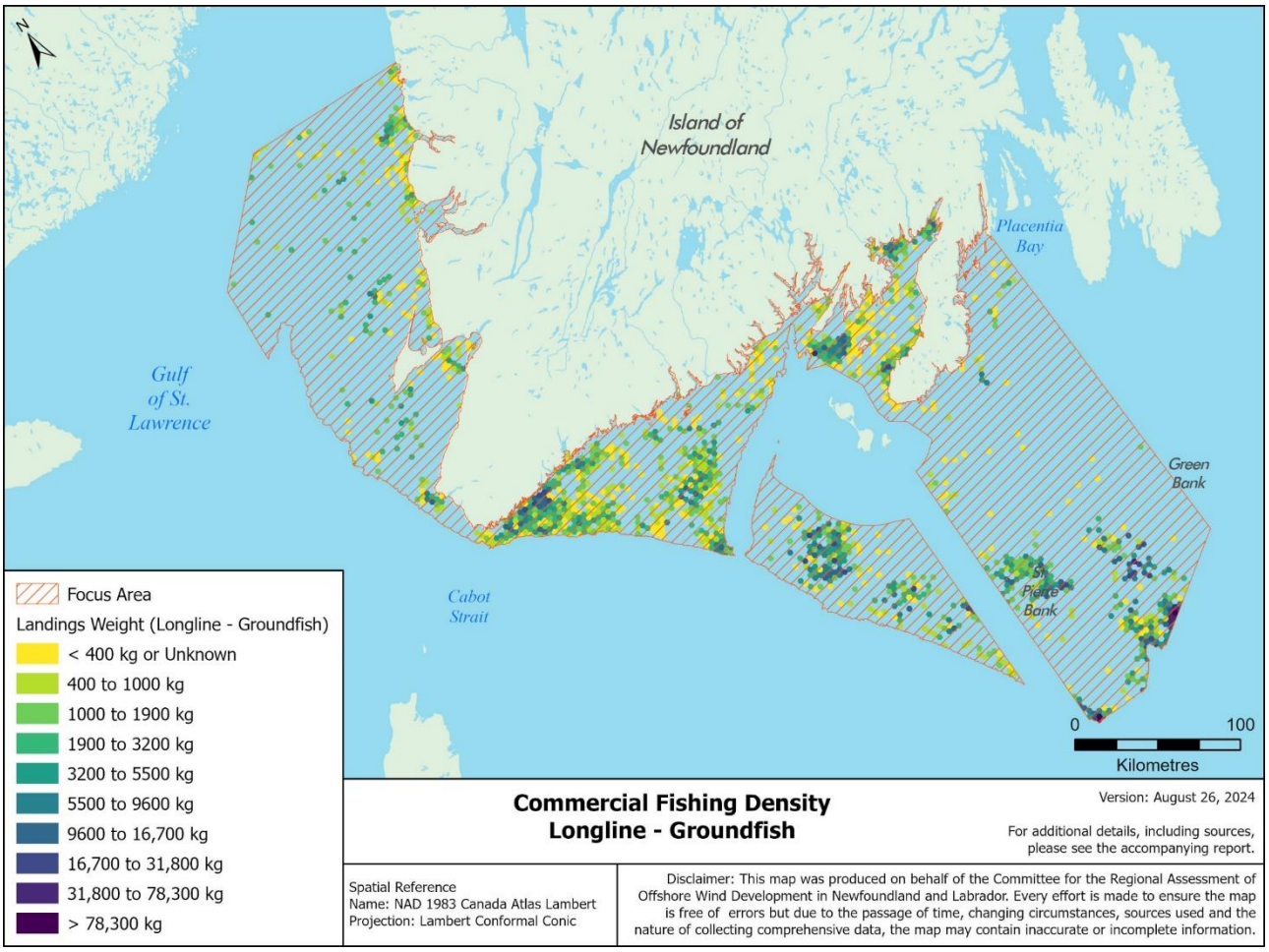


Figure Description: Map depicting longline (groundfish) commercial fishing density for the time period from 2012 - 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries spanning large area only shown as a single location). Some species may not include all records or locations of activity due to regional differences in mapping permissions or fishery is only partially georeferenced. Locations shown give an estimation of fishing intensity and a general idea of where species/gear type fishing occurs. Any data that contains less than five vessel IDs, licences or fishers, will appear as 'Unknown' due to privacy concerns.

Data Source: DFO, 2024j.

Figure 7.7.13. Longline (pelagics) Commercial Fishing Density within the Focus Area

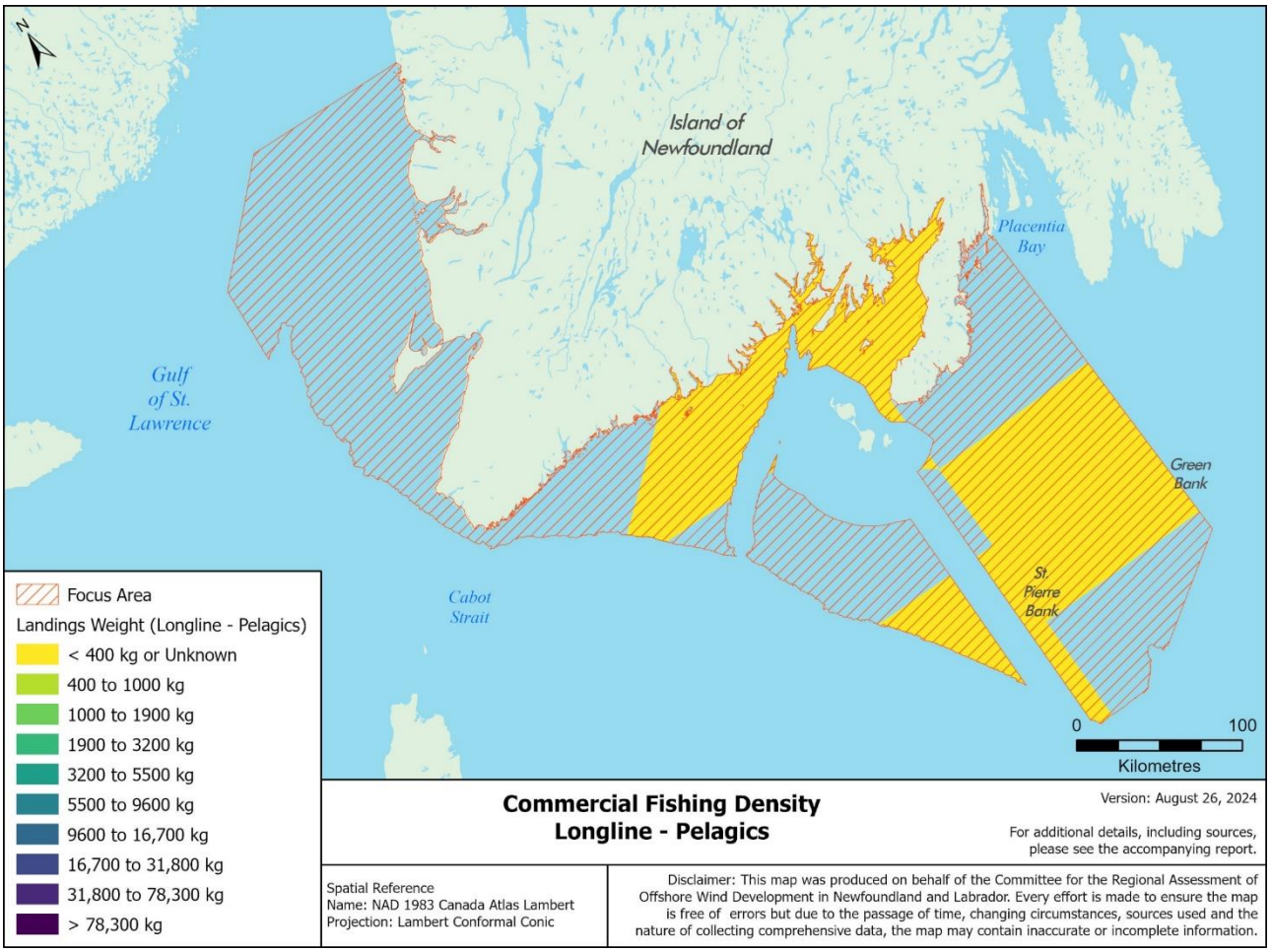


Figure Description: Map depicting longline (pelagics) commercial fishing density for the time period from 2012 - 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries spanning large area only shown as a single location). Some species may not include all records or locations of activity due to regional differences in mapping permissions or fishery is only partially georeferenced. Locations shown give an estimation of fishing intensity and a general idea of where species/gear type fishing occurs. Any data that contains less than five vessel IDs, licences or fishers, will appear as 'Unknown' due to privacy concerns.

Data Source: DFO, 2024j.

Figure 7.7.14. Pot (all types) Commercial Fishing Density within the Focus Area

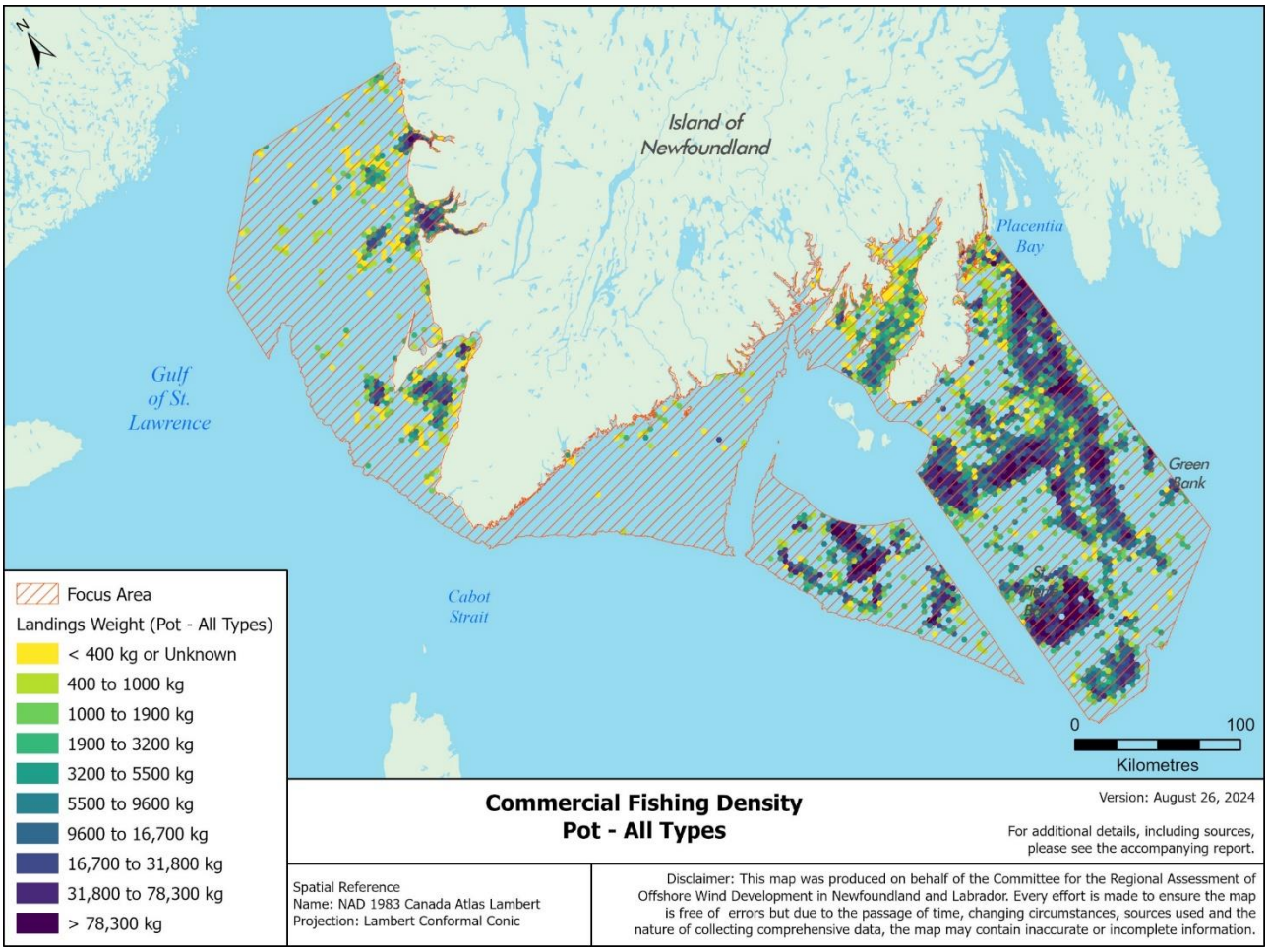


Figure Description: Map depicting pot (all types) commercial fishing density for the time period from 2012 - 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries spanning large area only shown as a single location). Some species may not include all records or locations of activity due to regional differences in mapping permissions or fishery is only partially georeferenced. Locations shown give an estimation of fishing intensity and a general idea of where species/gear type fishing occurs. Any data that contains less than five vessel IDs, licences or fishers, will appear as 'Unknown' due to privacy concerns.

Data Source: DFO, 2024j.

Figure 7.7.15. Purse or Tuck Seine Commercial Fishing Density within the Focus Area

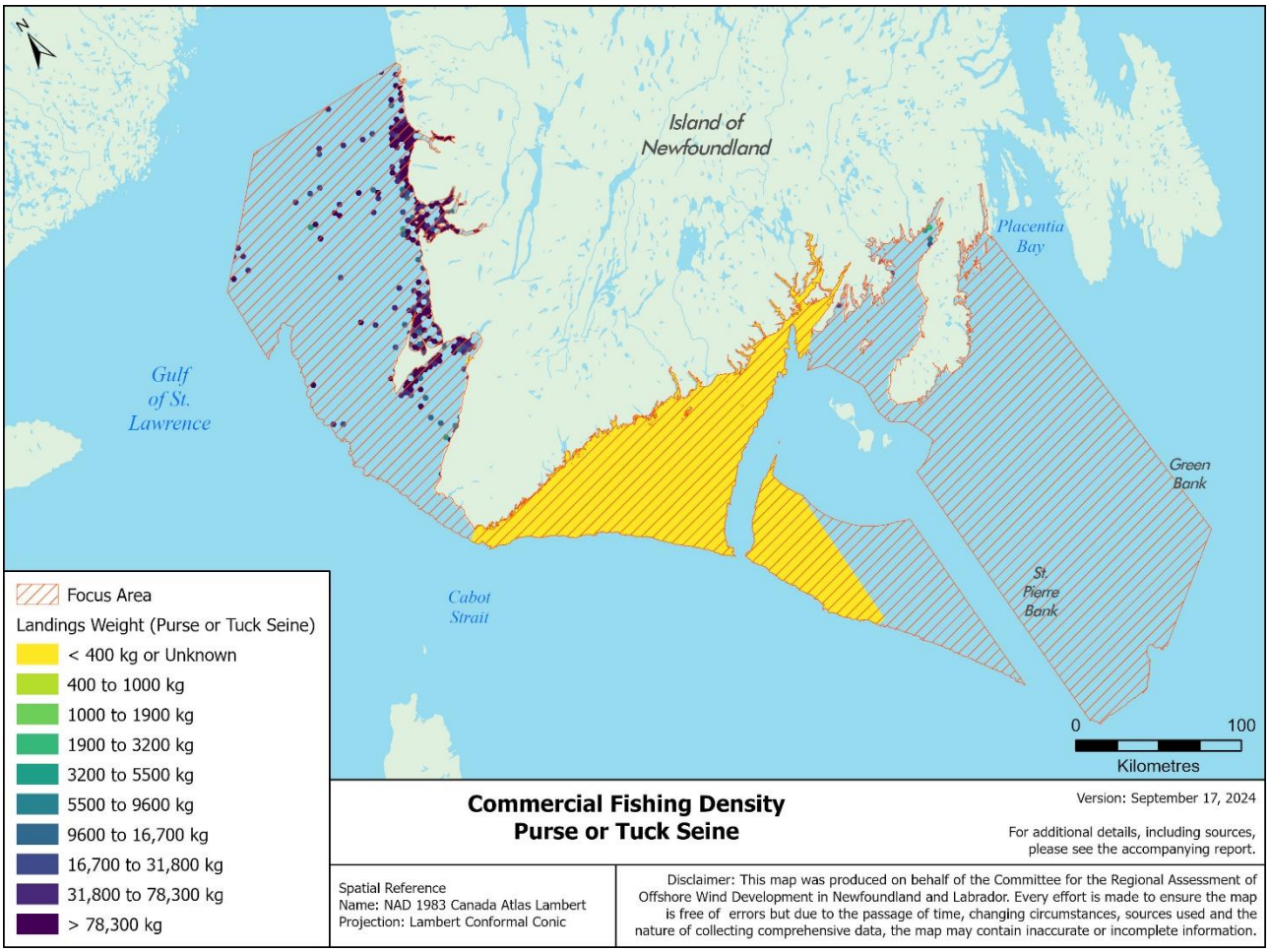


Figure Description: Map depicting purse or tuck seine commercial fishing density for the time period from 2012 - 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries spanning large area only shown as a single location). Some species may not include all records or locations of activity due to regional differences in mapping permissions or fishery is only partially georeferenced. Locations shown give an estimation of fishing intensity and a general idea of where species/gear type fishing occurs. Any data that contains less than five vessel IDs, licences or fishers, will appear as 'Unknown' due to privacy concerns.

Data Source: DFO, 2024j.

Figure 7.7.16. Shrimp Trawl Commercial Fishing Density within the Focus Area

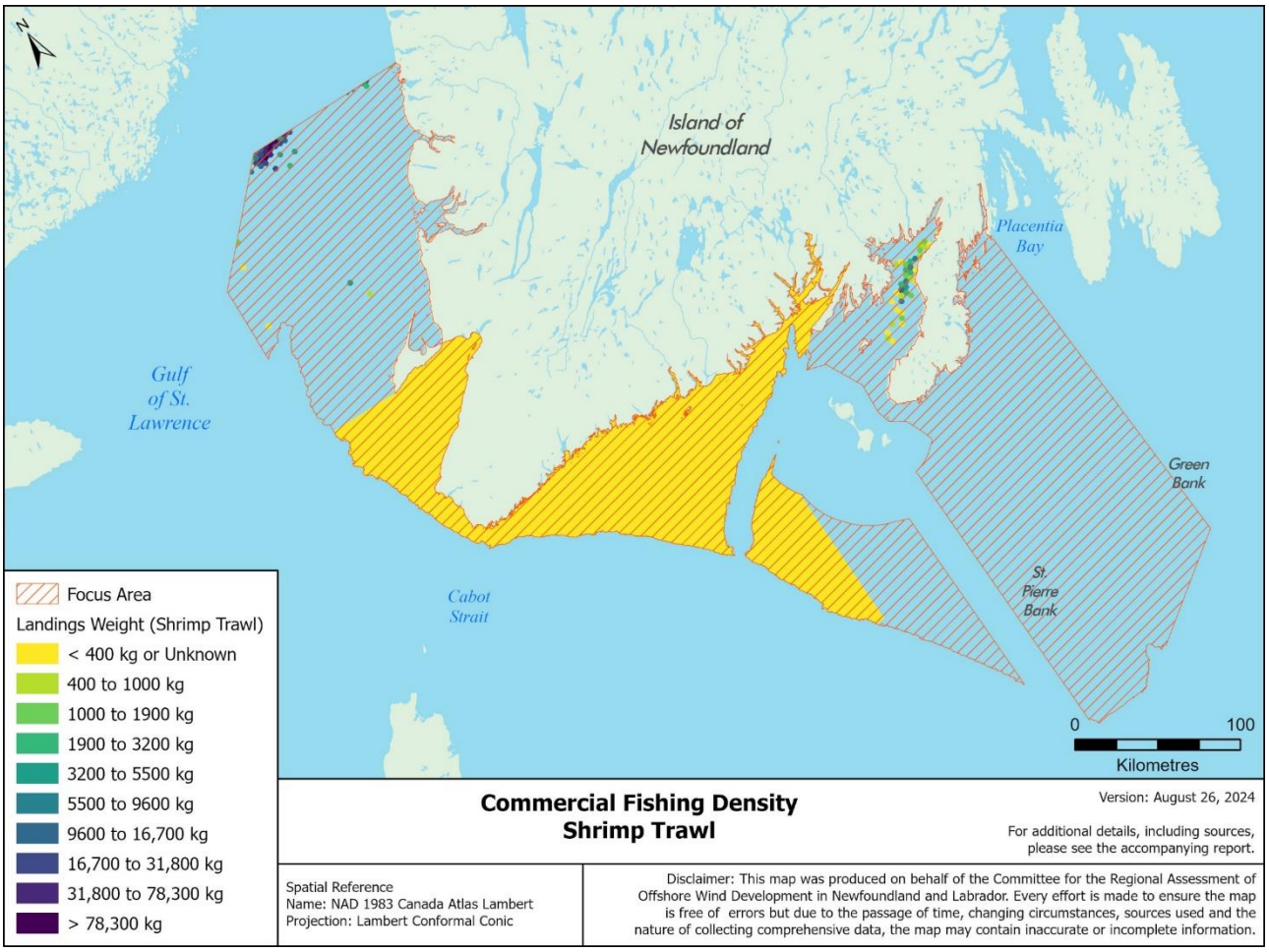


Figure Description: Map depicting shrimp trawl commercial fishing density for the time period from 2012 - 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries spanning large area only shown as a single location). Some species may not include all records or locations of activity due to regional differences in mapping permissions or fishery is only partially georeferenced. Locations shown give an estimation of fishing intensity and a general idea of where species/gear type fishing occurs. Any data that contains less than five vessel IDs, licences or fishers, will appear as 'Unknown' due to privacy concerns.

Data Source: DFO, 2024j.

Figure 7.7.17. Trap Gear (all types) Commercial Fishing Density within the Focus Area

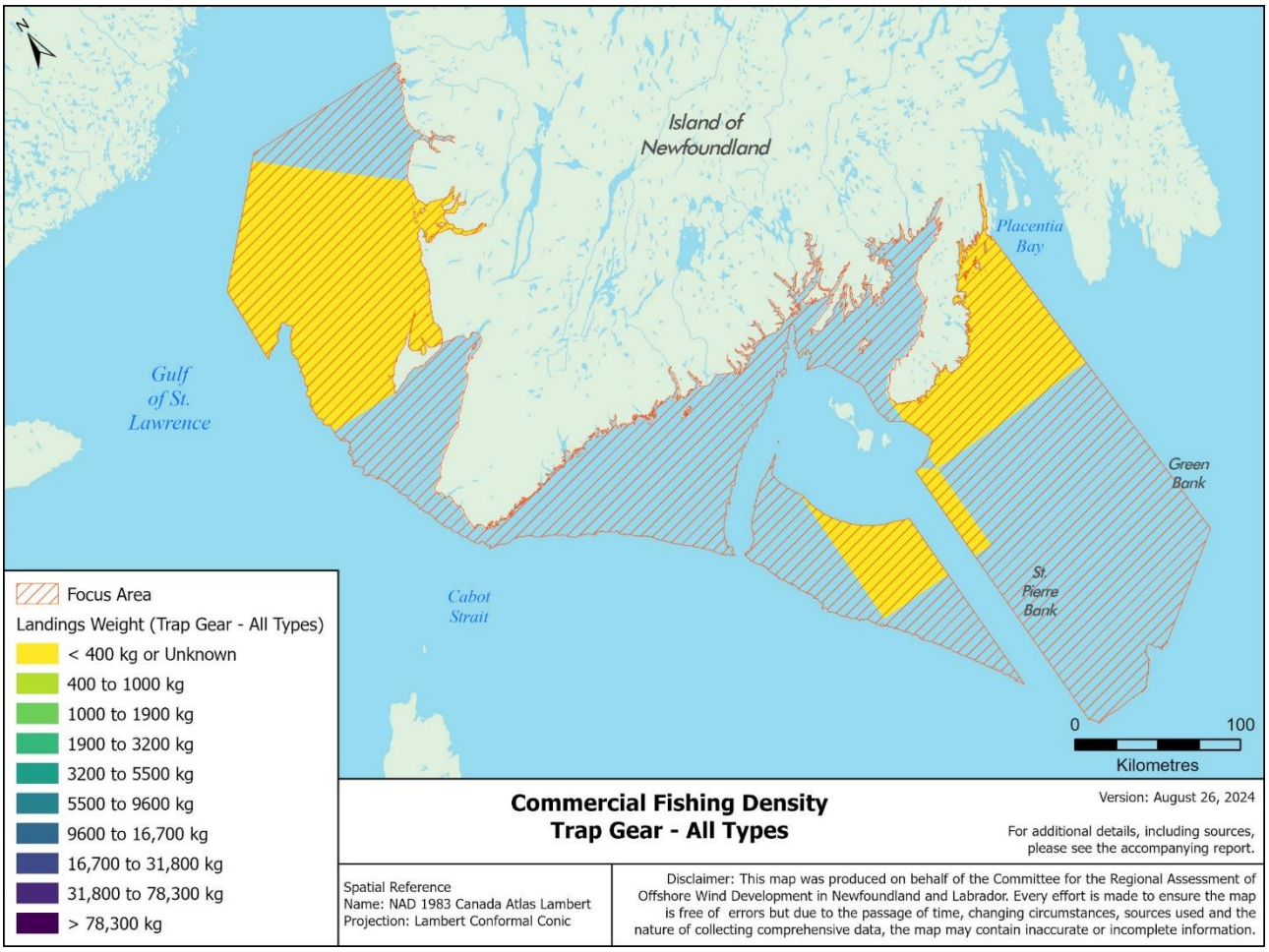


Figure Description: Map depicting trap gear (all types) commercial fishing density for the time period from 2012 - 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries spanning large area only shown as a single location). Some species may not include all records or locations of activity due to regional differences in mapping permissions or fishery is only partially georeferenced. Locations shown give an estimation of fishing intensity and a general idea of where species/gear type fishing occurs. Any data that contains less than five vessel IDs, licences or fishers, will appear as 'Unknown' due to privacy concerns.

Data Source: DFO, 2024j.

Figure 7.7.18. Trap Net Commercial Fishing Density within the Focus Area

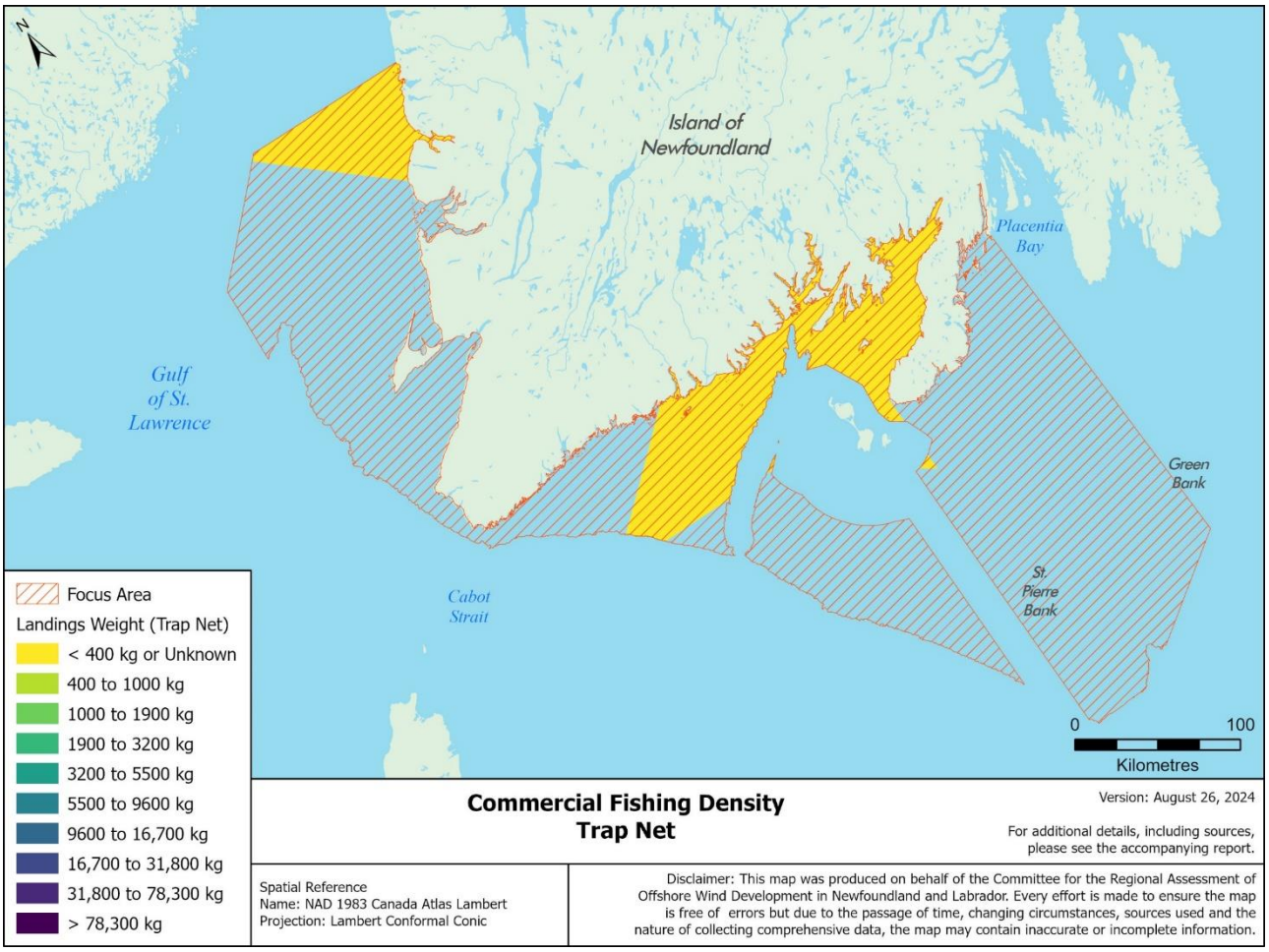


Figure Description: Map depicting trap net commercial fishing density for the time period from 2012 - 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries spanning large area only shown as a single location). Some species may not include all records or locations of activity due to regional differences in mapping permissions or fishery is only partially georeferenced. Locations shown give an estimation of fishing intensity and a general idea of where species/gear type fishing occurs. Any data that contains less than five vessel IDs, licences or fishers, will appear as 'Unknown' due to privacy concerns.

Data Source: DFO, 2024j.

Figure 7.7.19. Troller Lines Commercial Fishing Density within the Focus Area

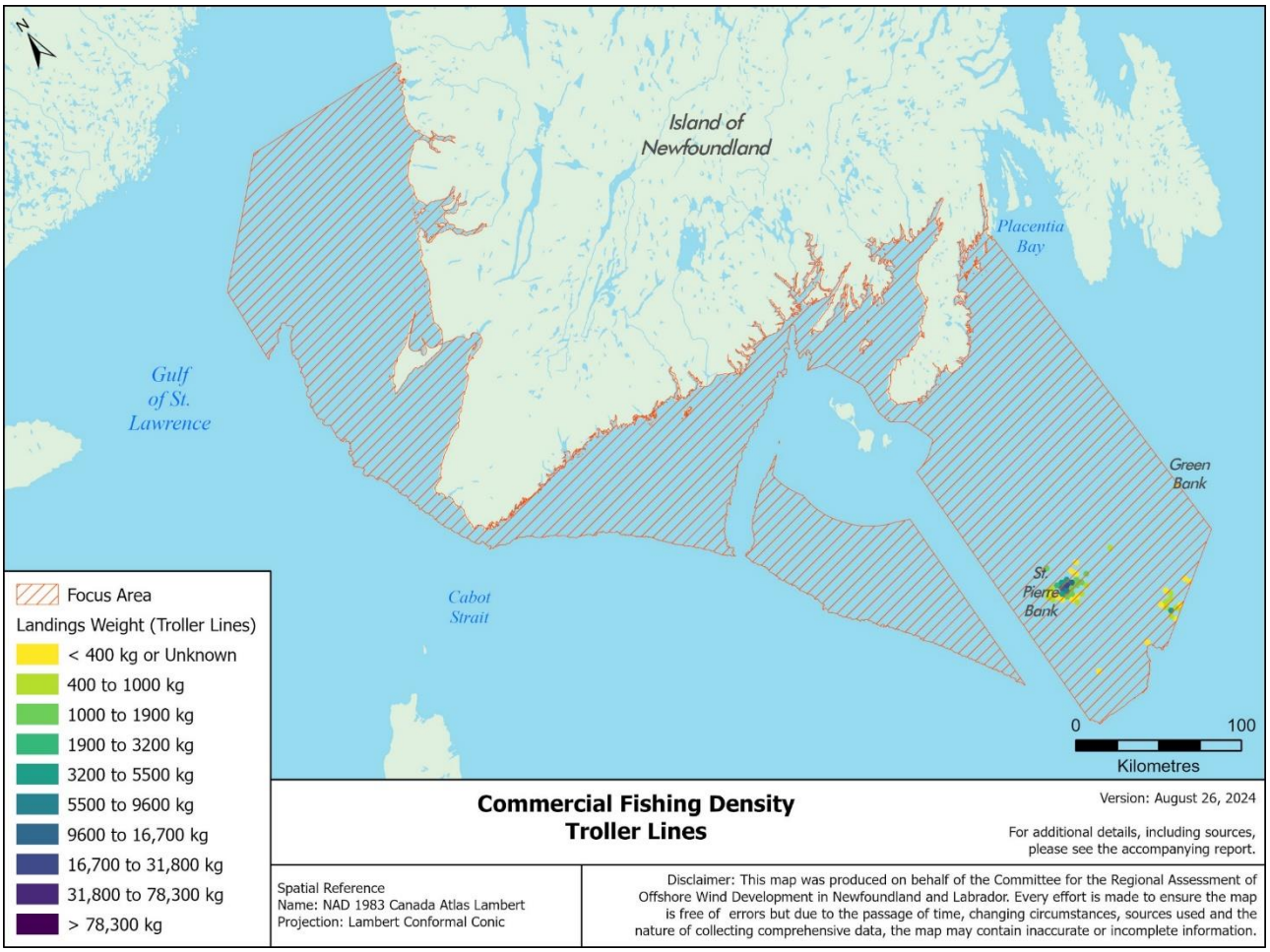


Figure Description: Map depicting troller lines commercial fishing density for the time period from 2012 - 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries spanning large area only shown as a single location). Some species may not include all records or locations of activity due to regional differences in mapping permissions or fishery is only partially georeferenced. Locations shown give an estimation of fishing intensity and a general idea of where species/gear type fishing occurs. Any data that contains less than five vessel IDs, licences or fishers, will appear as 'Unknown' due to privacy concerns.

Data Source: DFO, 2024j.

Noting different gear types being used for offshore fishing activities is important, as the way these gear types are employed can dictate what potential interactions and effects, with mobile gear types being most effected, they could have with marine development activities (see Section 7.7.4 of this Report).

Trends from gear types can provide insight on locations of select fisheries. For example, dredge boats help to delineate fisheries locations for species such as clams, which are focused on the St. Pierre Bank.

7.7.3.3 Recreational Fisheries

Coastal and nearshore areas around the province are used for recreational hunting and gathering activities by both residents and visitors. This includes harvesting various species of fish, marine mammals, and seabirds. Recreational fishing takes place in both coastal and inland waters of Newfoundland and Labrador, and includes species such as trout, char, smelt and Atlantic Salmon. One of the most popular and largest such fisheries is the recreational groundfish fishery that occurs during specific times in the summer and fall, where Atlantic Cod can be taken by both residents and non-residents without tags or licences, subject to specific requirements around timing, gear types and limits on the number of fish allowed to be taken. Residents and non-residents of the province may also collect shellfish such as clams and mussels in coastal areas. On the south coast of the Island of Newfoundland, the recreational scallop fishery is also very active, and areas fished can be seen in Figure 7.7.20 below.

Figure 7.7.20. 3Ps Scallop Areas

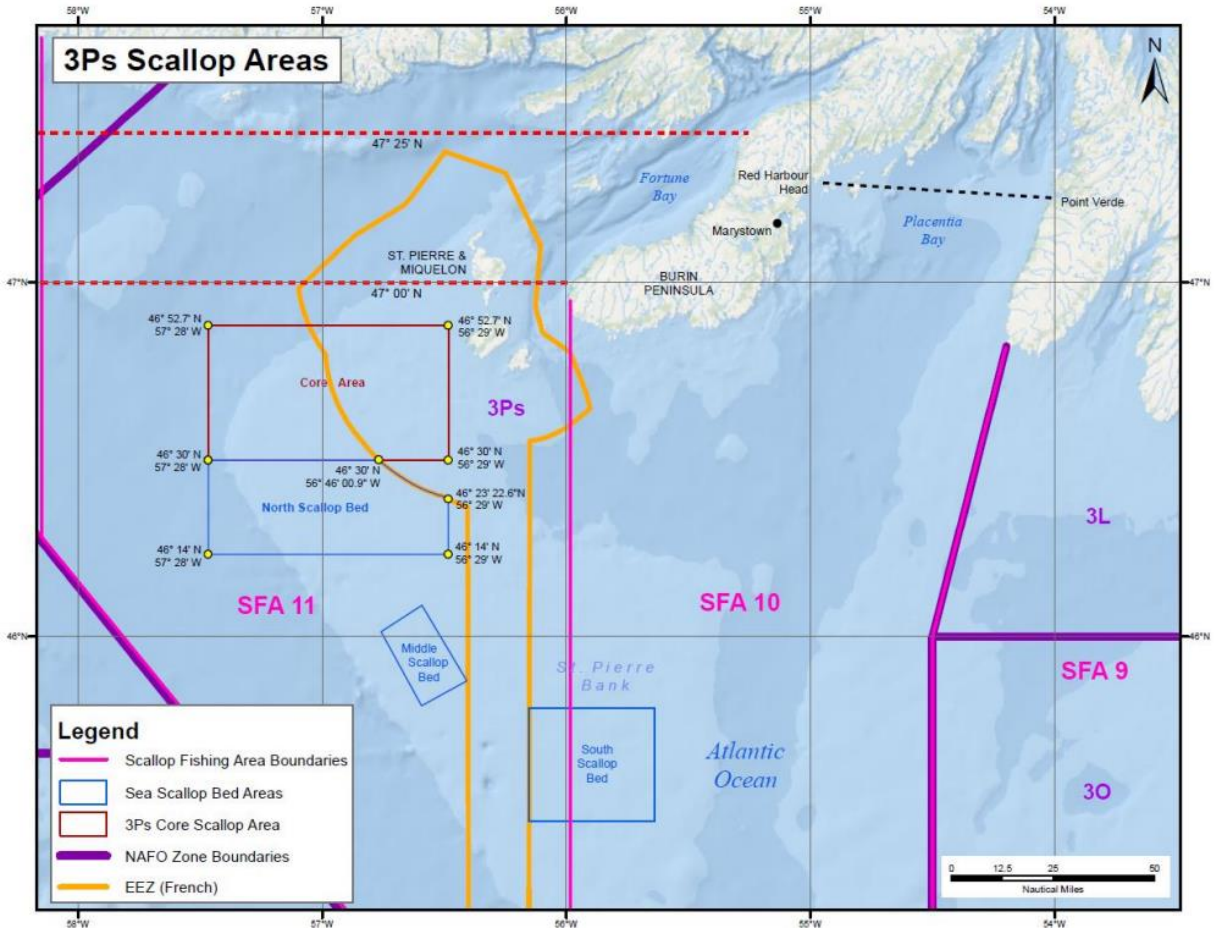


Figure Description: Scallop fishing areas within 3Ps. Map delineates Scallop fishing area boundaries, Sea Scallop bed areas and 3Ps Core Scallop area.

Data Source: Adapted from DFO, 2024q.

There is currently no georeferenced information on recreational fisheries included in the national database (DFO, 2023p). Table 7.7.7 contains information of the recreational fisheries that could occur in the Focus Area:

Table 7.7.7. Overview of Recreational Fisheries

Species	Licence Required	Season Dates	Authorized Gear	Limit	Other Considerations
Squid	No	Year-round	• Handheld squid jigger • Reels and rollers	No bag limit	• Use of mechanical/hydraulic devices to assist harvesting are not permitted. • All incidental groundfish catch must be released in a manner that causes the least amount of harm.
Mackerel	No	April 1 – December 31	• Hook and line (or angling gear)	20 in any one day	• Permitted to fish up to five lines or use a fishing line with up to six hooks attached. • There is a minimum retention size of 26.8 cm (length). • All incidental groundfish catch must be released in a manner that causes the least amount of harm.
Capelin	No	Year-round	• Hook and line (or angling gear) • Dip nets • Cast nets	No bag limit	All incidental groundfish catch must be released in a manner that causes the least amount of harm.
Trout	No	Year-round in coastal waters	Angling gear	• Daily bag limit of 12 fish (combination of any of the following: Speckled,	• All incidental groundfish catch must be released in a manner that causes the least amount of harm.

Species	Licence Required	Season Dates	Authorized Gear	Limit	Other Considerations
				Brown, Rainbow Trout (*Cynoscion nebulosus, Salmo trutta, and Oncorhunchus mykiss)*, Ouananiche (*Salmo salar ouananiche*)) or 5 lbs. round weight + one fish of any of these species, whichever is reached first. • Possession limit is twice the daily bag limit.	• No Rainbow Trout or Ouananich less than 20 cm can be retained. • No guide requirements for harvesting in coastal waters. • All other Trout angling regulations apply in coastal waters. Refer to the Anglers' Guide for more information.
Smelt	No	Year-round in coastal waters	Angling gear	No bag or possession limit	All other general angling regulations apply in coastal waters. Refer to the Anglers' Guide for more information.
Groundfish	No	Announced annually each spring, usually opens in July	• Angling gear • Hand-lines with a maximum of three hooks (artificial lures, baited hooks and feathered hooks)	Five groundfish per day (including Cod). The maximum boat limit, with three or more people fishing, is 15 groundfish.	• Artificial lures with treble hooks weighing less than 142 grams are acceptable. • Traditional jiggers are not permitted unless they are modified, having one single hook. • Retention of Atlantic Halibut, Spotted and

Species	Licence Required	Season Dates	Authorized Gear	Limit	Other Considerations
					Northern Wolffish or any sharks is prohibited. • Sculpins and cunners may be released. • All other groundfish caught must be retained and account towards the daily limits.
Seal (Personal Use)	Yes Personal Use licence is required	Announced in the spring, usually opens in April			• To obtain a Personal Use Seal Licence, once must have: o Proof of age (18 years or older). o A Firearms Safety/Hunter Education Certificate; and o Proof of successfully completing a Seal Humane Harvesting information session. • All Licence holders must follow the Marine Mammal Regulations (1993) and Conditions of licence. • All Sealing activity is monitored by Fishery Officers.
Scallop	Yes	Year-round	• Scuba	• Daily limit is 50 scallops.	• Use of mechanical/hydraulic devices to assist

Species	Licence Required	Season Dates	Authorized Gear	Limit	Other Considerations
	Recreational licence is required		• Drag (limited to Scallop Fishing Areas 1, 2, 3, 4, 10 & 11) • Dip-net • Hand rake	• Possession limit is 100 scallops.	harvesting are not permitted. • All incidental catch must be released in a manner that causes the least amount of harm.
Shark	Yes Recreational licence is required	April 1 – December 31	Angling gear	Catch and release only	• There is a reporting requirement for this fishery. • All incidental catch of groundfish must be released in a manner that causes the least amount of harm.

Table Description: Table describing recreational fisheries occurring within the Focus Area. This includes licencing requirements, season, gear used, any limits imposed and any other considerations.

Sources: DFO, 2023p; q.

7.7.3.4 Community-based Coastal Resource Inventory

As above, in Section 7.7.1.1.2, the CCRI data not only captures past fisheries data, but also data of other coastal resources, such as tourism. Data from the CCRI can be seen in Figure 7.7.21.

Figure 7.7.21. Community-based Coastal Resource Inventory

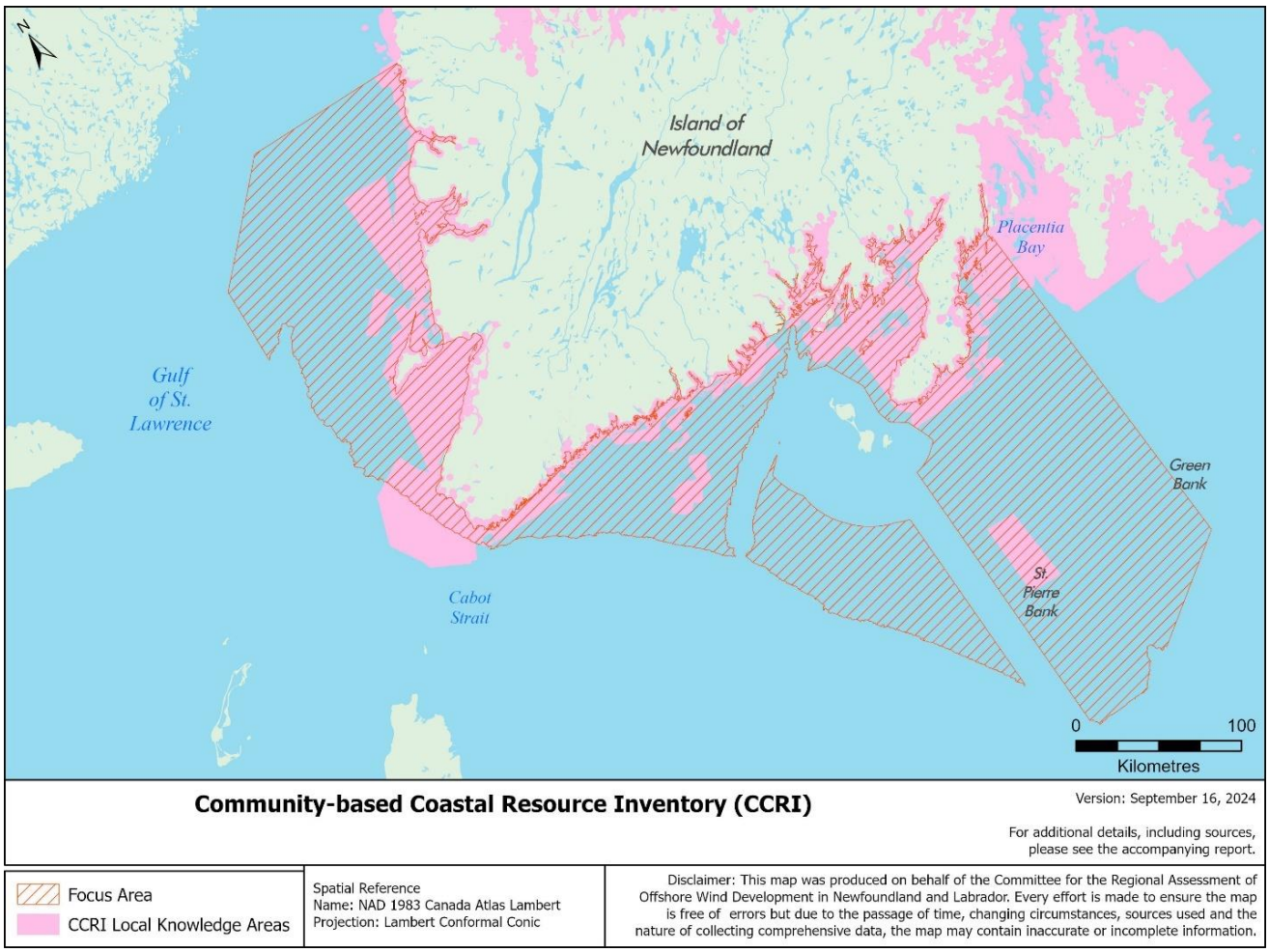


Figure Description: This map depicts CCRI local knowledge areas. The CCRI contains several decades' worth of local knowledge. Information was gathered through interviews with individuals who had extensive knowledge of the immediate geography and resources, having lived, worked and harvested the regions over a lifetime. CCRI local knowledge areas shown in the map include areas in the publicly available DFO (2023f) dataset and groundfish data from DFOs forthcoming CCRI update. The unpublished CCRI groundfish data was provided to the Committee by DFO for use in the Regional Assessment.

Data Sources: DFO, 2023f; 2024f.

As described in Section 6 of this Report, CCRI data was used in the Committee's constraints analysis as a final step (Step 9). Most changes to initial offshore wind energy licencing areas were because of unpublished CCRI groundfish data. Most CCRI local

knowledge areas in the publicly available dataset were already removed due to previously applied constraints.

Table 7.7.8 summarizes some details about the areas in the unpublished dataset. Further details will be available once the CCRI update is published on the Open Government Portal by DFO. For details about CCRI areas in the dataset currently available to the public, please refer to the data on the Open Government Portal.

Table 7.7.8. Community-based Coastal Resources Overlapping the Focus Area

Approximate Area	Details
Placentia Bay	• 5 unique areas identified with recreational, observed and/or commercial fisheries within Focus Area.3 unique sources (interviewees). • Species including Redfish, Atlantic Halibut, and Cod fished. Bycatches include Flounder, Redfish, Atlantic Halibut, and Sculpin. • No spawning reported. • Gear type include jigger, gillnet or not reported. • Most report fishing in summer months, one interviewee reports late October - November for one area. • Most do not report depth fished. For one area 24 - 25 ft reported.
Georges Bay to Port aux Port	• 7 unique areas identified with recreational, observed and/or commercial fisheries within Focus Area. 6 unique sources (interviewees). • Species including Atlantic Halibut, and Cod fish. No information on bycatch. • No information on spawning reported. • Gear type include pot, bottom otter trawl and jigger • Most do not report period fished. Several interviewees reported summer months for one of the unique areas. • Most do not report depth fished. For two areas 12 ft and 13 - 14 ft reported.
Fortune Bay	• 4 unique areas identified with commercial and/or recreational fisheries within Focus Area. 3 unique sources (interviewees). • Species including Cod and Atlantic Halibut fished. Bycatches include Flounder, Redfish, Shark, Atlantic Halibut, Cod, corals, sponges, and Turbot. • No spawning reported. • Gear type include gillnet, longline, handline (baited) and other. • Period fished include end of June - end of July, August, mid-May to November, and September. • Depth fished include 35 - 95 ft, 90 - 130 ft or not reported.
Burgeo to Hermitage	• 58 unique areas identified with recreational, observed, commercial and/or food, social, ceremonial fisheries within Focus Area. Some areas overlap.13 unique sources (interviewees).

Approximate Area	Details
	• Species including Cod, Atlantic Halibut, White Hake, Pollock, Redfish, Skate, and Turbot/Greenland Halibut fished. Bycatches include Cod, Atlantic Halibut, Redfish, Pollock, and Winter Flounder. • Spawning reported in one area. No information on spawning reported in most areas. • Gear type include longline, gillnet, jigger, handline (baited) or not reported (most). • Most do not report period fished. In one aera report summer recreational. • No information on depth fished.
Southwest Coast	• 32 unique areas identified with commercial, recreational, and/or observed fisheries within Focus Area. Some areas overlap. 4 unique sources (interviewees). • Species including Cod, Cunner, Catfish (Striped Wolffish), Atlantic Halibut, Lumpfish, Pollock, Redfish, Sculpin, Spotted Wolffish, unspecified Wolffish, and Yellowtail Flounder fished. Bycatches not reported. • No spawning reported or no information on spawning. • Gear type include jigger, handline (baited), angling or not reported (most). • No information on depth or period fished.

Table Description: This table provides details about CCRI Local Knowledge Areas which were removed from the Step 8 Resulting Area in the constraints analysis used to identify initial offshore wind energy licencing areas. More detailed information (i.e., specifics about each individual area) can be found in the publicly available CCRI dataset on open government or will be available once the CCRI update is published on the Open Government Portal by DFO.

Sources: DFO, 2023f; 2024f.

7.7.3.5 Key Species Overtime

While all fisheries in Newfoundland and Labrador carry economic and socio-cultural value, most fishing activity within the region is for shellfish, groundfish, and pelagic species (Government of Newfoundland and Labrador, 2023). These fisheries are summarized in the sections below as it relates to time and space considerations. Some values may not be included for all species, but it is reflective of information the Committee has received to date.

7.7.3.5.1 Shellfish

Shellfish species comprise a large portion of fisheries landings within Newfoundland and Labrador. Species such as Snow Crab and Northern Shrimp have been and continue to be important species for the fishing industry, after the collapse of groundfish stocks in the 1990s. Notable species harvested either in quantity and/or value include Snow Crab, scallops, whelk and Northern Shrimp. A general summary of shellfish fisheries and applicable closures within the Focus Area, based on data from 2012 - 2021, are provided below.

Table 7.7.9. Shellfish Fishing Trends throughout the Year*

Species	Percent of Landed Value	Month
Snow crab	43	April
	39	May
	17	June
Scallops	20	June
	29	July
	32	August
Whelk	29	June
	27	July
	24	August
	20	April, May, September, October
Lobster**	16	April
	55	May
	29	June

Table Description: Table providing breakdown by shellfish species and their landed value percentage per month.

* Percentages in table may not add up to 100 but are taken directly from the source material. The Committee assumes this is a rounding error.

* Based on Small Vessel Fishing Activity within the Focus Area (non-georeferenced).

Source: DFO, 2023p.

Table 7.7.10. Shellfish Fishing Trends within NAFO Divisions*

Species	Percent of Landed Value	NAFO Divisions
Snow Crab**	75	3Psf
	25	3Psc
Scallops	51	3Pse
	19	3Psf
	17	3Psg
	13	3Psd
Whelk	32	3Pse
	36	3Psh
	22	3Psg
	15	3Psf
Lobster***	36	3Psb
	20	4Rc
	14	4Rd
	14	4Rb
	16	Remaining Areas

Table Description: Table providing breakdown by shellfish species and their landed value percentage per NAFO area

* Percentages in table may not add up to 100, but are taken directly from the source material. The Committee assumes this is a rounding error.

** DFO has noted that Snow Crab fishing occurs within other areas of 3Ps (e.g., 3Psb), but the table is based on information in the table source.

*** Based on Small Vessel Fishing Activity within the Focus Area (non-georeferenced).

Source: DFO, 2023p.

Table 7.7.11. Applicable Shellfish Fishing Closures

Species	NAFO/Management Area	Specific Area Description	Gear Type	Closure Period	Description
Lobster	3Ps/Lobster Fishing Area (LFA)11	Penguin Islands – Lobster Conservation Area	Lobster pots	Year-round	The portion of LFA 11 bounded by lines connecting the following points: • 47° 22' 01.8" N 57° 01' 01.0" W • 47° 23' 48.6" N 57° 01' 01.0" W • 47° 23' 53.2" N 57° 56' 54.5" W • 47° 22' 01.8" N 57° 56' 54.5" W
	4R/LFA 13B	Shoal Point, Outer Bay of Islands – Lobster Conservation Area			The portion of LFA 13 inside a line near an area known as Shoal Point, Outer Bay of Islands defined by joining the following coordinates in the order they are listed: • 49° 19' 42.2112" N 58° 14' 40.8804" W • 49° 19' 26.1696" N 58° 14' 50.9892" W • 49° 19' 20.1828" N 58° 14' 44.0520" W • 49° 19' 43.1292" N 58° 14' 32.4024" W
	4R/LFA 14A	Trout River Bay – Lobster Conservation Area			The portion of LFA 14 near an area known as Trout River Bay defined by straight lines drawn from: • shore at East Point 49° 29' 25.6020" N 58° 07' 40.4508" W, to • West Point position 49° 28' 59.4552" N 58° 07' 58.2168" W
Scallop	3Psn/Scallop Fishing Area 11	N/A	N/A	Year-round	The portion of Scallop Fishing Area 11 bound by straight lines drawn between the following coordinates: • 47°11’24” North, 55°27’36” West (White Point) to • 47°12’36” North, 55°29’24” seconds West to

Species	NAFO/Management Area	Specific Area Description	Gear Type	Closure Period	Description
					• 47°06'00" North, 55°51'00" West to • 47°04'48" North, 55°51'00" West.
		White Point to Point Rosie	Scallop Gear	Year-round • Exception of dive-only fishery from August – October (dates can vary)	The portion of Scallop Fishing Area 11, bounded by a line connecting the following coordinates: • 47°11'24" North, 55°27'36" West (White Point) to • 47°12'36" North, 55°29'24" seconds West to • 47°24'00" North, 55°19'48" West to • 47°23'24" North, 55°17'24" West (Point Rosie)
		White Point			The portion of Scallop Fishing Area 11 bound by straight lines drawn between the following coordinates: • 47°11'24" North, 55°27'36" West (White Point) to • 47°12'36" North, 55°29'24" seconds West to • 47°06'00" North, 55°51'00" West to • 47°04'48" North, 55°51'00" West
	4R/Scallop Fishing Area 13	Cape Ray to Cape St. George		Year-round	The portion of Scallop Fishing Area 13 from: Cape Ray, north to Cape St. George in water depths less than 5 fathoms
		Port au Port Bay from Bear Cove Brook Point			The portion of Scallop Fishing Area 13, inside Port au Port Bay from: • Bear Cove Brook Point (48 degrees 43 minutes 37 seconds North, 58 degrees 39 minutes 38 seconds West) to Broad Cove Point (48 degrees 45 minutes

Species	NAFO/Management Area	Specific Area Description	Gear Type	Closure Period	Description
					North, 58 degrees 39 minutes West), in water depths less than 5 fathoms.

Table Description: Table providing overview of shellfish fishery closures within the Focus Area. This includes the management area where the closure exists, a brief description of where within the area the closure is located, gear types that are not permitted, the closure period and a brief description.

Source: DFO, 2023p.

Snow Crab

Snow Crab is one of the most profitable shellfish fisheries within the Focus Area, amassing approximately $21.4 million in average annual value through the georeferenced fishery and up to $2.1 million through the small vessel (non-georeferenced) fishery, over the 2012-2021 period (DFO, 2023p). Within the totality of the NAFO divisions that overlap the Focus Area, 3Ps, 3Pn and 4R, about 16% of the province's overall crab fishery is conducted in these areas. The crab fishery within the full extent of these NAFO divisions amassed approximately $120 million in 2022 (Government of Newfoundland and Labrador, 2023; DFO, 2024n). Snow Crab landings were first recorded in the late 1960s in Trinity Bay. It continued within the Focus Area in 3Ps in the 1970s, then developed into a regularly occurring fishery in the mid-1980ss. The fishery commenced in 4R in 1993. It then became a "supplementary" fishery within 3Ps in 1985 to help supplement fishers who were negatively affected by the decline of the groundfish fishery. By 1995, temporary seasonal permits were issued to continue aiding vessels under 35 feet as groundfish continued to decline, and by 2003 they transitioned into permanent licences. Over the next few years, eligibility expanded to all heads of core enterprises to help accommodate for the groundfish moratoria. As of 2021, there were approximately 2,300 licence holders as well as several fleet sectors. While quota controls were applied since the late 1980s in every NAFO division, a protocol was initiated in 2004 that resulted in the closure of areas when soft-shelled crab exceeded 20% of the legal-sized catch. Mandatory use of electronic Vessel Monitoring Systems (VMS) was also implemented to ensure compliance within areas fished. In 3Ps, Snow Crab landings experienced an all-time low in 2017, but then steadily increased to 5,000 tonnes in 2021. Within 3Pn and 4R, landings declined from 2013, until their all-time low in 2020, but then increased to 300 tonnes in 2021 (DFO, 2019e; 2022c). In their response to the Committee's Request for Advice, DFO provided information on FSC fisheries and Communal-Commercial fishing licences. However, while the Committee cannot publish this information due to its sensitive nature, the Committee has been granted permission to disclose that there are Indigenous organizations that hold FSC and Commercial Communal licences for Snow Crab within the Focus Area. Within MFN's *Comments on the Regional Assessment of Offshore Development*, MFN identified the south coast of Newfoundland as a principal area of concern, due to the Commercial Communal Fishery that takes place in these waters and represents one of MFN's largest sources of own-source revenue. For crab, Netukulimk Fisheries Limited (NFL), holds a quota of 3,000,000 lbs in 2024 (Miawpukek First Nation, 2024). Density of the geo-referenced snow crab fishery can be seen in Figure 7.7.22.

Figure 7.7.22. Commercial Snow Crab Fishery Density within the Focus Area

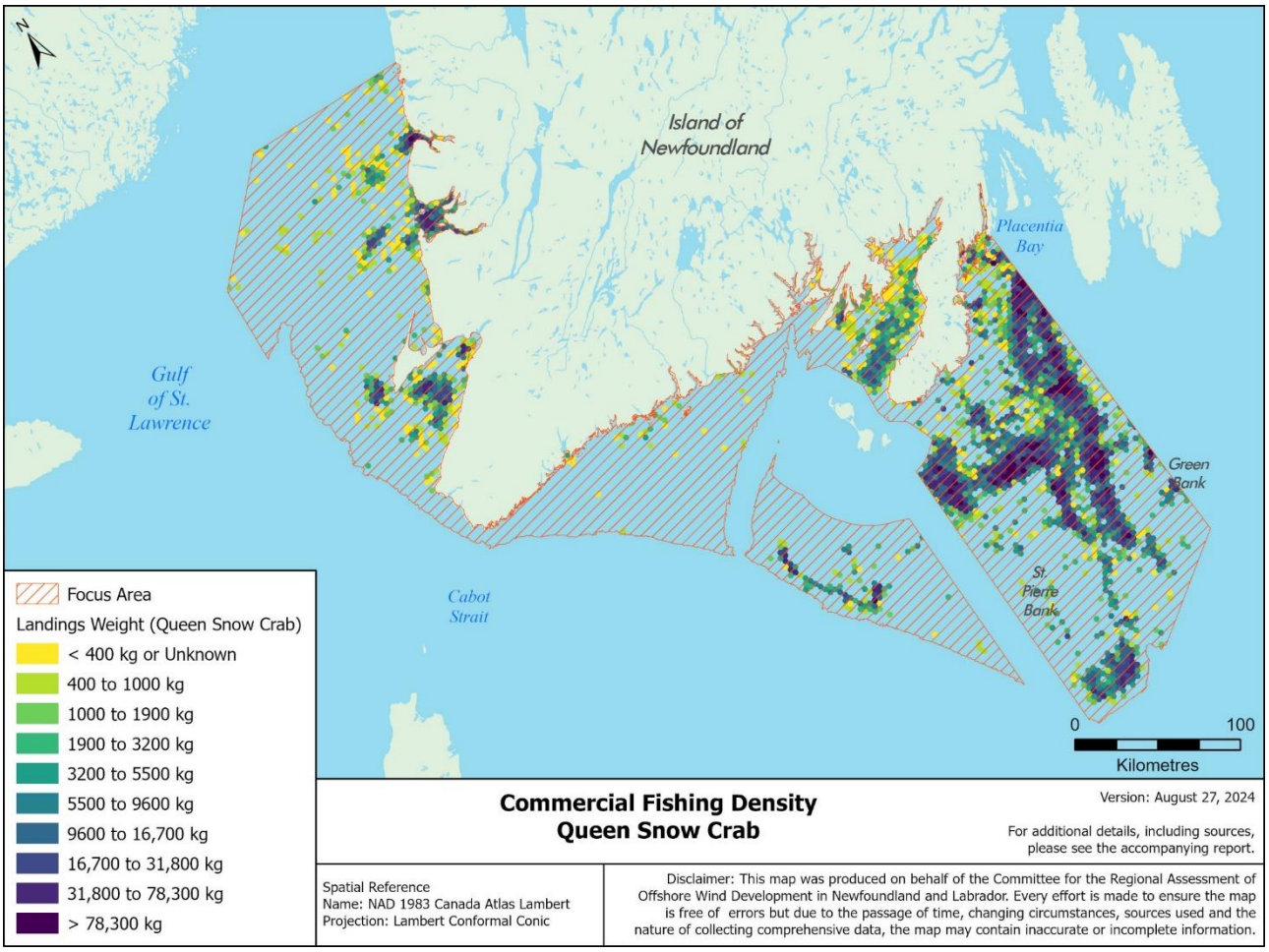


Figure Description: Map depicting Snow Crab commercial fishing density for the time period from 2012 - 2021 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries spanning large area only shown as a single location). Some species may not include all records or locations of activity due to regional differences in mapping permissions or fishery is only partially georeferenced. Locations shown give an estimation of fishing intensity and a general idea of where species/gear type fishing occurs. Any data that contains less than five vessel IDs, licences or fishers, will appear as 'Unknown' due to privacy concerns.

Data Source: DFO, 2024j.

Scallop

The Iceland Scallop fishery initially started in the late 1960s in the Strait of Belle Isle (4R) and then later expanded in the late 1980s on the St. Pierre Bank (3Ps), while the Sea Scallop fishery has been predominantly a 3Ps fishery. The Iceland Scallop 3Ps fishery was primarily harvested by Canadian fishers, but after the jurisdictional changes over the waters of Newfoundland and Labrador near St. Pierre and Miquelon, France, an annual joint TAC was established, allowing France and Canada a 70% and 30% percentage of

catch, respectively. Less than 10% of the TAC was taken from 1995-1997, then 1997 until 2016, there was no fishing in the joint jurisdictional zone. A TAC of 100 tonnes (30 tonnes in Canada) was established in 1999, then progressively increased to 1,650 tonnes in 2006, where it remained until at least 2018 (Coughlan et al., 2021). For the Sea scallop fishery in 3Ps, both the inshore and offshore fleets are involved, with the TAC being applied to each fleet after 2006. In 2000 a redistribution strategy divided the TAC equally north and south of the 51°25' North latitude line and a refugium was established to try to enhance scallop survival but was eliminated in 2009. In 2014, the fishery in the Strait of Belle Isle was closed to scallop dragging for infrastructure protection (DFO, 2019c; 2021b; Coughlan et al., 2023). On average, from 2012 - 2021 the scallop fishery within the Focus Area brings in about $3.1 million yearly (DFO, 2023p). Within DFO's response to the Committee's Request for Advice, information was provided on FSC fisheries and communal-commercial fishing licences, but due to the sensitive nature of this information, it could not be posted publicly on the Registry. The Committee has been granted permission to disclose that there are Indigenous organizations that hold FSC and Commercial Communal licences for scallop within the Focus Area. Density of the geo-referenced scallop crab fishery can be seen in Figure 7.7.23.

Figure 7.7.23. Commercial Scallop Fishery Density within the Focus Area

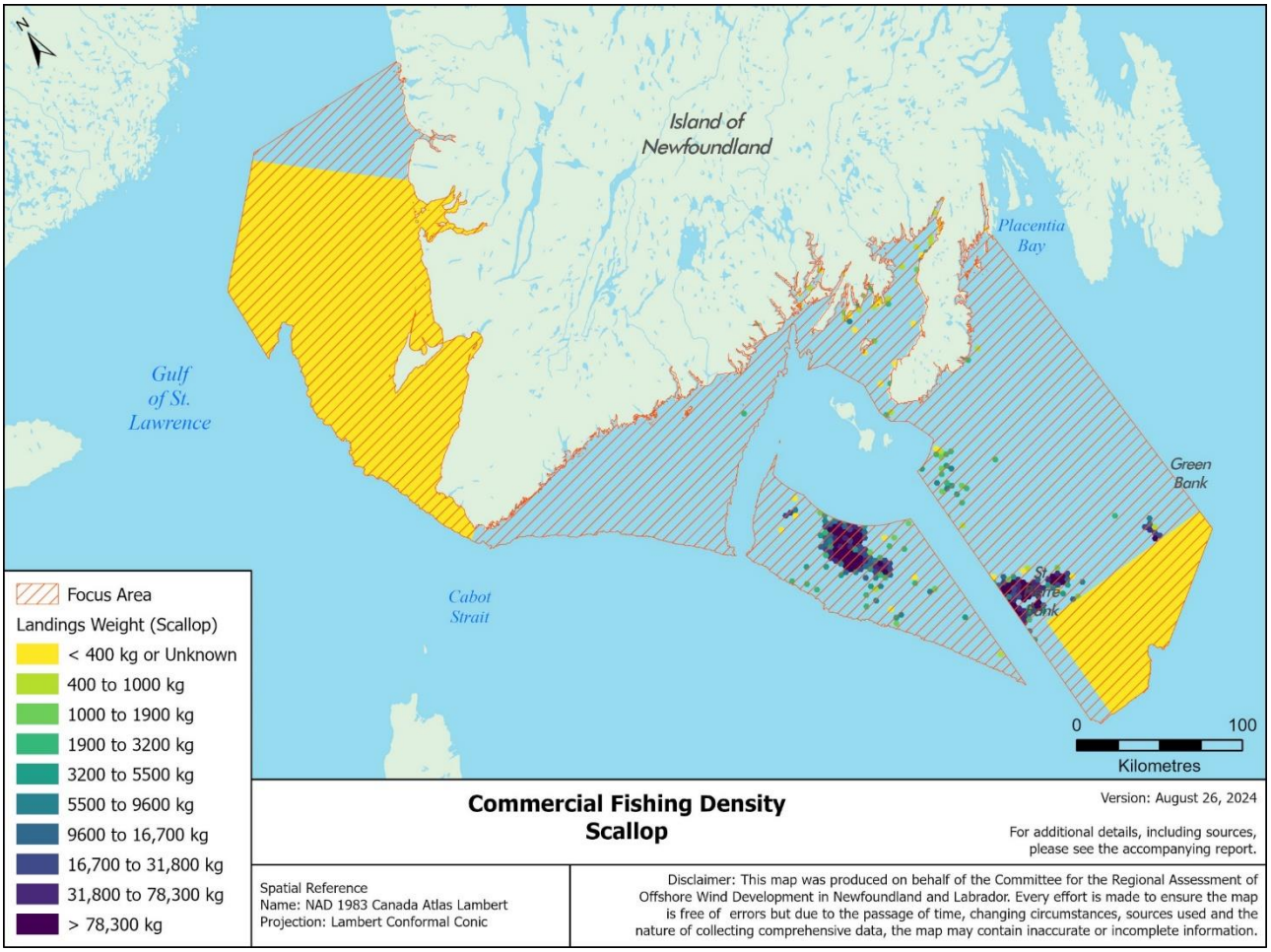


Figure Description: Map depicting scallop commercial fishing density for the time period from 2012 - 2021 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries spanning large area only shown as a single location). Some species may not include all records or locations of activity due to regional differences in mapping permissions or fishery is only partially georeferenced. Locations shown give an estimation of fishing intensity and a general idea of where species/gear type fishing occurs. Any data that contains less than five vessel IDs, licences or fishers, will appear as 'Unknown' due to privacy concerns.

Data Source: DFO, 2024j.

Whelk

In 1986, the commercial fishery for whelk began in other areas around the province, while in the early 2000s it started within the 3Ps division (within the Focus Area), which developed and expanded rapidly. 3Ps was divided into three whelk fishing areas, North, West and South grounds, with the North grounds being the first fished area in 2004. While landings peaked in 2011 with 5,819 tonnes, and then slowly diminished since, the TAC that was established prior to the 2009 season still remained in place as of 2021 (DFO, 2013f;

2021j). The whelk fishery usually coincides with the 3Ps offshore Snow Crab fishery, so most fishers will have licences for both. Due to this, it sometimes results in a delay to the start of the whelk fishery as fishers will usually complete the crab fishery first. This also allows the female whelks a chance to deposit their egg masses before they are captured (DFO, 2013f). Within DFO's response to the Committee's Request for Advice, information was provided on FSC fisheries and communal-commercial fishing licences, but due to the sensitive nature of this information, it could not be posted publicly on the Registry. The Committee has been granted permission to disclose that there are Indigenous organizations that hold FSC and Commercial Communal licences for whelk within the Focus Area. Within MFN's *Comments on the Regional Assessment of Offshore Development*, MFN identified the south coast of Newfoundland as a principal area of concern, due to the Commercial Communal Fishery that takes place in these waters and represents one of MFN's largest sources of own-source revenue For whelk, NFL, is a part of the competitive fishery in 2024 (Miawpukek First Nation, 2024). Density of the geo-referenced whelk fishery can be seen in Figure 7.7.24.

Figure 7.7.24. Commercial Whelk Fishery Density within the Focus Area

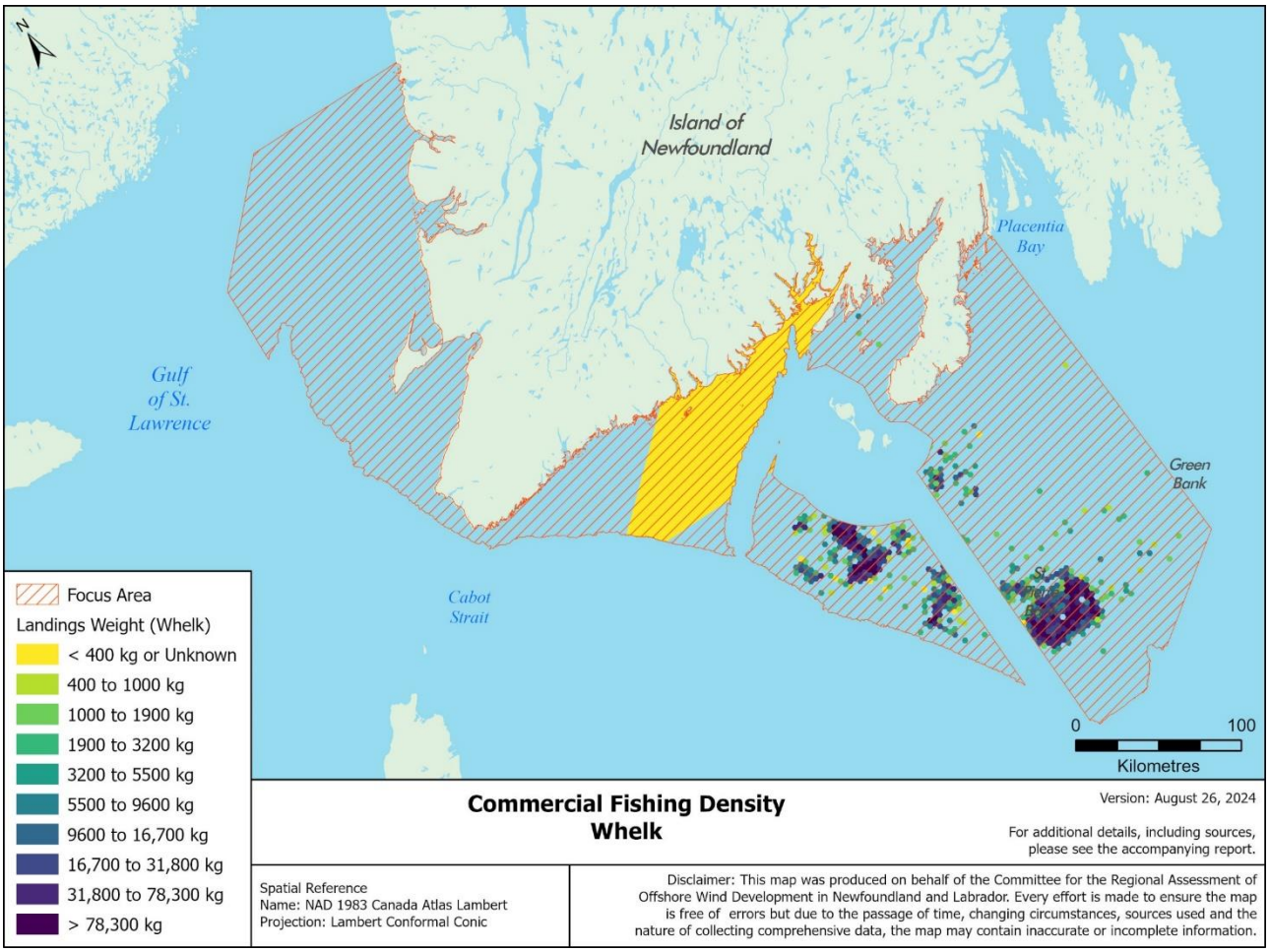


Figure Description: Map depicting whelk commercial fishing density for the time period from 2012 - 2021 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates,

landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries spanning large area only shown as a single location). Some species may not include all records or locations of activity due to regional differences in mapping permissions or fishery is only partially georeferenced. Locations shown give an estimation of fishing intensity and a general idea of where species/gear type fishing occurs. Any data that contains less than five vessel IDs, licences or fishers, will appear as 'Unknown' due to privacy concerns.

Data Source: DFO, 2024j

Lobster

The lobster fishery follows LFAs, in which LFA 10,11,12,13A and 13B fall in the Focus Area. This fishery dates back to the 1870s, and then in the 1920s a stock collapse occurred which resulted in the closure of the fishery for a few years. From the 1930s, into the 1950s the shipment of live animals to the U.S. started, which included the shipment of most landed lobsters and increased protections enforced for undersized and egg-bearing lobsters. Up until the late 1970s, since fishing efforts were uncontrolled, a limited entry licencing policy was introduced, as well as daily trap limits. Throughout the 1980s landings increased, thought to be caused by strong recruitment and consistent favorable environmental and ecological factors. By 1986 a new geographical management system, LFAs, was established with a conversion to uniform trap limits based on each LFA. In 1995, concerns were expressed on the future viability of Atlantic Canada's lobster stocks due to high exploitation rates, influx of harvesting immature lobsters and less than favorable environmental conditions. From 1998-2002, there was a 25% reduction in licences in the province and size retention was increased, in accordance with the management plan at the time. The Lobster Sustainability Measures Program and a Lobster Enterprise Retirement Program were implemented in 2010 and 2011, respectively, which led to license and trap limit reductions, specifically within the South and West Coast regions. As of July 2023, there were 2,300 licences, with trap limits ranging from 100-300 per fisher, with additional trap regulations, depending on the LFA. There is also a voluntary practice for fishers in which they cut a shallow mark (v-notch) in the tail fin of an egg-bearing female, which identifies the lobster to be prohibited from retention, protecting the spawning lobsters (DFO, 2021a; 2023c). There is little spatial data since it is primarily a small vessel fishery, but lobster has become a more important species in recent years. It is now the most valuable shellfish species, per pound harvested in the province (Government of NL, 2023). Lobster landed value for small vessels (non-georeferenced) could be up to $34 million on average annually within the Focus Area (2012-2021), accounting for about 80% of the total non-georeferenced landed value for small fishing vessels within the Focus Area. All lobster catch reported within the above mentioned NAFO areas were located along the coast, close to shore, as lobster is present around these areas, as seen in Figure 7.7.6 (DFO, 2023p). Within the totality of the NAFO divisions that overlap the Focus Area, 3Ps, 3Pn & 4R, the lobster fishery within the full extent of these divisions amassed approximately $91 million in 2022 and accounted for approximately 86% of total landings within the province (Government of Newfoundland and Labrador, 2023; DFO, 2024n).

Within DFO's response to the Committee's Request for Advice, information was provided on FSC fisheries and communal-commercial fishing licences, but due to the sensitive nature of this information, it could not be posted publicly on the Registry. The Committee has been granted permission to disclose that there are Indigenous organizations that hold FSC and Commercial Communal licences for lobster within the Focus Area. Presence of lobster along the coastline, which would help indicate where this fishery takes place, can be seen in Figure 7.7.25.

Figure 7.7.25. Lobster Harvested Within the Focus Area

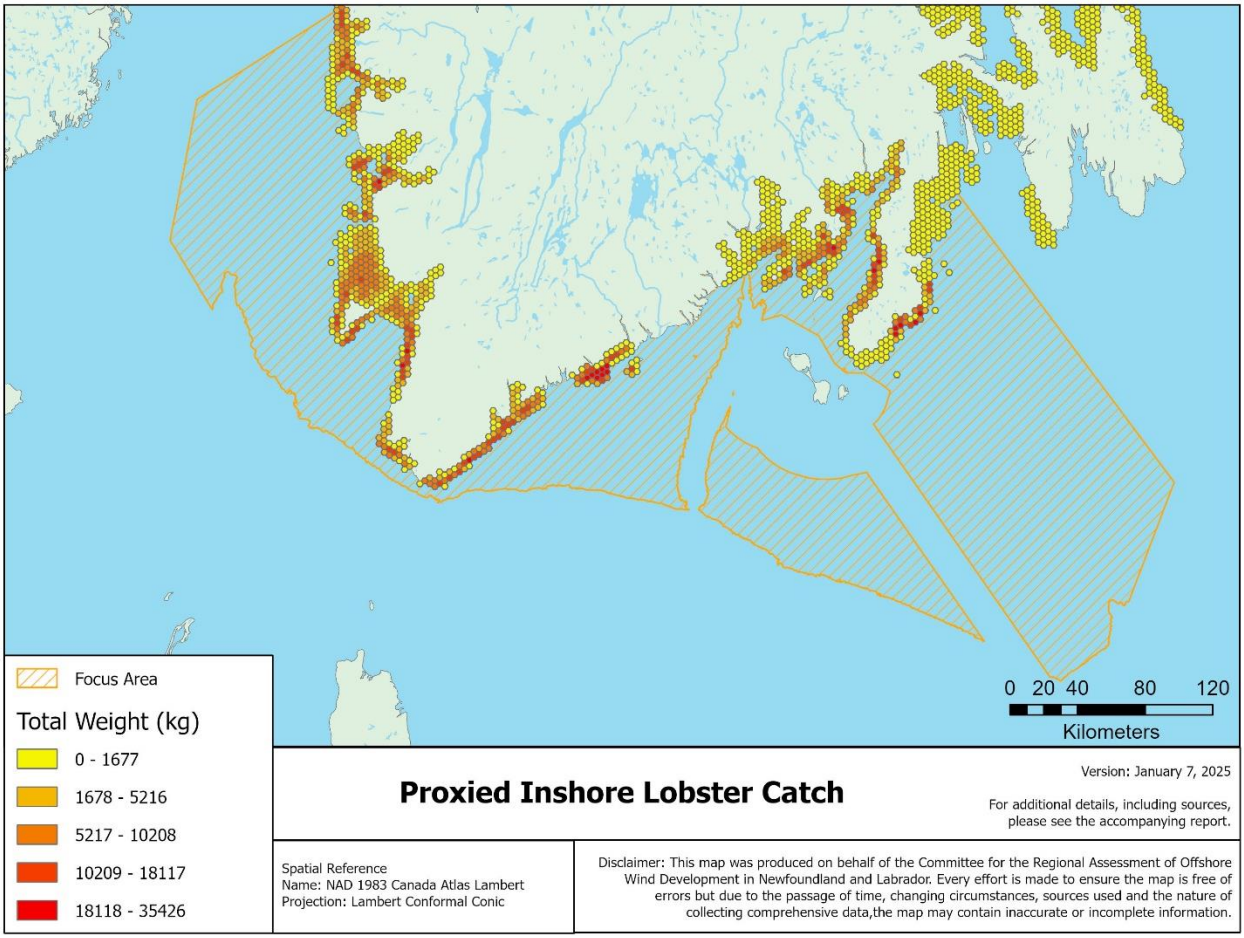


Figure Description: Map depicting proxied data for inshore lobster commercial fishing from 2010 - 2021. Lobster records are not georeferenced, so the Gulf region created a lobster proxy mapping tool, which associates each commercial lobster record with the most likely 10km² hexagon grid cell based on weighted variables. This was adopted by the Newfoundland and Labrador region and was altered to include human use, habitat, accessibility, area/location, home port distance, traditional ecological knowledge and depth. Each hexagon is the summed weight of all records associated with a hexagon. This data is based on landings data and may not include catches with cash or wharf sales, therefore some areas may be underrepresented, especially in areas where wharf sales are high. This is a general estimation on lobster harvesting patterns within the province.

Data Source: DFO, 2024s.

Northern Shrimp

The Northern Shrimp fishery, within the 4R NAFO region of the Focus Area, is known as the Esquiman or SFA 8, falling under the Estuary and GSL management region. Since this fishery began, landings in this management region have gradually increased, rising from about 1,000 tonnes at the start of the 1970s up to more than 35,000 tonnes by the end of the 2000s. At that time, landings began to fall, hitting 17,217 tonnes in 2021. Since 1982, the fishery in this region had been managed by TACs, while individual quotas have been allocated to harvesters since the 1990s. In 2020, while other areas increased their TAC, it remained the same within SFA 8 (Esquiman). Landings within SFA 8 (Esquiman) in 2021 were about 5,498 tonnes, which includes some area that is outside of the Focus Area (DFO, 2022d).

While there is some data available from Canadian multispecies randomized trawls and logbooks from the area, no assessment has been made for the 3Ps shrimp stock as it has a limited TAC. Even so, the fishery in 3Ps is considered to reflect the trend in the adjacent 3LNO portion of the SFA 7 stock, which is currently in the critical zone with no indication of recovery within the past few years and no exploitation since 2015. The fishing effort within 3Ps is concentrated within the deeper section of the Fortune Bay Channel, from off Grand bank up to almost Bay L'Argent. There is currently no information that would support any relationship between the shrimp stocks within 3Ps and 4R (GSL) (DFO, 2023p). Density of the geo-referenced Northern Shrimp fishery can be seen in Figure 7.7.26.

Figure 7.7.26. Commercial Northern Shrimp Fishery Density within the Focus Area

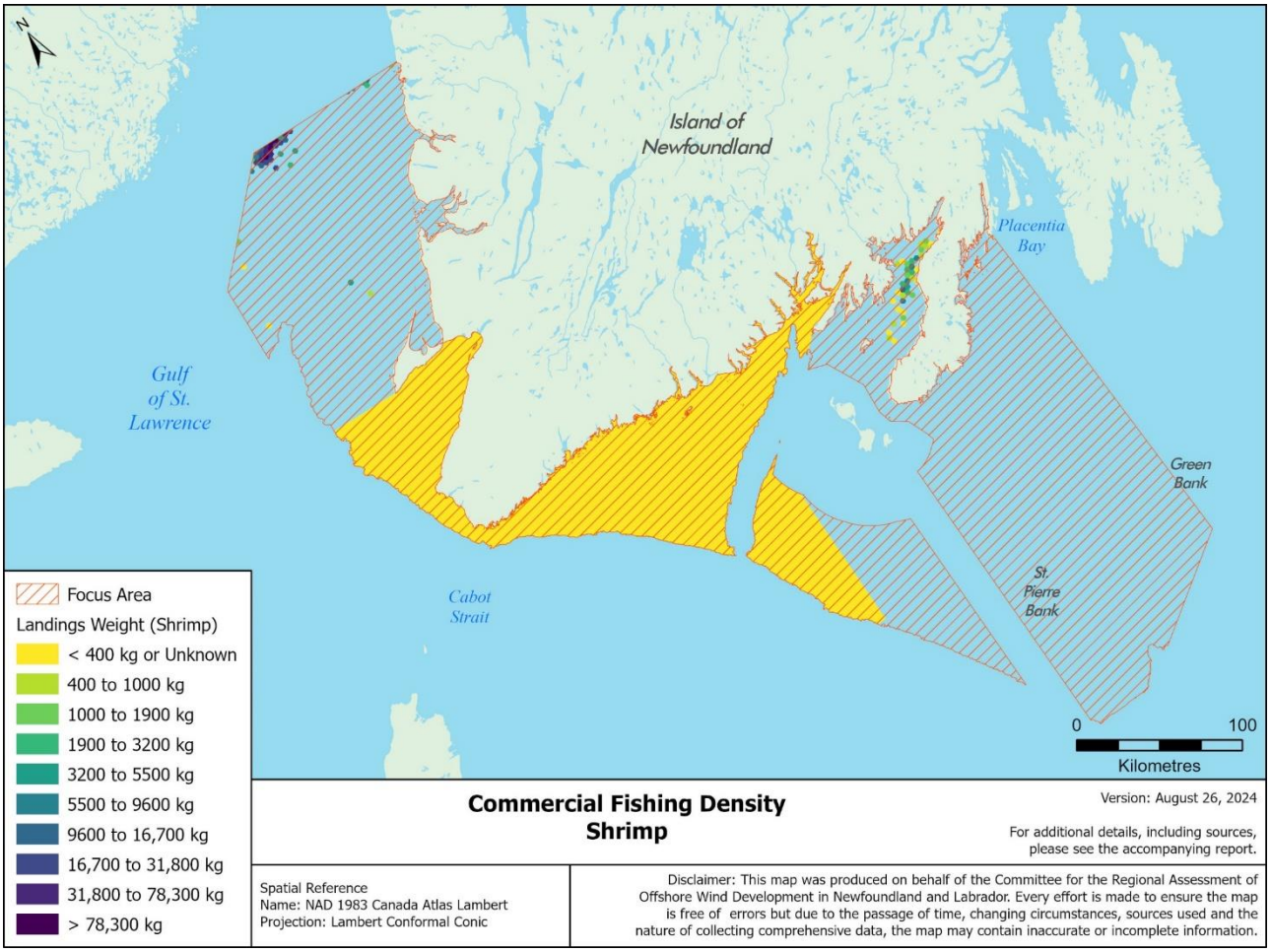


Figure Description: Map depicting northern shrimp commercial fishing density for the time period from 2012 - 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries spanning large area only shown as a single location). Some species may not include all records or locations of activity due to regional differences in mapping permissions or fishery is only partially georeferenced. Locations shown give an estimation of fishing intensity and a general idea of where species/gear type fishing occurs. Any data that contains less than five vessel IDs, licences or fishers, will appear as 'Unknown' due to privacy concerns.

Data Source: DFO, 2024j.

7.7.3.5.2 Groundfish

The Newfoundland and Labrador's groundfish fishery, notably Atlantic Cod, has been integral to the province's economy and culture for centuries. Initially, it was mainly conducted as an inshore, small vessel fishery. However, post-World War II, the larger commercial fishery emerged, employing more advanced technology and expanding geographically. This expansion led to a significant increase in groundfish landings by 1968.

Over the subsequent decades, the increase in intensive fishing practices began depleting stocks and affecting species habitat. In 1977, after Canada extended its marine jurisdiction, foreign fishing activity was restricted within its waters. Despite this, the intensive fishing and stock depletion continued. In 1992, Canada imposed a moratorium on the Cod fishery, in areas outside of the Focus Area. Additional moratoriums quickly followed for many other groundfish in 1994. Groundfish and shellfish fisheries not under moratorium became vital fisheries for the province.

Groundfish resources have increased in recent years, due to changing marine conditions, (DFO, 2021e). This trend may signal a return to a groundfish-dominated ecosystem (DFO, 2021e). DFO provided the Committee information on FSC fisheries and communal-commercial fishing licences, but due to the sensitive nature of this information, it could not be posted publicly on the Registry. The Committee has been granted permission to disclose that there are Indigenous organizations that hold Commercial Communal licences for groundfish within the Focus Area.

The tables below outlines the primary groundfish species harvested within the Focus Area, along with the notable times and locations of these activities and applicable closures (DFO, 2023p):

Table 7.7.12. Seasonal Groundfish Fishing Trends, within the Focus Area

Species	Percent of Landed Value	Month
Atlantic Cod	22	January
	12	February
	19	March – August
	10	September
	12	October
	15	November
	10	December
Atlantic Halibut	9	March
	12	May
	21	June
	18	July
	12	August
	28	January, February, April & September - December

Table Description: Table providing breakdown by groundfish species and their landed value percentage per month.

Source: DFO, 2023p.

Table 7.7.13. Groundfish Fishing Trends, within the Focus Area, based on NAFO Divisions

Species	Percent of Landed Value	NAFO Divisions
Atlantic Cod	31	3Psh
	28	3Psf
	13	3Psg
	11	3Psb
	17	Remaining Areas (4R, 3Pn)
Atlantic Halibut	21	3Psd
	18	3Psh
	13	3Psa
	10	3Pn
	38	Remaining Areas (4R)

Table Description: Table providing breakdown by groundfish species and their landed value percentage per NAFO area.

Source: DFO, 2023p.

Table 7.7.14. Applicable Commercial Groundfish Fishing Closures

Species	NAFO Area	Specific Area Description	Gear Type	Closure Period	Description
All groundfish species	3Psc	Bakers Cove to Brimstone Head	All groundfish gear	January 1 – February 28	The portion of 3Psc inside lines drawn between the following coordinates: • 47º49.747'N 54º07.386'W • 47º49.265'N 54º08.053'W
		Sound Island Point to Tobin's Point			The portion of 3Psc inside lines drawn between the following coordinates: • 47º47.322'N 54º10.033'W • 47º42.825'N 54º12.376'W
		Southern tip of Bar Haven Island to the southern tip of Ship Island			The portion of 3Psc inside lines drawn between the following coordinates: • 47º40.923'N 54º14.937'W • 47º40.342'N 54º16.967'W
		Paradise Sound			The portion of 3Psc north of a straight line defined by joining the following coordinates: • 47°29.350'N 54°29.953'W • 47°29.657'N 54°31.100'W
		Ship Island to Jigging Point			The portion of 3Psc inside lines drawn between the following coordinates: • 47º40.342'N 54º16.967'W • 47º40.342'N 54º19.128'W
	4R	Bay St. Georges and Port au Port Bay		April 1 – June 23	The portion of NAFO Division 4R near the entrance to Bay St. Georges and Port au Port Bay defined by straight lines drawn from the following coordinates: • 48°15'N 59°20'W • 49°10'N 59°20'W • 49°10'N 60°00'W

Species	NAFO Area	Specific Area Description	Gear Type	Closure Period	Description
					• 48°15'N 60°00'W • 48°15'N 59°20'W
		St. George's Bay	Trap nets	January 1 – December 31	Fishing prohibited in waters within 55 m of the shore in that part of St. George's Bay in a straight-line joining Latitude 48°08′30″N., Longitude 58°57′26″W. (Shoal Point) to Latitude 48°33′25″N., Longitude 58°43′12″W. (Gravels)
		Bay of Islands		April 15 – September 15	Fishing prohibited in waters of the Bay of Islands enclosed by the coastline and a line joining Latitude 49°06′N., Longitude 58°21′W. (Tortoise Point) to Latitude 49°04′N., Longitude 58°11′W. (Shoal Point), thence to Latitude 49°08′N., Longitude 58°09′W. (Middle Arm Point), thence to Latitude 49°11′N., Longitude 58°07′W. (North Arm Point), and thence to Latitude 49°14′N., Longitude 58°12′W. (Crab Point)
Cod	3Ps	Cod closure	Cod directed gear	Mixing Closure for all fleets: • 3Psd & 3Pse: November 15 – mid-May Spawning closure for all fleets: • All 3Ps: March 1 – mid-May	• N/A

Table Description: Table providing overview of groundfish fishery closures within the Focus Area

Source: DFO, 2023p.

Cod

Newfoundland and Labrador's Atlantic Cod fishery was historically one of the richest fishing industries in the world, which supported the intense migratory fishery that occurred since the late 15th century. For hundreds of years, cod was plentiful, and nations (mainly England, France and Spain) competed for the favorable fishing areas around the province. As the years went on, the resident population, consisting mainly of settlers from England and Ireland, were landing the majority of cod at that time, making it the main pillar of Newfoundland and Labrador's economy. After joining confederation in 1949, Newfoundland and Labrador's offshore fishing grounds once more became contentious between nations (Wright, 1998). Within 3Ps, 3Pn, and 4R(4S) from the 1960s - 1970s, this was no exception as the cod stock was heavily exploited in these areas.[116] A TAC was implemented in 1973 within 3Ps at 70,500 tonnes, while a TAC of 55,000 tonnes was set within 3Pn and 4R (4S) in 1977. Landings all around the province sharply decreased in the early 1990s, causing extreme strain to the stock due to overfishing, leading to the initiation of the moratorium in 1993 and 1994 in 3Ps and 3Pn & 4R (4S), respectively. While both areas reopened in 1997, 3Pn and 4R (4S) closed an additional two times, in 2003 and 2022. For 3Ps, when the fishery reopened, a TAC was set of 10,000 tonnes and increased to 30,000 tonnes by 1999. Since then, it steadily declined, with TACs set at 2,691 tonnes and 1,346 tonnes for the 2020-2021 and 2021-2022 management periods, respectively. For 3Pn and 4R (4S), from 2018-2021, the TAC was set at 1,000 tonnes, corresponding to the available fishing allocation of 641 tonnes. (DFO, 2023dd; Wright, 1998). From 2012-2021 within the Focus Area, the average annual landed value for cod was $1,663,600 for on average 1,100 tonnes of annual catch. Cod is also an important fishery to smaller non-georeferenced vessels, which from 2012 - 2021 brought in $2.8 million in annual landed value, a portion of which was likely caught inside the Focus Area. (DFO, 2023p). Within DFO's response to the Committee's Request for Advice, information was provided on FSC fisheries and communal-commercial fishing licences, but due to the sensitive nature of this information, it could not be posted publicly on the Registry. The Committee has been granted permission to disclose that there are Indigenous organizations that hold FSC and Commercial Communal licences for Atlantic cod within the Focus Area. Within MFN's *Comments on the Regional Assessment of Offshore Development*, MFN identified the south coast of Newfoundland as a principal area of concern, due to the Commercial Communal Fishery that takes place in these waters and represents one of MFN's largest sources of own-source revenue. For cod, NFL, holds a quota of 577,626 lbs in 2024 (Miawpukek First Nation, 2024).

Through engagement, the Committee received information that all of 3Ps and St. Pierre Bank is a historical and important spawning ground for cod, with stocks at an all time low within 3Ps, but an all-time high within 3Pn. Density of the geo-referenced cod fishery can be seen in Figure 7.7.27.

[116] Reports and data that includes the NAFO division 4R, also includes 4S, which is outside of the Focus Area.

Figure 7.7.27. Commercial Atlantic Cod Fishery Density within the Focus Area

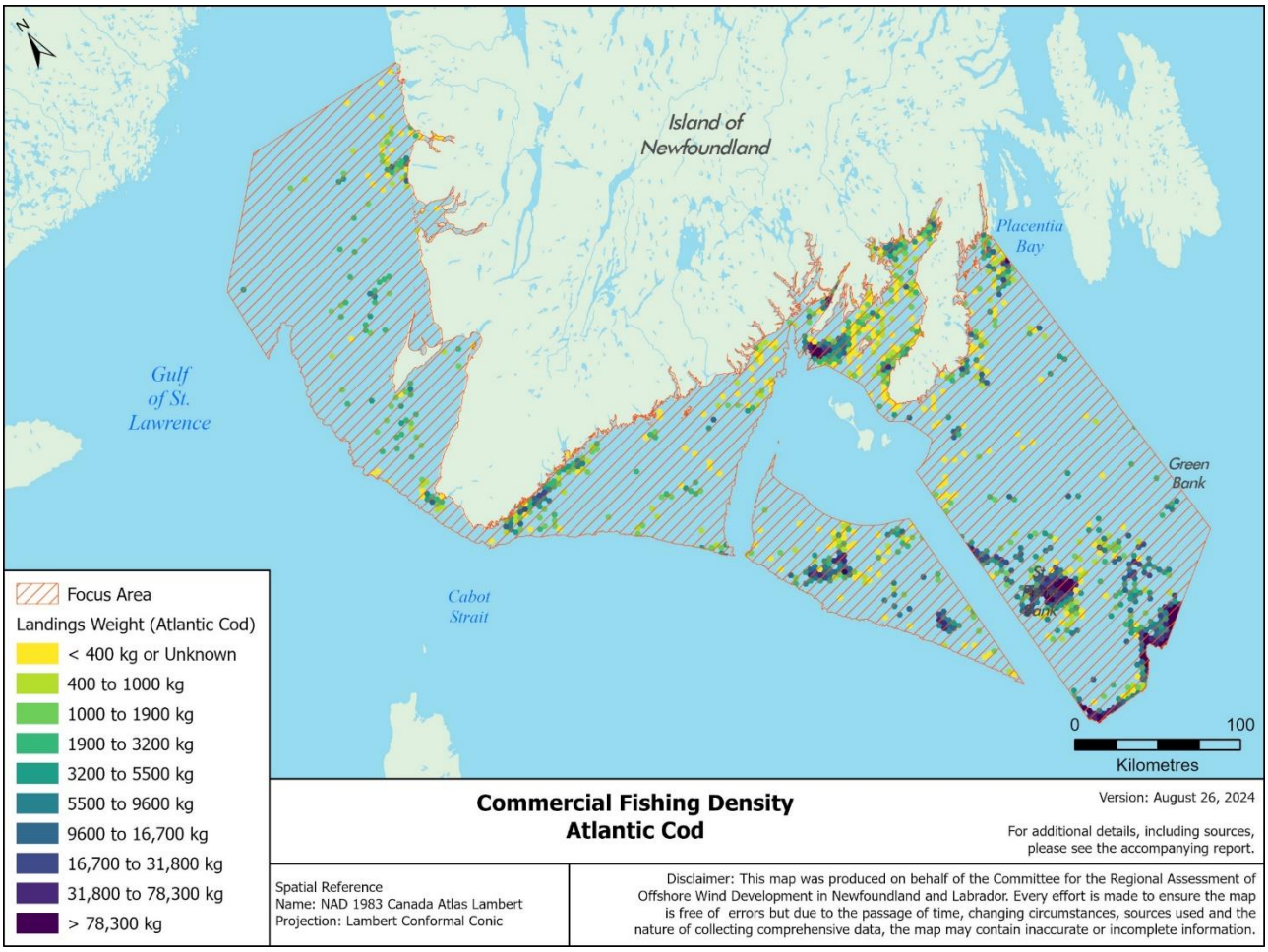


Figure Description: Map depicting Atlantic cod commercial fishing density for the period 2012 - 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries spanning large area only shown as a single location). Some species may not include all records or locations of activity due to regional differences in mapping permissions or fishery is only partially georeferenced. Locations shown give an estimation of fishing intensity and a general idea of where species/gear type fishing occurs. Any data that contains less than five vessel IDs, licences or fishers, will appear as 'Unknown' due to privacy concerns.

Data Source: DFO, 2024j.

Halibut

The south coast Newfoundland Atlantic Halibut fishery occurs within 3Ps, within the larger fishery management unit of 3NOPs4VWX5Zc along the Scotian Shelf and southern Grand Banks. Within this broader area, the fishery was unregulated until 1988, when a TAC was set at 3,200 tonnes. In 1994, management plans and licence conditions were implemented, requiring the release of any halibut that was less than 81 cm. The TAC was continuously reduced until 1999, where it then increased to 1,000 tonnes as

recommended by the Fisheries Resource Conservation Council. The TAC then continued to be increased several times throughout the 2000s (DFO, 2015a; 2018b; 2023u).

The Atlantic halibut fishery that occurs within the GSL and surrounding areas, is assessed on areas 4RST.[117] This fishery began at the end of the 1800s, with it first being exploited by American and Canadian fleets in the early 1900s. In the second half of the 1900s, landings began to decline as the fishery was being exploited by Canadian fishers from the Atlantic provinces and Quebec, with 650 tonnes during the 1960s down to 91 tonnes in 1982. Landings began to increase from the 1990s onward, and as of 2023, ended up at the highest level ever recorded in the past 60 years at 1,500 tonnes. In 1988 a TAC was first introduced, along with a minimum legal size being introduced in 1997. The fishery is usually performed with longlines under a competitive management regime or by individual transferable quota (DFO, 2023t). Between 2012-2021, the small vessel fishery for Atlantic halibut averaged $2.7 million of annual income within the Focus Area (DFO, 2023p). Within Fisheries and Oceans response to the Committee's Request for Advice, information was provided on FSC fisheries and communal-commercial fishing licences, but due to the sensitive nature of this information, it could not be posted publicly on the Registry. The Committee has been granted permission to disclose that there are Indigenous organizations that hold Commercial Communal licences for Atlantic halibut within the Focus Area. Density of the geo-referenced halibut fishery can be seen in Figure 7.7.28.

[117] For the purposes of this Regional Assessment, 4R is the only NAFO area partially within the Focus Area.

Figure 7.7.28. Commercial Atlantic Halibut Fishery Density within the Focus Area

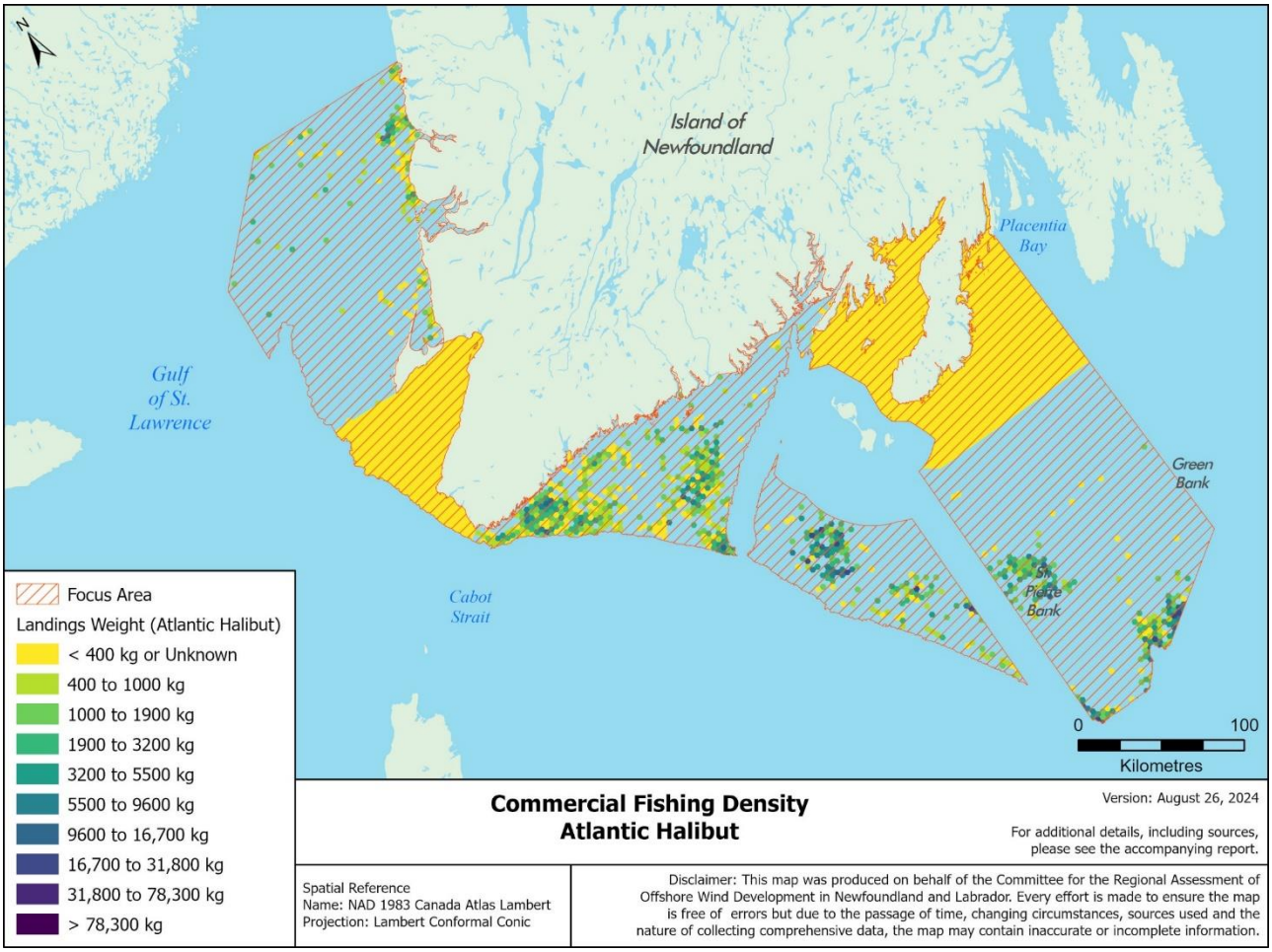


Figure Description: Map depicting Atlantic Halibut commercial fishing density for the time period from 2012 - 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries spanning large area only shown as a single location). Some species may not include all records or locations of activity due to regional differences in mapping permissions or fishery is only partially georeferenced. Locations shown give an estimation of fishing intensity and a general idea of where species/gear type fishing occurs. Any data that contains less than five vessel IDs, licences or fishers, will appear as 'Unknown' due to privacy concerns.

Data Source: DFO, 2024j.

Greysole/Witch Flounder

The commercial fishery for Witch Flounder (also known as Greysole) grew in popularity once otter trawling began in Newfoundland and Labrador in the 1940s. When stocks began to decline in the 1940s in Fortune Bay (3Ps), Danish seiners began to move over to St. George's Bay (4R). This began a small fishery within the area in the summer, with offshore, winter catches gaining importance as bycatch within cod and redfish fisheries. In the 1970s, it then expanded into the Esquiman Channel and northern shores of Cape Breton

Island. There is limited current information on the fishery within 4R but in 1997, the quota was set at 1,000 tonnes for the 4RST area (DFO, 1998).

The Witch Flounder fishery in 3Ps is divided into inshore and offshore operations, utilizing Danish seines and otter trawls, respectively. Historically, the Witch Flounder fishery within 3Ps ranged from 500 - 1,500 tonnes between the 1970s and the early 1990s and from 200 - 600 tonnes from the mid 1990s - 2017. From 2014 - 2017, annual landings averaged around 472 tonnes, with a TAC set at 650 tonnes. This was an increase from the previous three-year period, where landings reached a historical low, averaging about 196 tonnes. While the size composition of the commercial catch remained consistent between 2014 and 2016, since 2014 there has been no commercial sampling from the Danish seine fishery, therefore the most current size composition data is derived solely from the otter trawl fishery (DFO, 2018e). Density of the geo-referenced Greysole/Witch Flounder fishery can be seen in Figure 7.7.29.

Figure 7.7.29. Commercial Greysole/Witch Flounder Density within the Focus Area

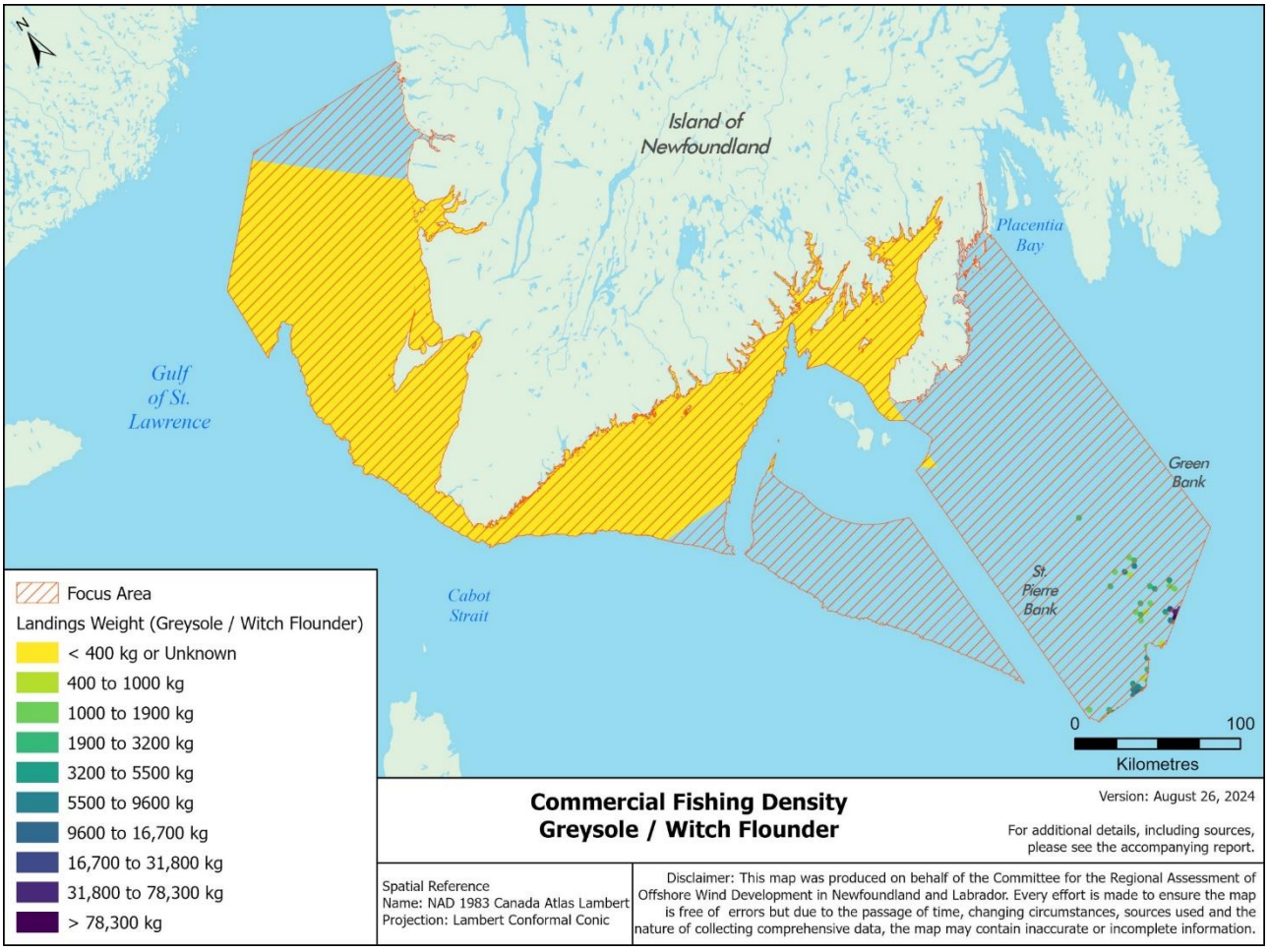


Figure Description: Map depicting Greysole/Witch Flounder commercial fishing density for the time period from 2012 - 2022 within the Focus Area Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing

event (i.e., fisheries spanning large area only shown as a single location). Some species may not include all records or locations of activity due to regional differences in mapping permissions or fishery is only partially georeferenced. Locations shown give an estimation of fishing intensity and a general idea of where species/gear type fishing occurs. Any data that contains less than five vessel IDs, licences or fishers, will appear as 'Unknown' due to privacy concerns.

Data Source: DFO, 2024j.

Turbot/Greenland Halibut

Within the GSL (NAFO Divisions 4RST), Greenland Halibut, or turbot, was primarily bycatch from shrimp or groundfish fisheries until the mid 1970s. While there is no specific breakdown for TAC within 4R that falls within the Focus Area, after the specific gillnet fishery commenced for Greenland halibut in 1977, a TAC was established at 7,500 tonnes in 1982 for the entirety of 4RST. Peak landings were seen in 1979 and 1987 at 8,000 tonnes, but then steep decline in landings followed in the early 1990s. The TAC was fixed at 4,500 tonnes as of the 2004-2005 management year, with the fishing allocation being completely fished until 2011 - 2012, but then declined in the years after. This resulted in a lower fishing allocation being set at 3,751 tonnes in 2017 - 2018. It was again gradually reduced until 2021 - 2022, and then adjusted to 2,400 tonnes for the 2022 - 2023 season, while under the harvest control rule. The fishing allocation for Greenland Halibut is divided between Quebec and Newfoundland, with only 18% given to Newfoundland and Labrador fleets. As of January 2023, the Newfoundland fixed gear fleet landed 37% of their respective fishing allocation for 2022 - 2023. There has been a decrease in active fish harvesters for Greenland Halibut in Newfoundland, due to participation in more lucrative fisheries, the increasing cost of fuel and the fisheries management measures in place. Measures include:

- Imposition of minimum mesh size of 152 mm.
- Minimum Greenland halibut size of 44 cm (small fish protocol).
- Newfoundland harvesters are allowed a maximum of 90 gillnets.
- Harvesters are required to complete a logbook.
- Harvesters are required to have their catch weighed at dockside.
- Harvesters must agree to take an at-sea observer at the request of DFO for 5 - 15% of trips, depending on the fleet.
- In Newfoundland VMS systems are not required for the entire fleet; and
- Newfoundland harvesters are under a competitive regime (DFO, 2023cc).

Density of the geo-referenced turbot/Greenland Halibut fishery can be seen in Figure 7.7.30.

Figure 7.7.30. Commercial Turbot/Greenland Halibut Density within the Focus Area

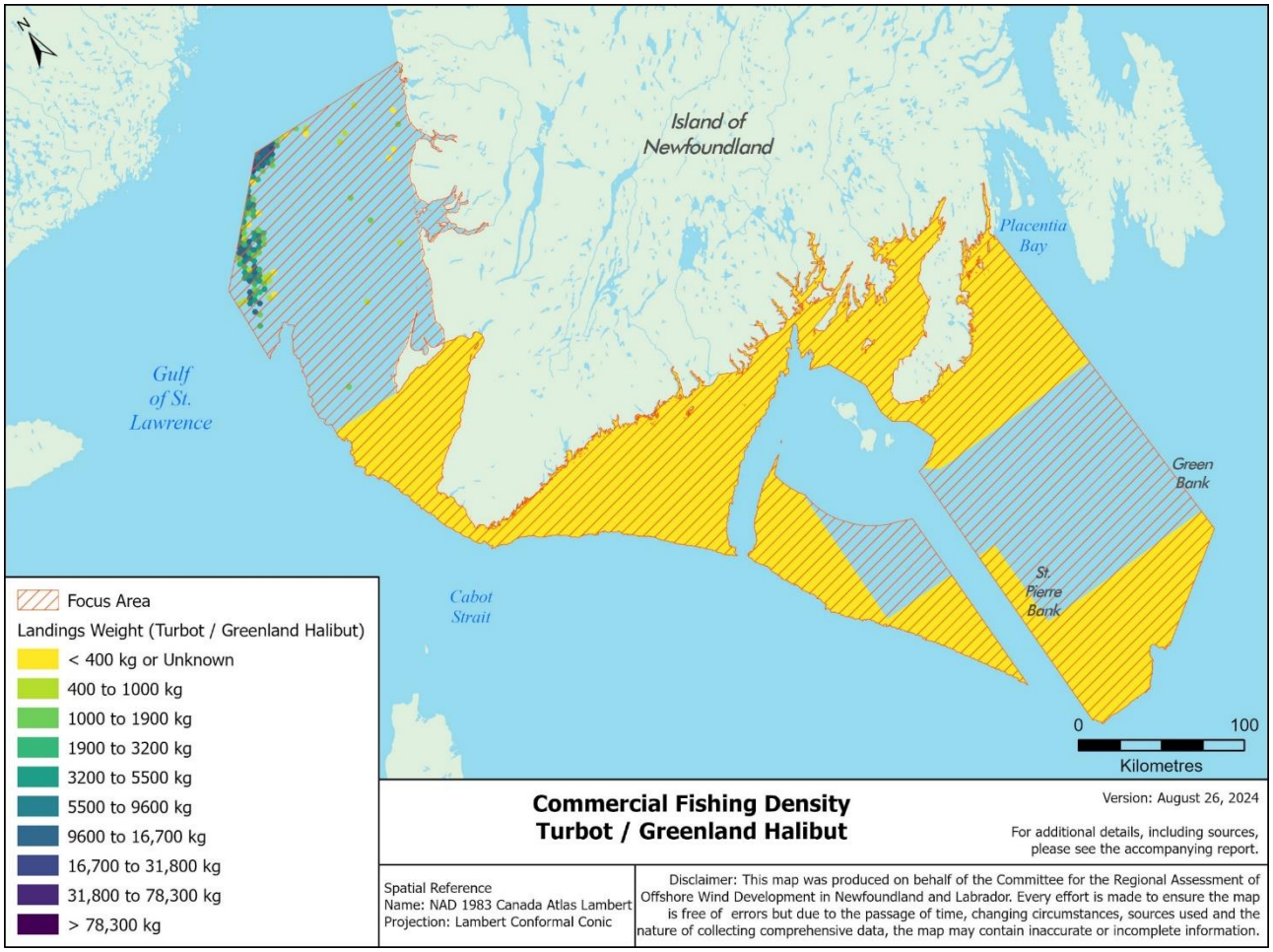


Figure Description: Map depicting turbot/Greenland Halibut commercial fishing density for the time period from 2012 - 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries spanning large area only shown as a single location). Some species may not include all records or locations of activity due to regional differences in mapping permissions or fishery is only partially georeferenced. Locations shown give an estimation of fishing intensity and a general idea of where species/gear type fishing occurs. Any data that contains less than five vessel IDs, licences or fishers, will appear as 'Unknown' due to privacy concerns.

Data Source: DFO, 2024j.

Redfish

The redfish fishery was first developed in the late 1950s. In 1993, management units were redefined resulting in Unit 1 (4RST and 3Pn4Vn from January - May) and Unit 2 (3Ps4Vs, 4Wfgj, and 3Pn4Vn) and Unit 3.[118] In 1993, the TACs for redfish were set at 60,000 tonnes

[118] Unit 3, does not fall within the Focus Area, so it will not be included in this discussion.

for Unit 1 and 28,000 tonnes for Unit 2. Due to a decrease in stock levels, a fishing ban was imposed in Unit 1 in 1995, although commercial fishing persisted in Unit 2. In 1999 a quota of 2,000 tonnes per year was introduced for an index fishery in Unit 1. The TAC for Unit 2 has been gradually reduced since 1993, and since 2006 it has been set at 8,500 tons annually for the commercial fishery. Landings peaked in the 1970s and early 1990s at 130,000 tonnes and 100,00 tonnes, respectively. After the moratorium in 1995, landings have remained below the TACs, which averaged around 500 - 1,000 tonnes in the early 2000s (DFO, 2022j). Within DFO Newfoundland and Labrador Region's response to the Committee, they indicated that there is currently an experimental redfish fishery on the west coast of Newfoundland to determine the viability of a commercial fishery and if it does open, it would potentially increase redfish catch within the Focus Area (DFO, 2023p). Therefore, while the above information on TACs and landings overlaps areas with the Focus Area, they may not be completely accurate to the entire Focus Area. Within DFO's response to the Committee's Request for Advice, information was provided on FSC fisheries and communal-commercial fishing licences, but due to the sensitive nature of this information, it could not be posted publicly on the Registry. The Committee has been granted permission to disclose that there are Indigenous organizations that hold FSC licences for redfish within the Focus Area. Density of the geo-referenced redfish fishery can be seen in Figure 7.7.31.

Figure 7.7.31. Commercial Redfish Density within the Focus Area

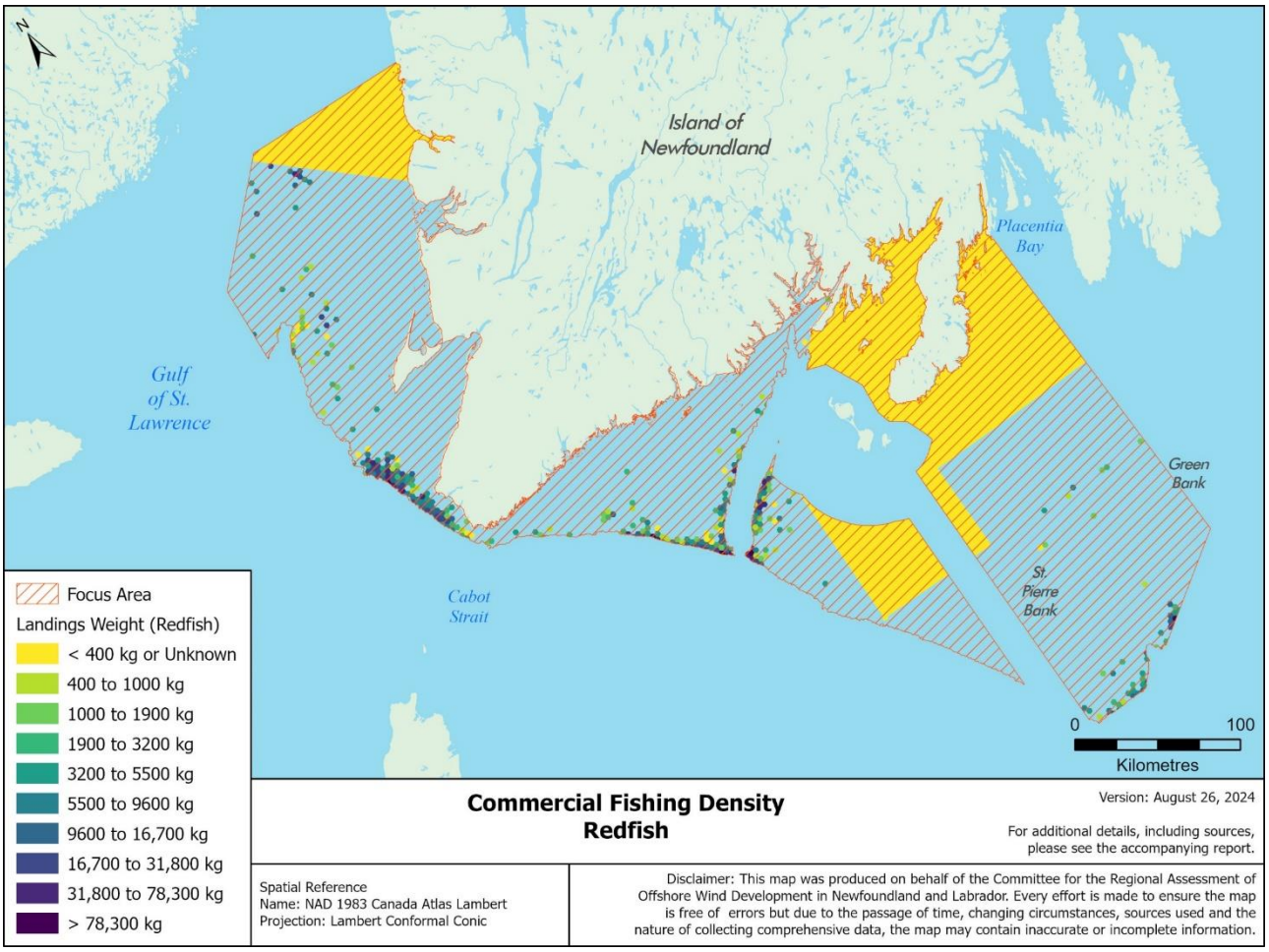


Figure Description: Map depicting redfish fishing density for the time period from 2012 - 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries spanning large area only shown as a single location). Some species may not include all records or locations of activity due to regional differences in mapping permissions or fishery is only partially georeferenced. Locations shown give an estimation of fishing intensity and a general idea of where species/gear type fishing occurs. Any data that contains less than five vessel IDs, licences or fishers, will appear as 'Unknown' due to privacy concerns.

Data Source: DFO, 2024j.

American Plaice

From 1968 to 1973 within 3Ps, annual catches of American Plaice stock peaked, with three years surpassing 12,000 tonnes. Since 1977, the fishery has been conducted solely by Canada and France. During the 1980s, catches averaged just under 4,000 tonnes but saw a sharp decline after 1991. A moratorium on American Plaice has been in place since September 1993, with subsequent catches occurring as bycatch in other fisheries. Following 1995, bycatch volumes rose significantly, reaching over 1,000 tonnes annually

between 2001 and 2003. Catches have since decreased, remaining below 200 tons in all years except for 2017 since 2011. Most bycatch of American Plaice occurs from the cod fishery, and a small percentage from the Witch Flounder fishery. Due to the timing of the assessment in 2019, the total annual catch at that time was estimated based on the percentage of the year's catch up to October compared to the previous three years (DFO, 2020b). Due to lack of availability of data for density for commercial fishery of American Plaice, the presence of this species is indicated in Figure 7.7.32 below.

Figure 7.7.32. American Plaice Presence within the Focus Area

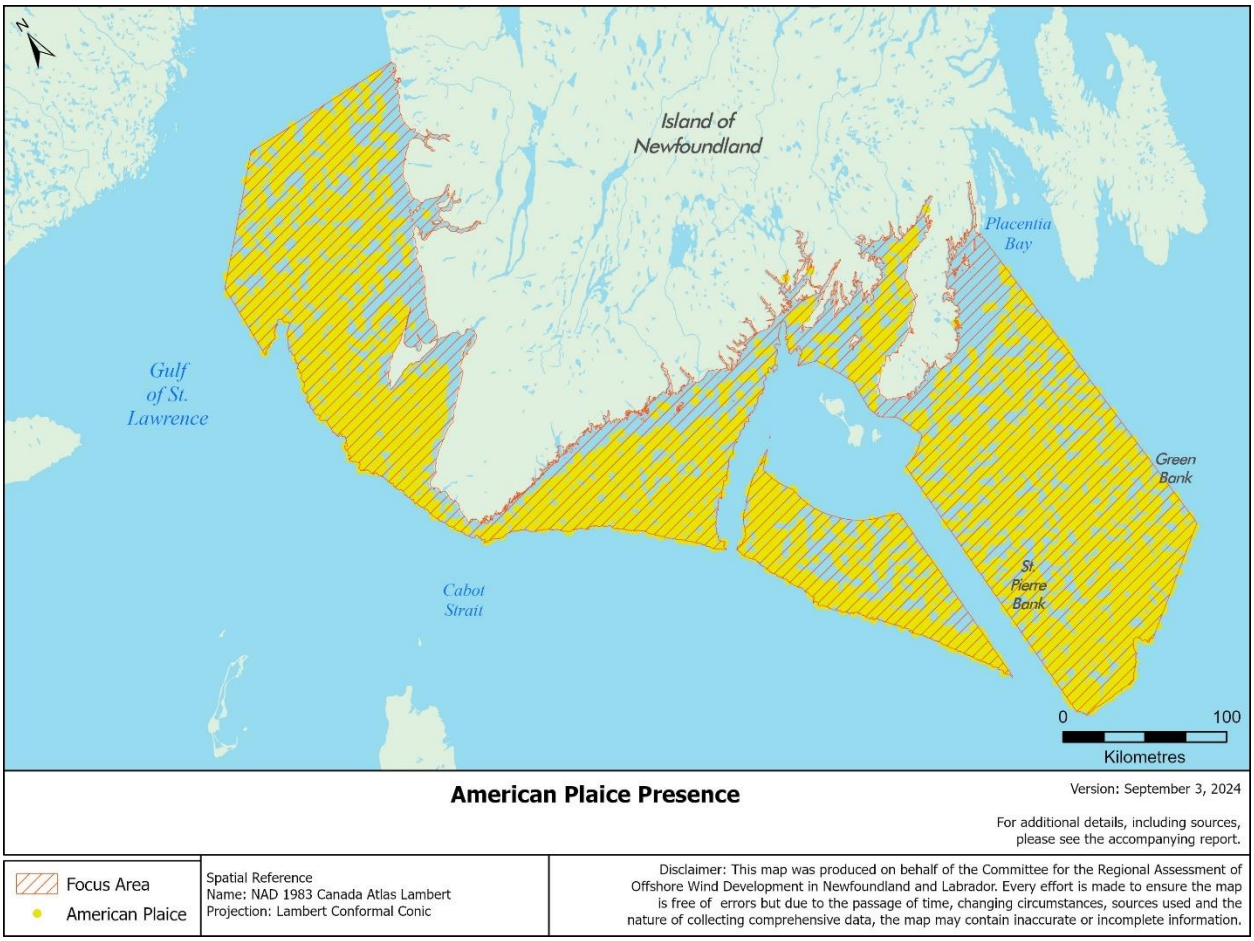


Figure Description: Map depicting American Plaice presence within the Focus Area. Since this fishery is not geo-referenced, indicating the presence of American plaice may aid in showing approximate areas where this fishery may occur.

Data Sources: DFO, 2024f; OBIS, 2024

7.7.3.5.3 Pelagics

On the western coast of Newfoundland, the pelagic fishery is more prominent than other fisheries that Newfoundland is known for (e.g., shrimp and crab). Fisheries data used in the Strategic Environmental Assessment Update for Western Newfoundland and Labrador

indicated that in terms of harvest by weight; herring, mackerel, and Capelin made up the majority of landings within the region (AMEC, 2014). Larger pelagic species such as tuna do not appear to be harvested, other than a small area of activity on the St. Pierre Bank.

The tables below outline Herring harvested within the Focus Area, along with the notable times and locations of these activities and applicable closures.

Table 7.7.15. Pelagic Fishing Trends, within the Focus Area, throughout the season

Species	Percent of Landed Value	Month
Herring	37	November
	40	December
	23	Remaining Season
Capelin	100	All Year
Mackerel	Moratorium 2022-Present	N/A until fishery re-opens

Table Description: Table providing breakdown by pelagic species and their landed value percentage per month.

Source: DFO, 2023p.

Table 7.7.16. Pelagic Fishing Trends, within the Focus Area, based on NAFO Divisions

Species	Percent of Landed Value	NAFO Division
Herring	68	4Rb
	18	4Rc
	13	4Rd
Capelin	Unknown*	3Psn
		4R
Mackerel	Moratorium 2022-Present	3Psn
		4R

Table Description: Table providing breakdown by pelagic species and their landed value percentage per NAFO area.

* Breakdown of percentage of landed value was not provided.

Source: DFO, 2023p.

Table 7.7.17. Applicable Commercial Pelagic Fishing Closures

Species	NAFO Area	Specific Area Description	Gear Type	Closure Period	Description
Herring	4R	Bay of Islands Salmon Migration Protection Closure	Fixed gear: • Seine (Barr) • Gillnets • Trap nets	• Seines (Barr): Year-round • Gillnets/trap nets: April 1 – December 31	Prohibited fishing in the portion of Herring Fishing Area 13 referenced as the inner portion of the Bay of Islands (North Arm, Humber Arm, York Harbour, and Lark Harbour): • inside of a straight line drawn from Crabb Point • to North Arm Point • to Middle Arm Point • to Peter Point, Woods Island • to Shoal Point • to Fleming Point. (4R south)
		Flat Bay Spawning Closure		Year-round	Prohibited fishing in the portion of Herring Fishing Area 13: • inside of a straight line drawn from Indian Head, Port Harmon South (48°30'N, 58°31'W. • to Harbour Point, Flat Island (48° 27'27" N, 58°29' 18"W), and • includes all of the waters of Flat Bay
		Bay St. George Spring Spawner Area	All herring mobile gear		Prohibited fishing in the portion of Herring Fishing Area 13 (Bay St. George) inside of the 50-fathom contour, from a line drawn from Cape Ray to Cape St. George (4R south).
		Port au Port Bay Spring Spawner Area			Prohibited fishing in the portion of Herring Fishing Area 13 (Port au Port Bay) inside of a line drawn from Long Point, Port au Port Peninsula to Bluff Head (4R south).
	4R (Herring Fishing Area 14)	St. Paul's Inlet	Any gear	February 1 – December 31	Prohibited fishing in the waters of St. Paul's Inlet in Herring Fishing Area 14 lying inside of the Highway 430 bridge.

Species	NAFO Area	Specific Area Description	Gear Type	Closure Period	Description
	3Ps	N/A	Mobile gear	April 15 – December 31	Prohibited fishing in waters of Fortune Bay, in Herring Fishing Area 11, lying in a straight line joining: • Latitude 47° 34′ 59″ N., Longitude 55° 05′ 10″ W. (Faria Head) to • Latitude 47° 30′ 01″ N., Longitude 55° 02′ 12″ W. (Big Head).
Herring (for bait purposes)	3Pn	N/A	N/A	Year-round	To help protect migrating salmon, the following areas are closed: • The portion of Herring Fishing Area 12 defined as follows: o Channel – Port aux Basques area: inside a line drawn from the breakwater near Graveyard Point (47° 34' 23.56" N, 59° 7' 45.66" W) to Channel Head Lighthouse (47° 33' 59.96 " N, 59° 7' 18.97" W), and outside of a straight line drawn from Point 1 at shore (47° 34' 1.67" N, 59° 7' 29.33" W) and Point 2 at Channel Head Island (47° 33' 59.14" N, 59° 7' 26.64" W). • The portion of Herring Fishing Area 12, known as Shark Cove, defined as follows: o Shark Cove area (near Harbour LeCou): inside a line drawn from Shark Cove North (47° 37' 35.83" N, 58° 40' 8.68" W) to Shark Cove South (47° 37' 31.17" N, 58° 39' 52.62" W).
Mackerel	4R	Bay of Islands Annual Salmon	Fixed Gear: • Gillnets	June 15 – July 28	If using fixed gear, fishers are not permitted to fish in the inner portion of the Bay of Islands (North Arm, Humber Arm, York Harbour and Lark Harbour) inside

Species	NAFO Area	Specific Area Description	Gear Type	Closure Period	Description
		Migration Closure	• Handlines • Traps		and shoreward of a straight line connecting the following points: • Crabb Point (49 degrees 14 minutes North, 58 degrees 12 minutes West), to • North Arm Point (49 degrees 11 minutes North, 58 degrees 07 minutes West), to • Middle Arm Point (49 degrees 08 minutes North, 58 degrees 09 minutes West), to • Peter Point, Woods Island (49 degrees 05 minutes North, 58 degrees 10 minutes West), to • Shoal Point (49 degrees 04 minutes North, 58 degrees 11 minutes West), to Fleming Point (49 degrees 07 minutes North, 58 degrees 21 minutes West).
		Fox Island River Annual Salmon Migration Closure			Prohibited from fishing in a specific area within Mackerel Fishing Area 13: • near Fox Island River, inside a straight line from Road Point (48°55' N, 58°32' W), • north to position 48°43.392' N, 58°39.634' W and the area within one nm seaward of that line. (4R south)
		Serpentine River Annual Salmon Migration Closure			Prohibited from fishing in a specific area within Mackerel Fishing Area 13: • near Serpentine River, inside a straight line from Rope Cove (48°55' N, 58°32' W), • north to Coal River Head (48°58' N, 58°31' W) and • the area within one nm seaward of that line. (4R south)

Species	NAFO Area	Specific Area Description	Gear Type	Closure Period	Description
		Cape Ray to Cape St. George Annual Salmon Closure			Prohibited from fishing in a specific area within Mackerel Fishing Area 13: • from a line drawn due west of Cape Ray, north to a line drawn due west of Cape St. George
		The Arches to Cliffy Point Annual Salmon Migration Closure		June 15 – August 1	Prohibited from fishing in a specific section of Mackerel Fishing Area 14: • inside a straight line drawn from The Arches (50°06'N; 57°40'W) • to Cliffy Point (50°12'N; 57°37'W) and within 1 nm seaward of the line. (4R north)
		Bonne Bay Annual Salmon Migration Closure			Prohibited from fishing in a specific section of Mackerel Fishing Area 14 known as Bonne Bay: • inside a straight line drawn from Western Head (49°33'N; 58°02'W) to Lobster Cove Point (49°36'N; 57°58'W) (4R north)
Capelin	4R	Bay of Islands Annual Salmon Migration Closure	Fixed gear: • Seines (Barr) • Gillnets • Trap nets	Year-round	Prohibited from fishing in a portion of Capelin Fishing Area 13, inside of a straight line drawn from: • Crabb Point (49°14'N, 58°12'W) to • North Arm Point (49°11'N, 58°07'W) to • Middle Arm Point (49°08'N, 58°09'W) to • Peter Point, Woods Island (49°05'N, 58°10'W) to Shoal Point (49°04'N, 58°11'W) to Fleming Point (49°07'N 58°21'W)

Table Description: Table providing overview of pelagic fishery closures within the Focus Area.

Source: DFO, 2023p.

Herring

The southeast coast of Newfoundland, 3Ps, has historically been one of the primary herring fishing areas in the province since at least the 1940s, supporting both commercial food and bait fisheries. For the bait fishery, harvesters are allowed to use gillnets. Herring caught is used for other commercial fisheries (lobster and Snow Crab) and is not allowed to be sold if caught for bait purposes. While annual herring landings averaged around 30,000 tonnes from 1945 - 1950, they declined by 1,000%, with less than 3,000 tonnes annually, due to worsening market conditions in the early 1950s and 1960s. Soon after, an extensive purse seine fishery started along the southwest coast of the Island of Newfoundland, which then extended into the waters of the southeast coast. In the 1970s the stocks in the southeast waters were placed under quota management, while the inshore gears were placed under quota management in the 1980s. The TAC levels for herring divided into three categories, each with individual quotas: mobile gear greater than 55 feet, mobile gear less than 55 feet and fixed gear. (DFO, 2021f). Within DFO's response to the Committee's Request for Advice, information was provided on FSC fisheries and communal-commercial fishing licences, but due to the sensitive nature of this information, it could not be posted publicly on the Registry. The Committee has been granted permission to disclose that there are Indigenous organizations that hold FSC and Commercial Communal licences for herring within the Focus Area. Density of the geo-referenced Atlantic Herring (*Clupea harengus*) fishery can be seen in Figure 7.7.33.

Figure 7.7.33. Commercial Atlantic Herring Fishery Density within the Focus Area

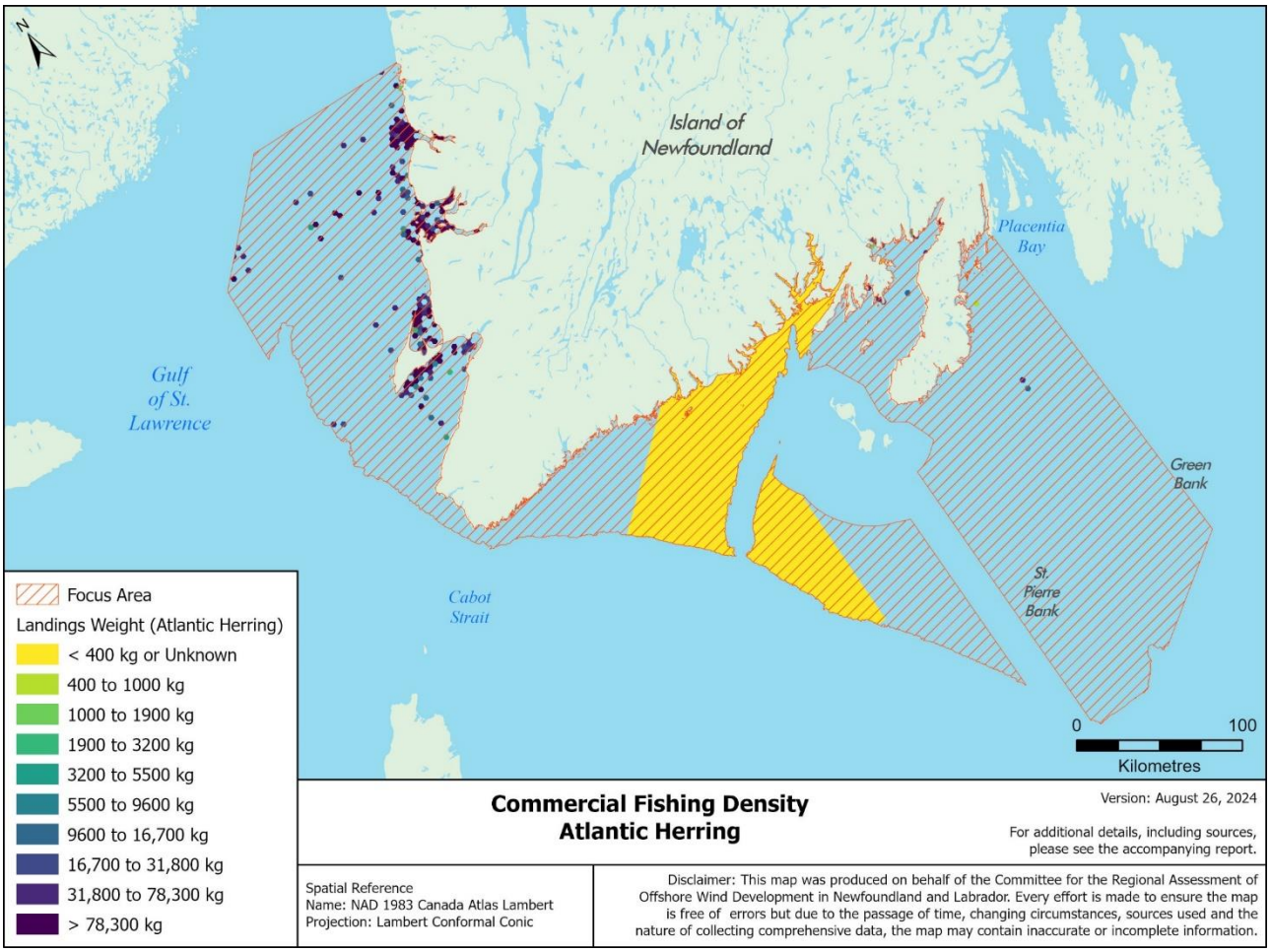


Figure Description: Map depicting Atlantic Herring fishing density for the time period from 2012 - 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries spanning large area only shown as a single location). Some species may not include all records or locations of activity due to regional differences in mapping permissions or fishery is only partially georeferenced. Locations shown give an estimation of fishing intensity and a general idea of where species/gear type fishing occurs. Any data that contains less than five vessel IDs, licences or fishers, will appear as 'Unknown' due to privacy concerns.

Data Source: DFO, 2024j.

Capelin

Historically, the Capelin fishery started as a domestic fishery, with an estimated harvest of 25,000 tonnes for spawning capelin across the province. Capelin provided food, bait and fertilizer for locals. In the late 1970s to early 1980s, a small number of fish harvesters began fishing Capelin for commercial purposes, with an increased demand of exporting mature females to Asian markets, through the seiner and trap fisheries. In the past the males were either released or used as fishmeal or fertilizer, but they are now marketed as a food fishery or sold to zoos or marine parks in the U.S. or China. Within 4R, the Capelin

fishing season is relatively short as it corresponds to the pre-spawning period for the seine fishery and with the spawning period for the trap and weir fisheries. The fishery is also managed by a TAC since 1999 and has been shared throughout the different fleets of the GSL and the Estuary. Within the Focus Area, 4R and 3Pn are included in this sharing arrangement as outlined in Table 7.7.18

Table 7.7.18. Capelin Sharing Arrangements in the Estuary and Gulf of St. Lawrence Region

NAFO Division/Capelin Fishing Area	Gear	Type of Quota	Sharing Arrangement (%)*
4R (CFA 12[119]-14)	Fixed gear	Competitive	37.82
	Mobile gear <65’	Individual	24.15
	Mobile gear ≥65’	Competitive	24.15

Table Description: Table outlining sharing arrangement for Capelin TAC within the regions that fall into the Focus Area

* Percentages may not add to 100, based on information referenced.

Source: DFO, 2022e.

While 3Pn is included within the Integrated Fisheries Management Plan for Divisions 4RST, is it has never been included in the stock assessment (DFO, 2022e). Within DFO’s response to the Committee’s Request for Advice, information was provided on FSC fisheries and communal-commercial fishing licences, but due to the sensitive nature of this information, it could not be posted publicly on the Registry. The Committee has been granted permission to disclose that there are Indigenous organizations that hold FSC and Commercial Communal licences for Capelin within the Focus Area. Density of the geo-referenced Capelin fishery can be seen in Figure 7.7.35.

[119] CFA 12 includes NAFO Division 3Pn.

Figure 7.7.35. Commercial Capelin Fishery Density within the Focus Area

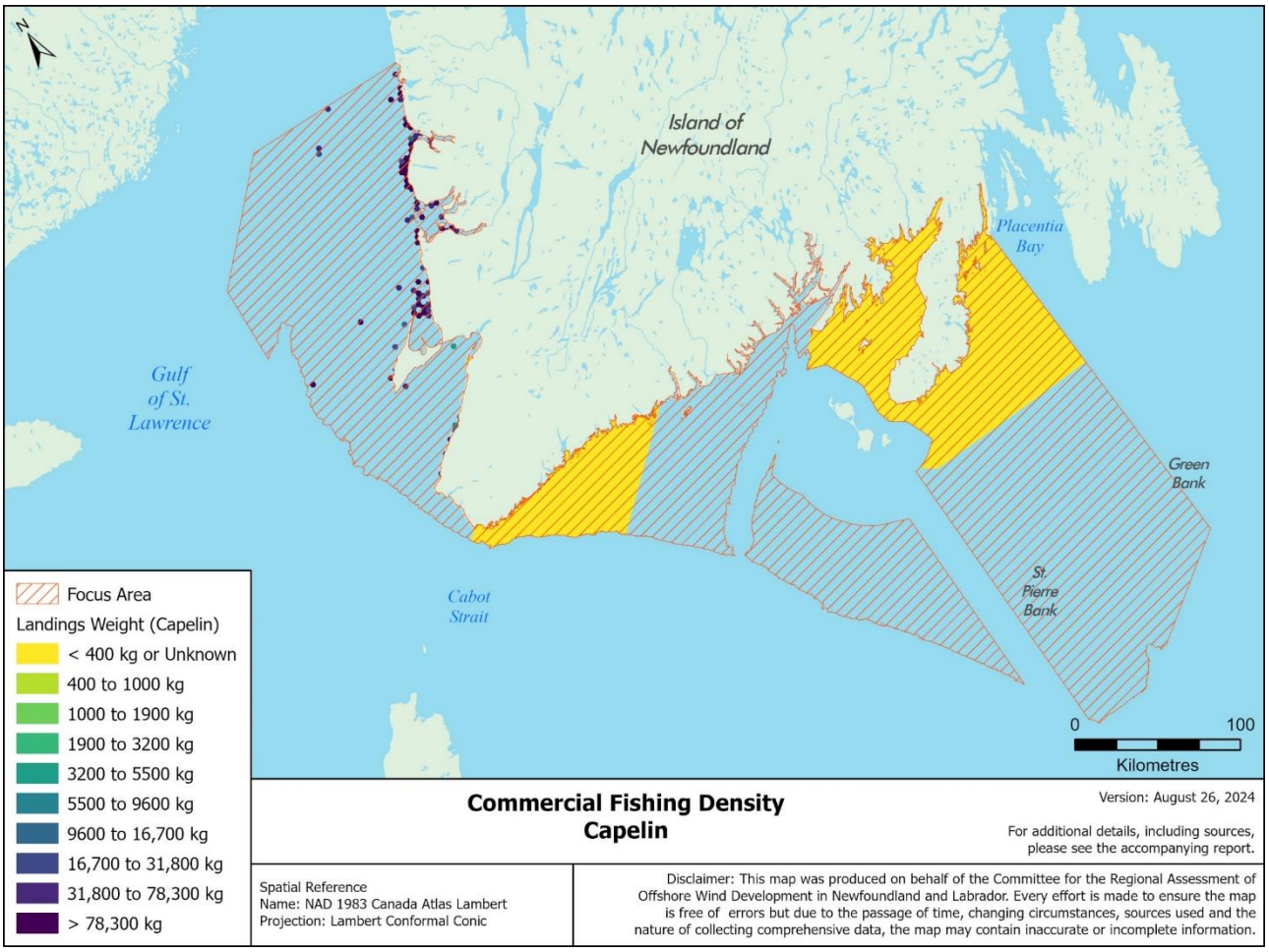


Figure Description: Map depicting Capelin fishing density for the time period from 2012 - 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries spanning large area only shown as a single location). Some species may not include all records or locations of activity due to regional differences in mapping permissions or fishery is only partially georeferenced. Locations shown give an estimation of fishing intensity and a general idea of where species/gear type fishing occurs. Any data that contains less than five vessel IDs, licences or fishers, will appear as 'Unknown' due to privacy concerns.

Data Source: DFO, 2024j.

Mackerel

Historically, the mackerel fishery in North America began in the 1600s, but landings only began to be regularly recorded in the early 1800s. After improved salting methods began to be utilized, the Atlantic mackerel food fishery grew rapidly, and transitioned from the use of beach seines, nets and hand lines to purse seines. A peak in landings in Canada and the U.S. of around 106,000 tonnes was recorded in 1884 but then catches started to decline near the end of the 1800s as American vessels were denied access to Canadian waters. The 1920s saw increased catches due to advancements in power-driven mobile gear. From

1961 - 1978 foreign fleets, primarily Eurasian countries, fished extensively in 3Ps (subareas 4,5 and 6), reaching up to 420,000 tonnes in 1973. However, after the establishment of 200 nm exclusive economic zones by the U.S. and Canada, foreign access was restricted, leading to a decline in catches, although France (St. Pierre & Miquelon) remains the only foreign fleet in subdivision 3 and 4. Canadian catches were stable in the 1980s and 1990s, averaging around 22,000 tonnes per year then reached a peak at 55,726 tons in 2005 before declining sharply to 4,272 tons in 2015. This drop, accompanied by poor recruitment and the loss of older mackerel, continued with landings of 9,679, 10,905, 8,628, 7,835 and 4,326 tonnes, respectively from 2017 - 2021. In recent years, the TACs continued to decline, as from 2017 - 2018 they were 10,000 tonnes, then from 2019 - 2020, they were reduced to 8,000 tonnes. In 2021, a 50% reduction was seen when the TACs was reduced to 4,000 tonnes. In response to declining stock status, commercial and bait fisheries were closed in 2022 following a stock assessment indicating the mackerel had declined into the critical zone. The fishery involves hundreds of fishers using various gear types, with Newfoundland and Labrador becoming the dominant region since 2000. The shift from gillnets and traps to seiners has marked the recent catch methods. Mackerel also holds cultural significance for Indigenous communities in Atlantic Canada, who have commercial and communal fishing licenses (DFO, 2022h). Within DFO's response to the Committee's Request for Advice, information was provided on FSC fisheries and communal-commercial fishing licences, but due to the sensitive nature of this information, it could not be posted publicly on the Registry. The Committee has been granted permission to disclose that there are Indigenous organizations that hold FSC and Commercial Communal licences for mackerel within the Focus Area.

Figure 7.7.36. Commercial Mackerel Fishery Density within the Focus Area

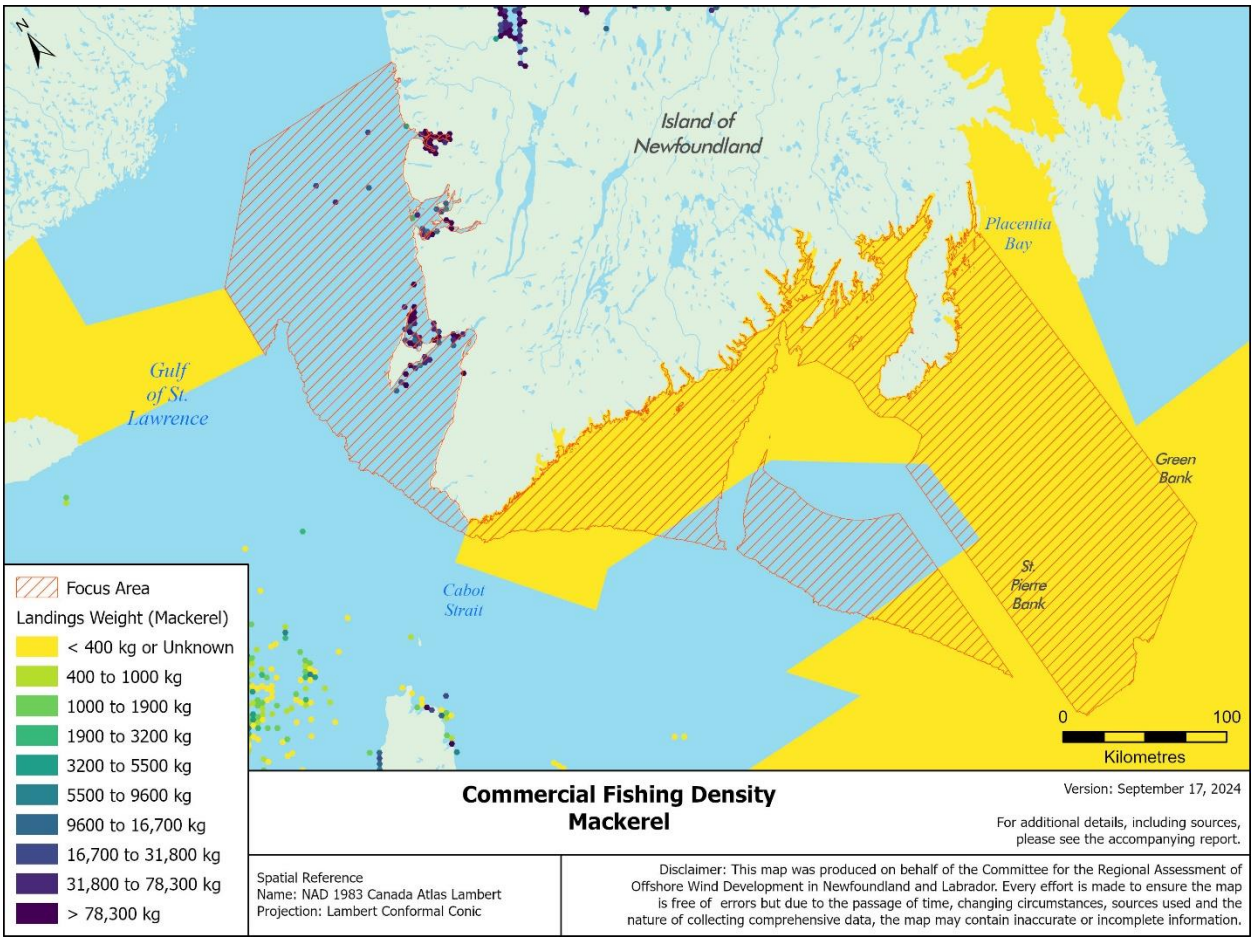


Figure Description: Map depicting mackerel fishing density for the time period from 2012 - 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries spanning large area only shown as a single location). Some species may not include all records or locations of activity due to regional differences in mapping permissions or fishery is only partially georeferenced. Locations shown give an estimation of fishing intensity and a general idea of where species/gear type fishing occurs. Any data that contains less than five vessel IDs, licences or fishers, will appear as 'Unknown' due to privacy concerns.

Data Source: DFO, 2024j.

7.7.3.6 Sea Cucumber

The Sea Cucumber fishery is mainly a commercial fishery but is also accessible for scientific and research purposes. There is currently no recreational or an Indigenous FSC Sea cucumber fishery in the Newfoundland and Labrador region. In 2003, interested fish harvesters in 3Ps applied to participate in a Joint Project Agreement with DFO, the Government of Newfoundland and Labrador's Department of Fisheries and Agriculture and the industry, under eight exploratory licences. This started in 2004 and was an exploratory fishery and resource survey that lasted five years, which collected data on Sea Cucumber distribution on the St. Pierre Bank. Data was used to estimate biomass and evaluate the potential for a commercial fishery. In 2012, the Sea Cucumber fishery officially transitioned to a commercial fishery. The tables below outline Sea Cucumber harvested within the Focus Area, along with the notable times and locations of these activities and applicable closures.

Table 7.7.19. Sea Cucumber Fishing Trends, within the Focus Area, throughout the season

Species	Percent of Landed Value	Month
Sea Cucumber	26	July
	33	August
	23	September
	18	Remaining Season

Table Description: Table providing breakdown by pelagic species and their landed value percentage per month.

Source: DFO, 2023p.

Table 7.7.20. Sea Cucumber Fishing Trends, within the Focus Area, based on NAFO Divisions

Species	Percent of Landed Value	NAFO Division
Sea Cucumber	40	3Psd
	40	3Psg
	20	Remaining 3Ps areas

Table Description: Table providing breakdown by pelagic species and their landed value percentage per NAFO area.

Source: DFO, 2023p.

Table 7.7.21 Applicable Commercial Sea Cucumber Fishing Closures

Species	NAFO Area	Specific Area Description	Gear Type	Closure Period	Description
Sea Cucumber	3Ps	St. Pierre Bank	Drag	Year-round	Areas specifically closed to fishing sea cucumber on the St. Pierre bank: • Portion lying west of 56° 28' W longitude, the Western Cucumber area.

Table Description: Table providing overview of pelagic fishery closures within the Focus Area.

Source: DFO, 2023p.

The Sea Cucumber fishing area on the St. Pierre Bank is split into two zones, the Western and Eastern Beds, located northwest and southeast of the French Exclusive Economic Zone, respectively, as seen in Figure 7.7.34.

Figure 7.7.34. Sea Cucumber Fishing Areas

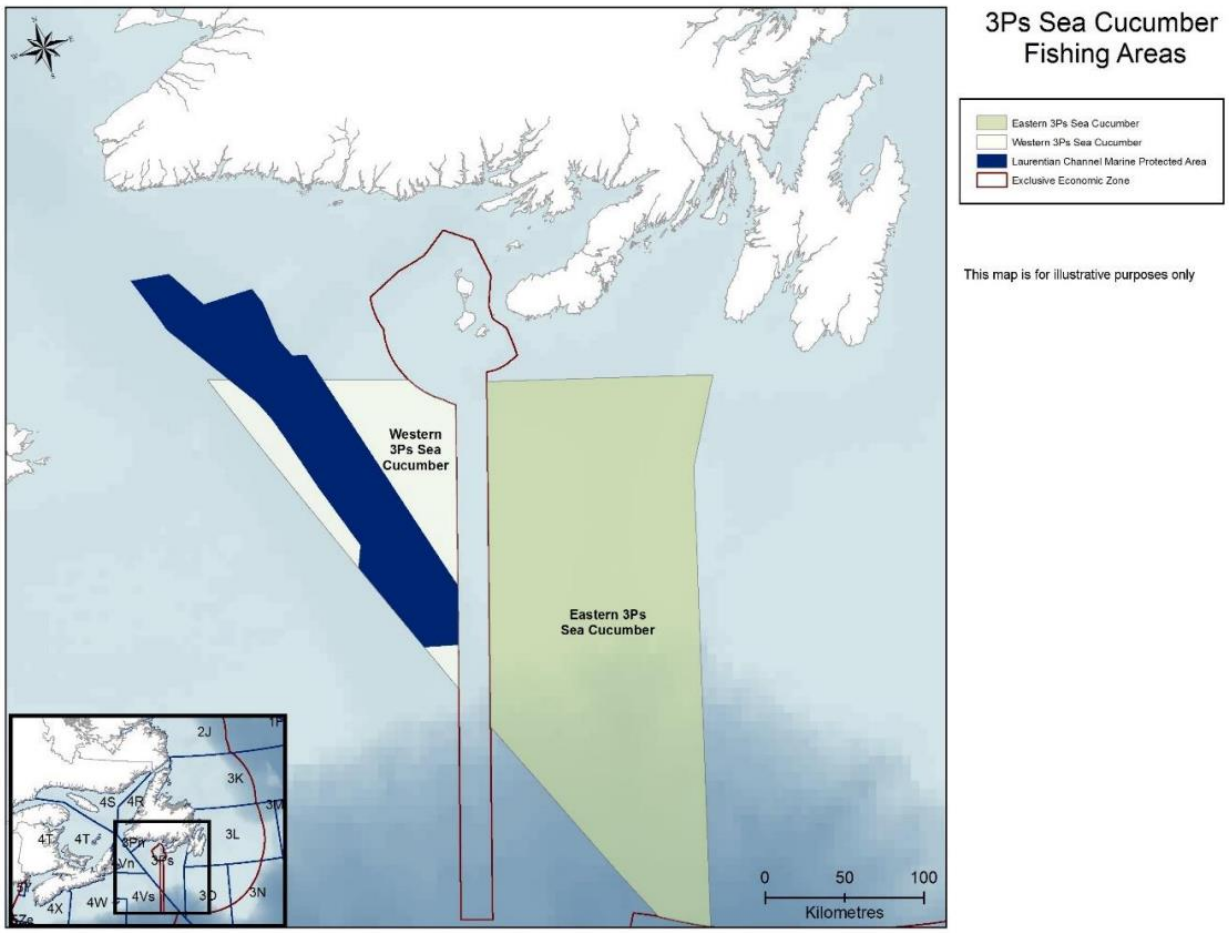


Figure Description: Map provided by DFO outlining the Sea Cucumber Western and Eastern 3PS fishing areas. The off-white area is the Western area, the green is the Eastern area, while the blue is the Laurentian Channel MPA.
Data Source: DFO, 2024q.

When the fishery opened a TAC of 2,242 tonnes was initially set for the Western Bed of the St. Pierre Bank, and a total of nineteen commercial fishing licences were issued: eight to the initial exploratory licence holders, one to MFN, and ten to a list of eligible participants from a public draw process. These licence holders were required to hold the licence for a minimum of two years before they would be eligible for reissuance and each holder was permitted to harvest 118 tonnes annually. The Eastern Bed was closed until 2017, in an act of conservation until the effects of fishing could be fully assessed. In 2017, when the Eastern Bed fishery opened, a TAC of 3,773 tonnes was set, while the Western Bed remained unchanged since 2013 at 2,242 tonnes (DFO, 2017b; 2019d). As of 2023, the TAC for the entire area was set at 6,959 tonnes, until 2027 (DFO, 2023aa). Within DFO's response to the Committee's Request for Advice, information was provided on FSC fisheries and communal-commercial fishing licences, but due to the sensitive nature of this information, it could not be posted publicly on the Registry. The Committee has been

granted permission to disclose that there are Indigenous organizations that hold Commercial Communal licences for Sea cucumber within the Focus Area. Within MFN's *Comments on the Regional Assessment of Offshore Development*, MFN identified the south coast of Newfoundland as a principal area of concern, due to the Commercial Communal Fishery that takes place in these waters and represents one of MFN's largest sources of own-source revenue. For Sea cucumber, NFL, holds a quota of 2,340,000 lbs in 2024 (Miawpukek First Nation, 2024). Due to sea cucumber fisheries data not being geo-referenced, presence of Sea cucumber can be seen within the Focus Area in Figure 7.7.35.

Figure 7.7.35. Sea Cucumber Presence within the Focus Area

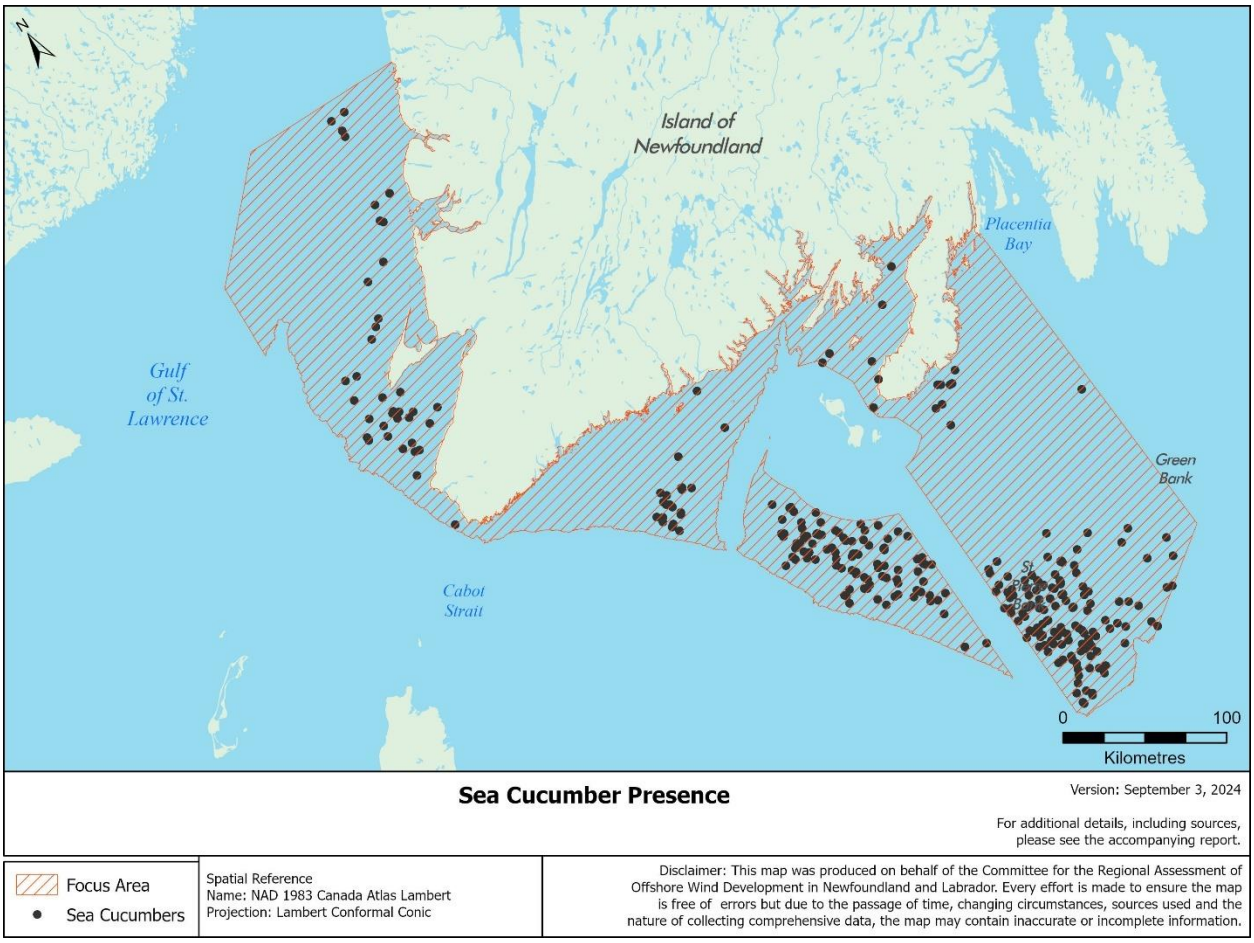


Figure Description: Map depicting Sea Cucumber presence within the Focus Area. Since this fishery is not geo-referenced, indicating the presence of Sea cucumber may aid in showing approximate areas where this fishery may occur.

Data Sources: DFO, 2024f; OBIS, 2024.

7.7.4Potential Effects

The development of offshore wind developments can have a range of direct and indirect effects on fisheries. Direct effects include physical alterations to the environment, such as installation of turbines and associated infrastructure, while indirect effects, such as disruption to fish behaviour and the creation or destruction of habitats, and alter fishing grounds. Understanding this range of impacts is crucial for balancing the offshore wind industry with the sustainability of marine resources and fishing livelihoods. Some effects are outlined below and further described in Table 7.7.22.

While it is understood that effects from offshore wind development on other components have indirect effects on fisheries, those specific effects on those components can be found in Table 7.7.22 below.

Table 7.7.22. Potential indirect effects caused by or affecting Fisheries

Component	Indirect Effects	Section
Marine Mammals and Sea Turtles	Impacts to prey-predator interactions, behaviours, distribution, abundance, health, and ecosystem.	7.5.2
Marine Fish and Fish Habitat	Impacts to commercial fishing economy through changes to prey-predator interactions (bottom-up and top-down), behaviours, distribution, abundance, health, and ecosystem of commercial species.	7.4.2
Physical and Cultural Heritage	Impacts to culturally important and historic areas from offshore wind farm locations and displacement of navigational routes or fishing areas.	7.11.2
Communities and Economy	Impacts to fishers' communities and their economies.	7.13.2

Table Description: Table depicting indirect effects of other components that are caused by or affect Fisheries.

7.7.4.1 Displacement of Fisheries

As offshore wind developments start to take up space in the marine environment, fishing grounds, both recreational and commercial, start to have more competing uses within these spaces. While this can vary based on jurisdiction, as in Belgium, access to offshore wind developments is prohibited for all vessels (excluding maintenance or research vessels), rendering fishing grounds inaccessible. While in the United Kingdom, fishing vessels may navigate through offshore wind developments, and may passively fish within these areas, but then results in additional safety concerns and lack of insurance to cover damages to vessels or gear in these areas. Similarly in the Netherlands, they first did not

allow fishing vessels within offshore wind development areas, but then after additional research and collaboration, they altered regulations to allow some types of fishing and for vessels to navigate through these areas. A reduction (or exclusion) of fishing activity within offshore wind development areas can lead to a spatial redistribution of fishing efforts, potentially leading to additional competition within the fishing industry, resulting in potential decreases in revenue and also compounding additional pressures on previously less impacted sensitive marine habitats (Gill et al., 2020; Chaji & Werner, 2023).

7.7.4.2 Collisions, Allisions, Gear Loss or Damage

The additional infrastructure that offshore wind developments impose on the marine environment pose further risks to fishing vessels, including potential collisions, allisions with turbine structures, and gear loss or damage due to interactions with the associated cables. Due to the increase of vessel traffic in the surrounding areas of an offshore wind development, this then increases the chances of collision of fishing vessels with other vessels and turbines. Studies on vessel collisions or allisions within offshore wind developments found a moderate increase in collisions (~12%) and a small increase in groundings (~0.4%) based on over a year of vessel traffic along the Atlantic coast. However, when models were created depicting vessel traffic at that time, including rerouting to avoid development areas, it found that vessels were forced seawards by the wind farms, therefore showing smaller increases in vessel collisions or allisions (Silva et al, 2022).

The most common interaction of fishing and submarine cables is with mobile gear, with fixed gear instances being less likely (Silva et al., 2022). In the U.K., while the use of fixed gear is allowed within all developments, there are instances, such as in Northern Ireland, where fishers will not fish in these areas due to safety and gear loss concerns. It has been found that gear such as otter trawls, beam trawls, scallop dredges, gill nets and demersal longlines (any gear with weighted nets, chain bags, or lines) presents the most significant risk to trawlers, as the gear may snag cables or cable armour, endangering the vessel and its crew. Fishers have also experienced losing their gear through these snags, and therefore will stay away from turbine structures (Silva et al., 2022)

7.7.4.3 Navigational Issues

Navigational issues for fishers in offshore wind developments present significant challenges. The impact on vessel traffic varies by location due to specific traffic management measures and local constraints. Additionally, vessel radar systems, which help fishers navigate in various conditions, may experience interference from offshore wind developments depending on factors such as turbine size, array layouts, number of turbines, construction materials, and vessel types. Generally, fishing and vessel traffic are prohibited in offshore wind developments, reducing the available fishing area and creating navigation barriers. Although Navigational Risk Assessments are conducted during the planning phases of offshore wind development, these assessments are often predictive models with limited understanding of post-construction risks, particularly for fishing vessels with gear in the water (European Marine Spatial Plan Platform, n.d.-b); Silva et al.,

2022). In the United Kingdom, while navigation of fishing vessels and passive fishing within developments is permitted, it is not yet common practice due to barriers related to safety concerns, lack of insurance coverage for damages to gear or vessels, and insufficient cooperation and knowledge exchange between sectors (Gill et al., 2020).

Table 7.7.23. Impact Pathways and Effects of Offshore Wind Development on Fisheries

Project Phase	Effects
Collisions, allisions, and gear loss or damage	
Operation and Maintenance	• Potential collisions, allisions, and gear loss or damage from gear caught on offshore wind turbine foundations, subsea cabling, scour protection or with support vessels. Fishers are also concerned with the risk of a vessel breakdown within an offshore wind farm and colliding with a turbine. • Fishers have expressed concern on fishing within offshore wind farms due to the risk of entanglement or collision with offshore wind infrastructure, cabling or debris. • If offshore wind turbine foundations and subsea cables are not properly installed or buried, fishing gear with weighted nets, chain bags, or lines such as otter trawls, beam trawls, scallop dredges, gillnets, and demersal longlines can become lost or damaged if snagged on any scour protection • Floating cables and anchors, depending on water depth, type of mooring system and other factors, when connected to floating offshore wind farms may present obstacles to safe vessel operations and fishing methods • In some literature, it was suggested that fishing and recreational vessel anchors may not be as likely to penetrate the seabed to the depth of cable burial depth or cause problems with cable protection measures, due to their size.
Malfunctions and Accidents	• With the increase in space taken by offshore wind farms and increase in marine traffic and ship size, the safety risk is heightened due to limited available fairways. This could cause collisions between offshore wind turbines and ships, or vessel-on-vessel collisions.
Navigational Difficulties	
Operations and Maintenance	• Wind farm maintenance can cause disruption to fishing activities and an increase in steaming distances to fishing grounds in instances where fishers have full access to the offshore wind farm sites. • Wind farm maintenance work was cited as causing disruption to fishing operations within and around wind farms. Conflict with offshore wind maintenance vessels, excessive area closures for maintenance work, and poor communication between fishermen and maintenance vessel operators was reported by fishermen. Fishermen complained about the increased steaming distance and time to fishing grounds beyond the offshore wind farm.

	• Lighting used on offshore wind turbines can affect fishing vessel navigation. • Due to additional transit time to avoid offshore wind turbines, fishers could experience an increase in fuel consumption & expenditures. • The cost of vessel insurance could increase due to the additional navigational hazards that offshore wind farms could impose. • Developments could become no-go areas, which can provide resource or habitat enhancements, by protecting spawning and rearing areas, or redistribution.
Fishing Displacement	
Operations and Maintenance	• Fishers may lose access to current or historic fishing grounds if exclusion zones are applied, or there may be restrictions on types of gear that can be used within the footprint of the development. Reduction of fishing activities within offshore wind developments can lead to a spatial redistribution of fishing activities to areas outside the wind farm, causing additional and more concentrated stress of all ocean users into other areas. • Offshore wind farms can cause fishing displacement, overcrowding in remaining areas, property loss or damage, which directly impacts fishers' revenues, overall income and livelihood.
Indirect Effects	
Pre-construction/Construction & Decommissioning	• Site surveys (multi-beam, side-scan sonar, seismic, etc.) can affect marine life, causing displacement of species (due to species behaviour change and other stresses) hence influencing location of fisheries. • Presence of larger vessels and other equipment during construction may create additional noise and vibration, electromagnetic fields and cause disturbance of the seabed, impacting marine life, and therefore the fishing grounds. • Seafloor preparation, foundation installation, vessel anchorage and cable installation can alter the benthic habitat and displace marine communities, which could displace fisheries or decrease fish stocks. • Installation of foundations, through pile driving or other methods that cause vibration, increase underwater sounds levels, causing issues to fish and marine mammals. • Presence of foundations and scour protection could act as an artificial reef, providing additional habitats for species.
Operations and Maintenance	• Exclusion zones may influence changes in seafloor communities (specifically benthic), which is also known as the fisheries exclusion effect.

	• Uncertainty over juvenile populations of fish species will continue to inhabit areas where turbine foundations are located, while fish species that prefer rocky habitats inhabit these structures, creating artificial reefs. These tradeoffs are still unclear whether this creates a positive or negative effect for fisheries.
Malfunctions and Accidents	• Cable failures may affect the reef effect of subsea floating and buried cables, impacting fish populations, which could then affect fisheries catch and location. • During installation, there is the chance that there could be an accidental release of chemicals and hydrocarbons, which could affect commercial fish species.

Table Description: Table depicting impact pathways and effects of offshore wind development phases and accidents on fisheries.

Sources: Andersson et al., 2017; Bat et al., 2013; BOEM, 2022b; Bonsu et al., 2024; Chaji & Werner, 2023; CSA Ocean Sciences Inc., 2021; 2023; De Backer et al., 2019; Farr et al., 2021; Gray et al., 2016; Hooper et al., 2015; Lipsky et al., 2016; Methratta et al., 2020; Mooney et al., 2010; Munroe et al., 2022; Murawski et al., 2005; NYSERDA, 2017c; b; 2022; Stanley et al., 2017; Svendsen et al., 2022; Raghukumar et al., 2023; van Hoey et al, 2021; Weigell & Jahn, 2022; Wysocki et al., 2006.

7.7.5Mitigation and Other Measures

Effective mitigation strategies are essential in addressing potential impacts to all components. When addressing fisheries mitigations, distributional, procedural and recognitional justice dimensions should be considered. Distributional justice can be achieved through proper siting, while procedural and recognitional justice would be through employment opportunities, inclusion of the fishing industry during project planning phases, adequate communication through all stakeholders throughout each phase of development and the use of fisheries working groups (Whitouck et al., 2023). In the U.K., it is a legal requirement for stakeholder engagement, with fishers in Belgium, Netherlands and Britain that have indicated that they had been engaged for each individual wind farm project that were set to occur in the North Sea, North Western Water and South Western Waters (BOEM, 2022b). Another mitigation utilized in the North Sea is the co-location of fisheries, which highlights the need for early involvement of fishers within offshore wind development processes, while considering important spawning areas for commercial species, while also including negotiations for compensation for disruption and displacement of the fishing industry. While passive fishing is allowed within offshore wind farms in the U.K. and studies show positive effects on crab abundance around turbines, there are still uncertainties related to the safety and liability concerns on fishing within these areas (Pettersen et al., 2024). Table 7.7.24 outlines the various mitigation measures that can be used to address various potential impacts.

Table 7.7.24. Mitigation measures for impacts to Fisheries

Mitigation/Enhancement Measure	Relevant Impact(s)	Description

Utilize Fish Harvesters' Expertise for Project Siting	Effects on fishing vessel operators	• Involve fishers, fisheries representatives and fishing communities early in planning and decision-making processes (collaborative approach). Effective community engagement, along with well-defined procedures for permissions, insurance, liability and gear recover is crucial for successful management.
		  ○ Meeting with these groups early in the planning process can help identify specific impacts and mitigation measures relevant to the area in question and help provide insight into what kind of turbine foundations, mooring systems and inter-array and export cable design would be best.
		• For vessel traffic modeling, including experience from fishers will reduce the uncertainty. Given the significance of fishing grounds, they need to be considered and included in the development of marine spatial planning. This includes strategic planning processes, such as the zonal approach in the Irish Sea, and during early stages of offshore wind development.
		  ○ Enhancing the spatial evidence base for fisheries by analyzing their significance and creating related marine plan policies will aid in recognizing and addressing the value of fishing areas early on. Additionally, ongoing monitoring and evaluation of fisheries near wind farms will improve understanding of potential coexistence levels.

Facility Design & mitigating fishing disruptions
Facility Design & mitigating fishing disruptions
	Effects from offshore wind developments facility design on fishing vessel operators	• To optimize access for fishers, it is important to consider the following strategies:
		  ○ Allowing traditional fishing activities and transit routes within offshore wind areas.
		  ○ Consolidating infrastructure to minimize space conflicts where feasible.
		  ○ Constructing fewer, larger turbines to reduce the overall footprint
		• Using fewer, larger turbines can increase the space between them, reducing the number of structures that fishing boats and gear must navigate
		• Placing offshore wind turbines as close together as safety allows can minimize the overall size of the wind farm and reduce its geographic footprint.
		• Coordination with adjacent offshore wind developments is crucial to ensure safe transit and fishing activities.

Mitigation/Enhancement Measure	Relevant Impact(s)	Description
		• If the layout design does not permit two common orientation lines across neighboring developments, a setback distance of at least one nm from offshore wind infrastructure should be established. • Offshore wind developments should be avoided in sensitive and productive fish habitats, such as natural and artificial reefs. • To maximize fish habitat, developments should consider nature-inclusive designs. • Conflicts with fishers can be reduced by co-locating offshore wind farms with aquaculture, potentially providing compensation through alternative employment or income opportunities. • Unused waters between offshore wind turbine piles and aquaculture cages or rafts might be considered for MPA designation. • Include the fishing industry in the development of cable plans, providing detailed and current maps of seabed hazards, using fishing-friendly cable armoring, employing advanced cable burial techniques, ensuring durable cable protection, removing waste material, conducting post-installation surveys to confirm safe fishing conditions, and communicating findings to the fishing industry. ○ Enhanced coexistence can be achieved by removing construction debris from the seabed, employing effective cable burial and armoring techniques, conducting post-installation seabed surveys, and sharing survey results. Monitoring for cable exposure, agreeing on operational protocols, utilizing fishermen for monitoring and guardship duties, and implementing mutually agreed disruption settlements are also important. Additionally, improving portside facilities to enhance fishing profitability can help offset any potential losses. • Appointing a fisheries liaison officer is commonly required by license conditions in other jurisdictions. Mutual agreements on operational protocols between fishers, offshore wind developers and maintenance teams can also improve communication. Such agreements could enhance understanding and address each stakeholder's needs, thereby reducing disruptions, loss of fishing gear, and maintenance delays.
Cable Design	Effects from offshore wind developments cable design on fishing vessel operators	• Design cable layouts to accommodate fishing activities and reduce the total length of cables installed. • Avoid situating offshore wind cables in areas with heavy vessel traffic, such as high-use fishing areas.

Mitigation/Enhancement Measure	Relevant Impact(s)	Description
		• Where feasible, bury cables to a minimum depth of 1.8 m (6 ft) below the seabed. • Arrange HVDC cables side by side with adequate burial depth. • Use installation techniques that prevent obstructions from reaching the surface, such as buried rocks or boulders, to avoid damaging fishing gear. • Install cables in areas that have minimal impact on benthic habitats. • Cable protection measures should be adapted to the existing site conditions, such as employing “trawl-friendly” protections with tapered or sloped edges in trawlable areas and using materials that match the benthic environment (e.g., rocky habitats) in non-trawlable zones. • Include cable removal as part of the decommissioning plan. • Whenever possible, align dynamic cables within shared corridors to reduce the overall footprint.

Navigation and Gear Use Within Offshore Wind Arrays	Effects from offshore wind developments on fishing vessel navigation and gear use within offshore wind arrays	• Provide the necessary training for fishing activities within offshore wind farm project areas.
		• Conduct field tests to evaluate the maneuverability and operation of various fishing gear types in and around offshore wind areas.
		• Gather comprehensive data on long-term trends in different types of fishing activities to make more informed decisions.
		• Ensure that turbine identification and marking are large, clear, and visible in all weather conditions.
		  ○ Standardize navigational aids and marking across all offshore wind projects to reduce navigational risks for mariners.
		  ○ Utilize additional navigational technologies, such as AIS on turbines, cell phone coverage in wind energy areas, and fog signals.
		• Require offshore wind developers to perform project-specific navigational safety risk assessments in collaboration with national coast guards.
		• Engage with experienced navigators, regulators, and other knowledgeable stakeholders to determine preferred fishing routes in the area.

Safety Measures	Effects from offshore wind developments on	• Map all infrastructure and obstacles for each project phase and distribute these maps to relevant stakeholders and regulators.

Mitigation/Enhancement Measure	Relevant Impact(s)	Description
	fishing vessel operators' safety	• Schedule infrastructure installation during periods that minimize disruption to fishing activities. • Maintain communication with the fishing industry through a liaison to provide updates on construction, operational activities, and safety measures. • Along with stakeholder engagement and utilizing logbook data to ensure the capture of small vessel operations, utilize AIS heat maps to analyze historical AIS data for understanding general ship travel patterns, which can inform the planning of offshore wind farm construction. Additionally, real-time AIS data can help assess ship behavior and reduce collision risks during operations. Navigational Risk Assessments should be required by the developer to ensure navigational risks are identified and include mitigations to manage the risk of collisions.
Support for Stakeholders	Effects from offshore wind developments on fishing vessel operators and stakeholders	• To aid fishers, offshore wind developers could implement measures in seafood promotion and marketing, gear innovation, and support programs to ensure safe and profitable fishing throughout the development of their projects. • Implementing a fair and equitable financial compensation plan is important for affected fishers and communities. ○ Developers should also offer compensation for fishing gear that is lost or damaged due to offshore wind activities.
Actions to Prevent Loss of Fishing during Post-Decommissioning Phase of Offshore Wind Developments	Decommissioning	• Agreement on what and how offshore wind infrastructures and materials are removed following the decommissioning phase needs to be communicated to the fishing industry.
Equitable Compensation for Loss of Fishing Grounds		• In other jurisdictions, there have been claims that fishers have reported issues with compensation arrangements, claiming that some eligible individuals did not receive compensation, while others received insufficient amounts due to undervaluation of fisheries and inadequate consideration of vessel size and fishing time. ○ To address these issues, compensation should be arranged prior to construction, once the value of fishing grounds and affected fishermen are determined. However, unexpected environmental impacts could affect future compensation arrangements. In other jurisdictions, through fisheries liaison officers, they have proposed guidelines for

Mitigation/Enhancement Measure	Relevant Impact(s)	Description
		disruption settlements and community funds to ensure fair compensation for all eligible fishermen. • Offshore wind developers could help increase profitability for fishermen through improvements in portside infrastructure and services, such as fuel depots and ice machines, which would help reduce costs and waste, and increase the value of the catch. • The fishing industry should provide evidence on the financial, economic, and social impacts of offshore wind development at the individual wind farm level, to aid the process of negotiating compensation arrangements. • Offshore wind developers should consider compensation for lost income if the entire area is off-limits or if fish behavior changes due to construction activities. • Ownership stakes in offshore wind projects could offer significant benefits to fishermen and potentially improve their acceptance of these projects.

Table Description: Table depicting mitigation measures for fisheries. Additional mitigation measures to indirect effects can be found in the supporting mitigation sections to those outlined in Table 7.7.22.

Sources: Allen-Jacobson et al., 2023; Bat et al., 2013; BOEM, 2016; BOEM, 2022b; FLOWW, 2014; Gaertner et al., 2020; Gray et al., 2016; Haggett et al., 2020; Hooper et al., 2015; Isaksson et al., 2023; Mackinson et al., 2006; MMO, 2014; NYSERDA, 2017c; 2022; Pettersen et al., 2024; Rawson & Rogers, 2015; Reilly et al., 2016; Weigell & Jahn, 2022; Withouck et al., 2023; Wright et al., 2019.

7.7.6 Engagement Outcomes

During Committee engagement sessions and activities, there was consistent attendance from fishers, but the Committee does understand that it was not able to engage with the vast majority of fishers, due to the unfortunate timing of their deliverables, which resulted in the bulk of their engagement sessions to be during the fishing season. The timing of the engagement sessions unfortunately aligned with the ideal timing of seasonal fisheries, resulting in fishers to be unable to attend the meetings. Some family members of the fishers were able to attend the engagement sessions to collect information regarding the Regional Assessment process and supplement it to the members of their families who were fishing at the time of the session. Fishers that did manage to attend engagement sessions expressed much concern on the potential for offshore wind being developed in Newfoundland and Labrador waters. The main themes of concerns and questions are as follows:

- Offshore wind development will displace fish harvesters, so what will happen to them if they can't carry out their livelihoods. Concern that due to lack of fishing opportunities, fishers will have to leave communities, resulting in resettlement.
- Fishers feel that they are being pushed out of their industry for other industries, such as oil & gas or offshore wind energy, to proceed.
- What are the are the positive and negative effects of offshore wind development on fisheries?
- How will offshore wind development benefit the province if it negatively affects fisheries?
- Concerns raised over the impact of climate change. As ocean warm due to climate change, and with the dynamic nature of fisheries, the Committee, utilizing the most recent fisheries data, could identify a location for offshore wind development where a future fishery may move to and take place.
- The concern for navigational issues and therefore increased risk for fishers, what additional safety measures will be implemented?
- Questions were raised on the topic of co-location of offshore wind developments and fisheries.

There was also heightened concern over the use of the available geospatial data for fisheries, as it does not recognize small vessel fisheries. Since these vessels do not have the AIS system on board, a full picture of where the fisheries occur was not obtained.

Some groups had identified opportunities they had to collect this data to provide to the Committee to further their understanding and aid in its analysis, but the Committee has yet to receive this additional data.

The Committee also attempted to gather any data it could on small vessel fisheries during in-person sessions, but understandably, most fishers did not want to divulge this information.

Through the advisory group meetings and exercises, many fishing stakeholders explained their frustration with the Regional Assessment process, mostly with the lack of time that is given to provide input, especially during the fishing season. There was also an emphasis on the importance of engagement with the fishing industry and stakeholders on any development that may occur, early in the planning process. The Committee also received

many additional references during the effects and mitigations advisory group exercises. The Committee also received letters from the public and stakeholders providing recommendations regarding the fishery and offshore wind development. In a letter from MRC, they indicated their support, in principle, to assess fisheries conflict at the project level and to consider co-location. They also indicated that a collaborative and proactive approach among offshore wind developers, regulators and fisheries should be taken to establish best practices, mitigation measures, etc. to help avoid and reduce conflict, and that there are many international best practices and guidance for this practice.

The Committee has received information and advice from DFO and the Government of Newfoundland and Labrador concerning the fishery. Both provided information they had available on the fisheries or identified other sources it could be available from, while also identifying the currently available geospatial data, and its previously described limitations.

The Flat Bay Band Inc., indicated in their Offshore Report to the Committee, that they rely on fishing and other marine based activities for their livelihoods and are concerned that offshore wind developments could interfere with their traditional fishing grounds, and culturally significant species such as eel. This sentiment was reinforced by a Flat Bay Band Inc. fisher who posted a comment on the Registry indicating that the Committee must consider the impact to inshore and offshore fishers.

In MFN's meetings with the Committee and in their Comments on the Interim Report they recommended that offshore wind developments should avoid all Indigenous and non-Indigenous fishing areas, as offshore wind energy should not be replacing the fishing industry in certain areas. They also specifically noted that the preliminary offshore wind licencing areas overlapped with their fishing activities, including their right to fish for FSC purposes, which include whelk, sea cucumber, crab and cod, as seen in Figure 7.7.35 below (Miawpukek First Nation, 2024).

Figure 7.7.35. NFL Commercial Fishery Locations Within the Preliminary Offshore Wind Energy Licencing Areas

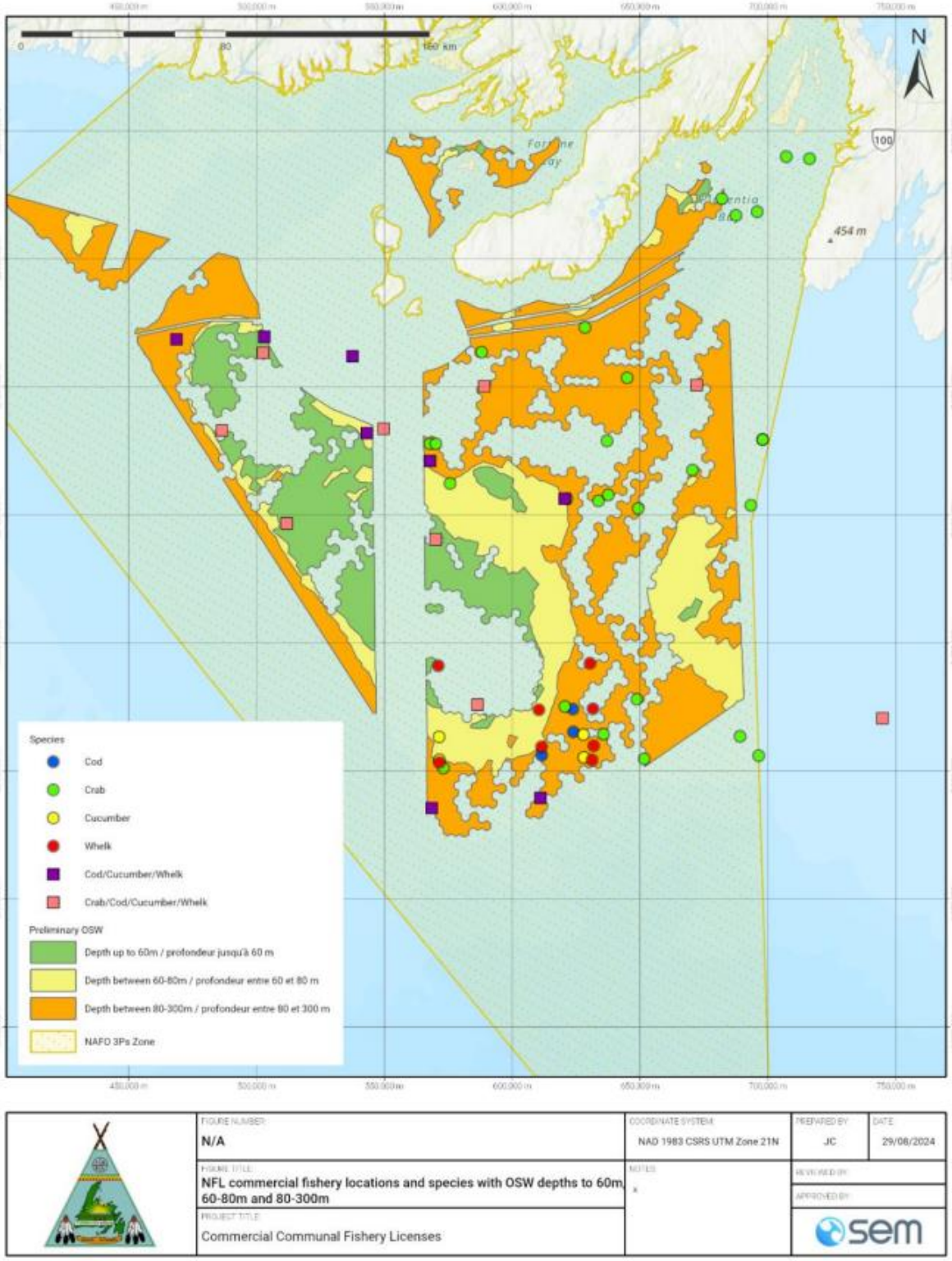


Figure Description: Map provided by MFN outlining the overlap of their fisheries with the preliminary offshore wind energy licencing areas. Blue circles are Cod, green circles are Crab, yellow circles are Sea Cucumber, red circles are Whelk, purple squares are Cod/Cucumber/Whelk and orange squares are Crab/Cod/Cucumber/Whelk.

Source: Miawpukek First Nation, 2024.

It was also noted that the St. Pierre Bank should be amended to reflect the overlap with commercial fishing in the area and to redefine the boundaries of the preliminary offshore wind energy licencing areas, such that it does not impact MFN fishing activities in this area. They did indicate that the 10 km buffer did significantly reduce the potential impact on the areas they are concerned with, which include their FSC areas, cultural and traditional use areas, environmentally sensitive ecosystems, and culturally relative species.

In Port au Port Indian Band's Letter to the Committee (2024), they echoed the concerns of the impact to fisheries, as it is their way of life. They also indicated that there was sea duck and cod fishing occurring at the mouth of Bay St. George and a harvester indicated that lobsters were migrating further north up the west coast of the Island of Newfoundland.

Within QFN's Fall 2023 letter, there was significant concern over the lobster fishery. They indicated that lobster fishing zones 13a, 13b, and 11 are directly adjacent to priority traditional use areas, and recommends that these areas be excluded from offshore wind licencing areas. They expressed concern over the impact offshore wind development would have on lobster as they can be affected during the development phase as their habitat is disturbed. If development does occur within these areas, they have asked to be engaged to ensure next steps in maintaining the integrity of the offshore resources. They also indicated that any other fisheries within the Focus Area will be addressed separately by their business development arm, Qalipu Holdings Limited Partnership.

7.7.7 Data Gaps and Limitations

Limitations associated with fisheries include:

- No access to geospatial data delineating LFAs.
- Fishing density data that is publicly available only captures most geo-referenced fisheries and has incorporated logbook data as best as possible. Small vessel fisheries (vessels smaller than 35 ft) and certain species are not captured in this dataset. Spatial data does not include historic fisheries and due to DFO's 'Rule of Five', this results in screened out data, limiting the available information on certain species. Much more engagement is needed to fill these gaps and get the full picture of fisheries in Newfoundland and Labrador.
- It is understood that fishing density may not give the best overall picture of fisheries. Lower levels of fishing activity does not diminish the socio-economic significance to the businesses and communities within Newfoundland and Labrador that depend on it.
- Given that Newfoundland and Labrador currently lacks any timelines or goals for offshore wind development, any potential projects will inevitably be years down the road, which will impact the accuracy of the information in this Report. As climate change and other factors occur, species and fisheries that may have been noted as important at the time of writing may not be considered as lucrative in the future.

7.7.8 Committee Findings and Recommendations

Based on the Committee's literature research, what it heard from their various engagement activities, and from advice from federal and provincial departments, the Committee has the following recommendations regarding fisheries and its relationship to offshore wind development:

- The Committee recommends that the regulator and/or developer conduct further research on the impacts of offshore wind development to fisheries, particularly in sensitive and low-productivity areas, in collaboration with fishers, fishing industry, and Indigenous and coastal communities. This additional research can then aid in developing buffer zones and climate resilient strategies,
- The Committee recommends consideration of co-location, which is in place in jurisdictions where offshore wind farms and fisheries co-exist. This includes applying buffers around turbines to limit negative impacts and avoid fisheries conflict.
- The Committee recommends multiple rounds of identifying offshore wind licencing areas as more information and data become available, and should require direct collaboration with fishers, industry groups, Indigenous peoples and coastal communities during each round of identification.
- The Committee recommends that offshore wind developers avoid peak season for fishers during construction and decommissioning to lessen the impacts of these activities. Collaboration with fishers, coastal fishing communities and Indigenous communities will be important throughout all phases of activity.
- The Committee recommends the establishment of a MSP for Newfoundland and Labrador, with a preliminary focus on areas of competing uses and areas in which offshore wind developers are considering.
- The Committee recommends TC work in collaboration with proponents to ensure implementation of navigational safety plans, to reduce navigational risks. As well as implement any additional technology that will aid all sea users in navigation.
- The Committee recommends a comprehensive review of publicly available information and information provided by fishers, as well as thorough engagement with fishers, fishery industry groups and government departments should be established during a project specific impact assessment, to avoid conflict of uses wherever possible.
- The Committee recommends consideration of compensation framework for fishers that are displaced by offshore wind development or experience gear damage or loss due to entanglement or damage caused by offshore wind farms.
- Compensation agreements should only be used where negative impacts to the fishing industry cannot first be avoided or mitigated.
- This framework should be developed in collaboration with fishers, fishing industry groups and Indigenous and coastal communities.
- Both direct and indirect impacts to the fishing industry should be considered in this framework.
- Any progress on this framework within Canada should be shared to reduce redundancy, but then also applied and changes made as appropriate to accommodate differences in fisheries from region to region.
- A non-attributional fund should also be developed, similar to the 'Canadian East Coast Offshore Operators Non-Attributional Fisheries Damage Compensation Program'.
- The Committee recommends that fishers and industry liaison groups be engaged with early in the offshore wind development processes, including any pre-work ongoing to develop frameworks and regulations. This includes proactive guidelines for fisheries co-existence to minimize conflicts and foster alignment. Creating an industry group, similar to One Ocean, to aid collaboration in these processes would also be recommended.

7.8 Other Ocean Uses

7.8.1 Existing Conditions

In addition to fishing activities taking place in the Focus Area, Newfoundland and Labrador's waters are also subject to various other activities. This includes offshore research programs from various institutions and companies, military training exercises from Canada's navy, shipping and transportation, aquaculture, seismic and exploration programs, tourism, and others. The following sections below provide a brief overview of some of the main activities occurring within the Focus Area. These activities are important to note, as it illustrates what additional activities are occurring in space and time within the area, in addition to fishing activity. This helps provide a more holistic view of how marine space is occupied within the Focus Area, and that could interact with offshore wind development activities. Where data is publicly available, Figures 7.8.1 - 7.8.5 also provide visual aids to see where some of these activities and features are located.

7.8.1.1 Marine Research

Marine Research activities may occur within the Focus Area at various locations and times depending on weather conditions and the aim of the research. These activities can be carried out by various government agencies, non-government organizations, academic institutions, or various industries. These research programs could include, but are not limited to:

- Summer and fall multispecies surveys conducted by DFO Newfoundland and Labrador occur throughout the Focus Area (DFO, 2023p).
- DFO AZMP which collects and analyzes biological, chemical and physical oceanographic field data to provide understanding of causes of oceanic variability, establish relationships among biological, chemical and physical variables and support development of other ocean activities (DFO, 2024a).
- ECCC oceanographic buoys and drifting collectors for meteorological and oceanographic data collection.
- Seismic and other surveys from the Geological Survey of Canada.
- Other research activities by other federal and/or provincial departments or agencies within the Focus Area.
- Marine archaeology activities related to shipwrecks and other historical features within the Focus Area.
- Marine research activities associated with academic institutions (e.g., Memorial University of Newfoundland and others).
- Research activities carried out by other parties (e.g., Ocean Frontier Institute, Environmental Studies Research Fund, Ocean Tracking Network, Marine Environmental Observation Prediction & Response network, etc.).
- Research surveys carried out by other industries (e.g., petroleum, mining, etc.).
- Indigenous communities research initiatives.

As research priorities arise, and funding opportunities become available, there may be several other research initiatives taking place within portions of the Focus Area. The list above represents a small portion of potential research activities that may occur.

7.8.1.2 Marine Shipping & Transportation

There are extensive marine vessel transits through the Focus Area throughout all seasons of the year. Marine traffic can include fisheries and research vessels; domestic activity such as cargo, cruise vessels, and passenger vessels moving to and from Canadian ports and/or between Newfoundland communities and Nova Scotia; and international traffic passing through the Focus Area or to ports within Newfoundland.

Some of the major traffic routes that can be found within the Focus Area, which house some of the most intense vessel activity in Newfoundland and Labrador, includes:

- The Cabot Strait is a major traffic route for both domestic and international vessel activity.
- Port aux Basques is one of the main ferry terminals for passenger vessels to and from the Island of Newfoundland.
- Placentia Bay is a major area for industrial activity for various sectors and is heavily trafficked.

Figure 7.8.1 below depicts the vessel density of all AIS tracked vessels within the Focus Area. While this represents a large portion of vessel activity within the Focus Area, it does not include any vessels that do not have AIS system on board, which can include smaller fishing, tourism or recreational vessels.

Figure 7.8.1. Vessel Density within the Focus Area

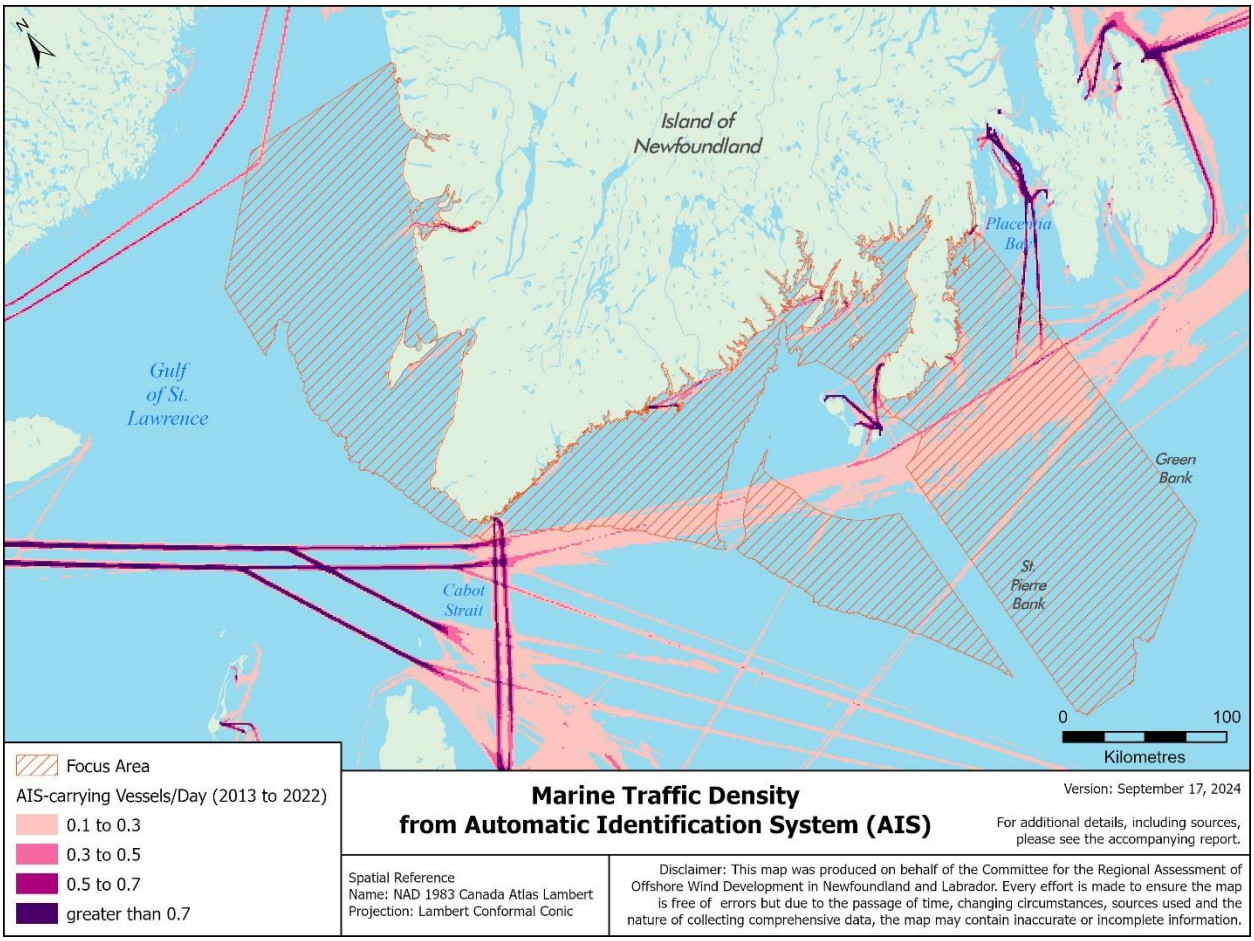


Figure Description: Map depicting the vessel density of AIS tracked vessels within the Focus Area.

Data Source: DFO, 2024p.

Due to the province's strong ties to the fishery, recreational and commercial fishing vessels add to the vessel traffic around the province. Most of these vessels berth, depart and return to Small Craft Harbours around the province (DFO, 2024o). Figure 7.8.2 depicts Small Craft Harbour locations adjacent to the Focus Area.

Figure 7.8.2. Small Craft Harbour locations adjacent to the Focus Area

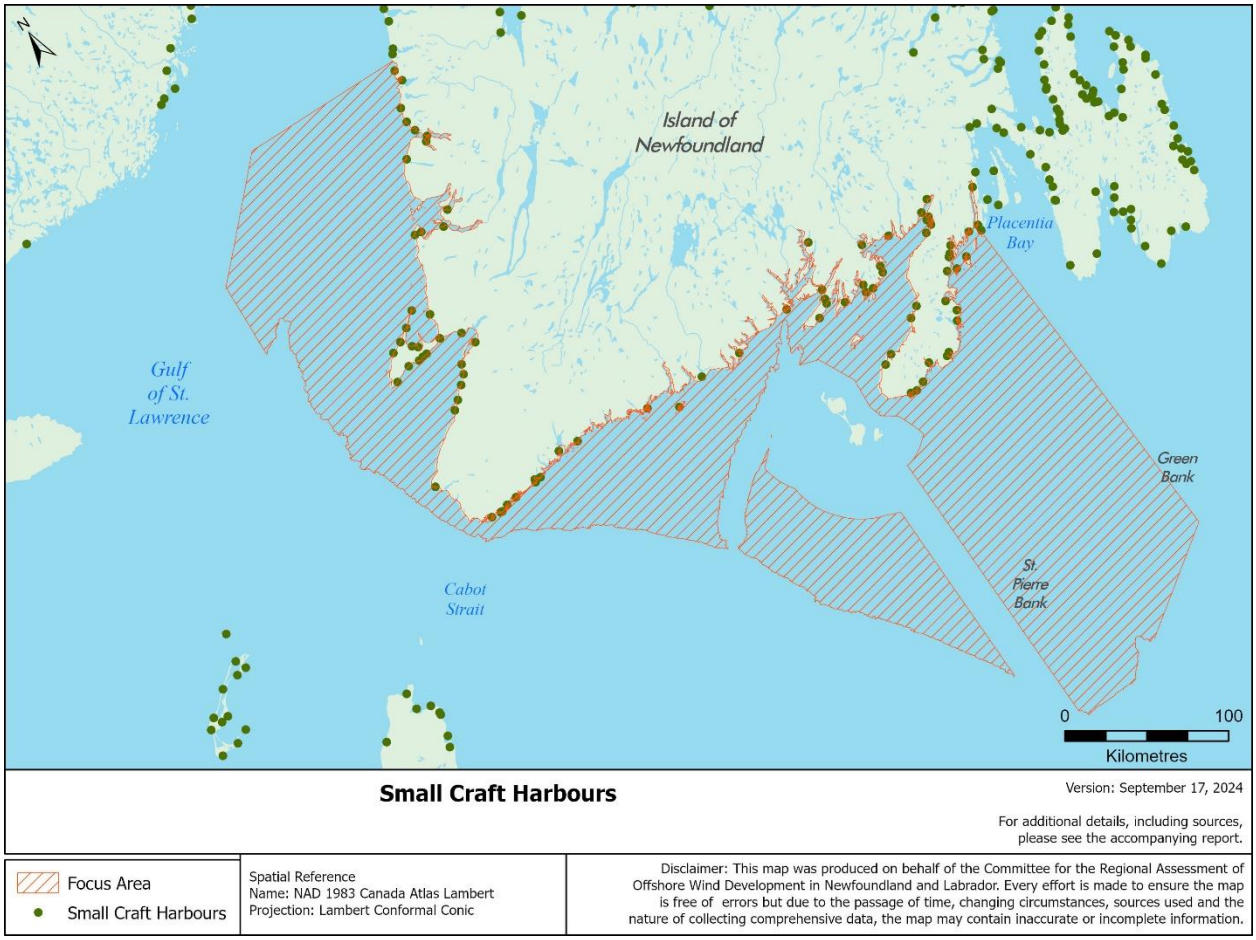


Figure Description: Map depicting Small Craft harbour locations adjacent to the Focus Area.

Data Source: DFO, 2023r.

7.8.1.3 Petroleum Industry

Western Newfoundland has had some past activity related to petroleum resource exploration and development, but to a lesser extent than in the Eastern area off the Island of Newfoundland.

There is currently one Exploration Licence on the West Coast of Newfoundland (EL 1070 – Shoal Point Energy Ltd.), which can be seen in Figure 7.8.3. Nine exploration wells have been drilled in or around the area of the Exploration Licence, either fully offshore, or along the shoreline (C-NLOPB, 2024).

Figure 7.8.3. Petroleum Activity in and around the Focus Area

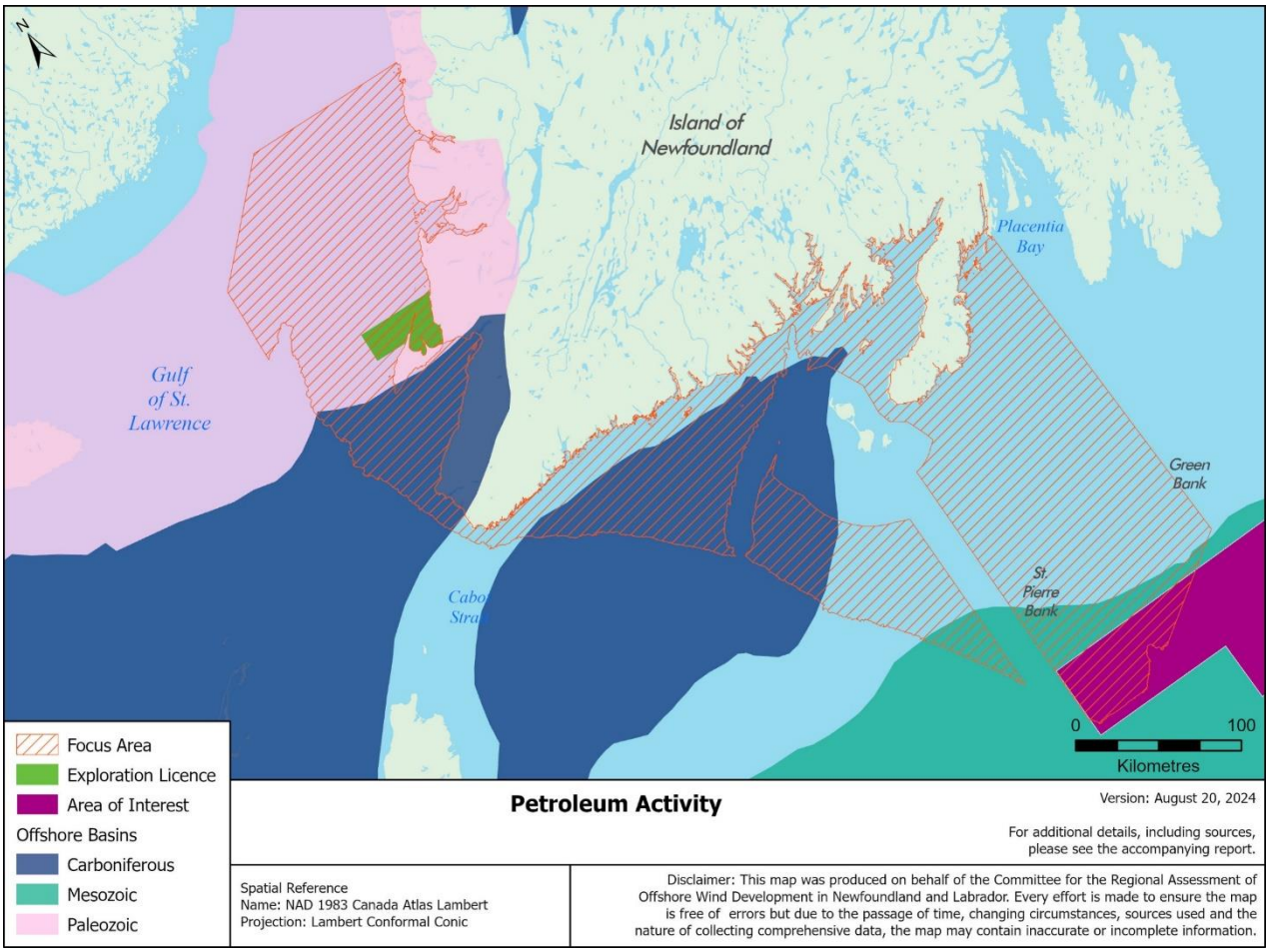


Figure Description: Map depicting Exploration Licences and Offshore Basins in and around the Focus Area.

Data Sources: Exploration Licences: Department of Industry, Energy and Technology, 2024b.
Area of Interest: Department of Industry, Energy and Technology, 2024a.
Offshore Basins: Department of Industry, Energy and Technology, 2022.

Seismic activity has and could occur within western and southern Newfoundland if the potential for hydrocarbons increases within these areas in the future. Future exploration drilling and production could also occur if hydrocarbons are discovered. During petroleum related activities, there is increased vessel traffic associated with support and servicing to and from a project area.

7.8.1.4 Aquaculture

Aquaculture facilities for Steelhead Trout, Atlantic Salmon, Blue Mussels, and Atlantic Cod are located throughout coastal Newfoundland, including within coastal regions adjacent to the Focus Area (FFA, n.d.-a). Specifically, there is a large concentration of licenced aquaculture facilities and grow out sites on the south coast of Newfoundland near

Hermitage and within Fortune Bay, along the Burin Peninsula within Placentia Bay and hatchery facilities around St. George's Bay, as seen in Figure 7.8.4. Aquaculture has added $240 million to the provincial economy and contributed 523 direct employment opportunities and approximately 994 indirect opportunities (Government of Newfoundland and Labrador, 2024a).

Figure 7.8.4. Aquaculture Licences and Processors within and adjacent to the Focus Area

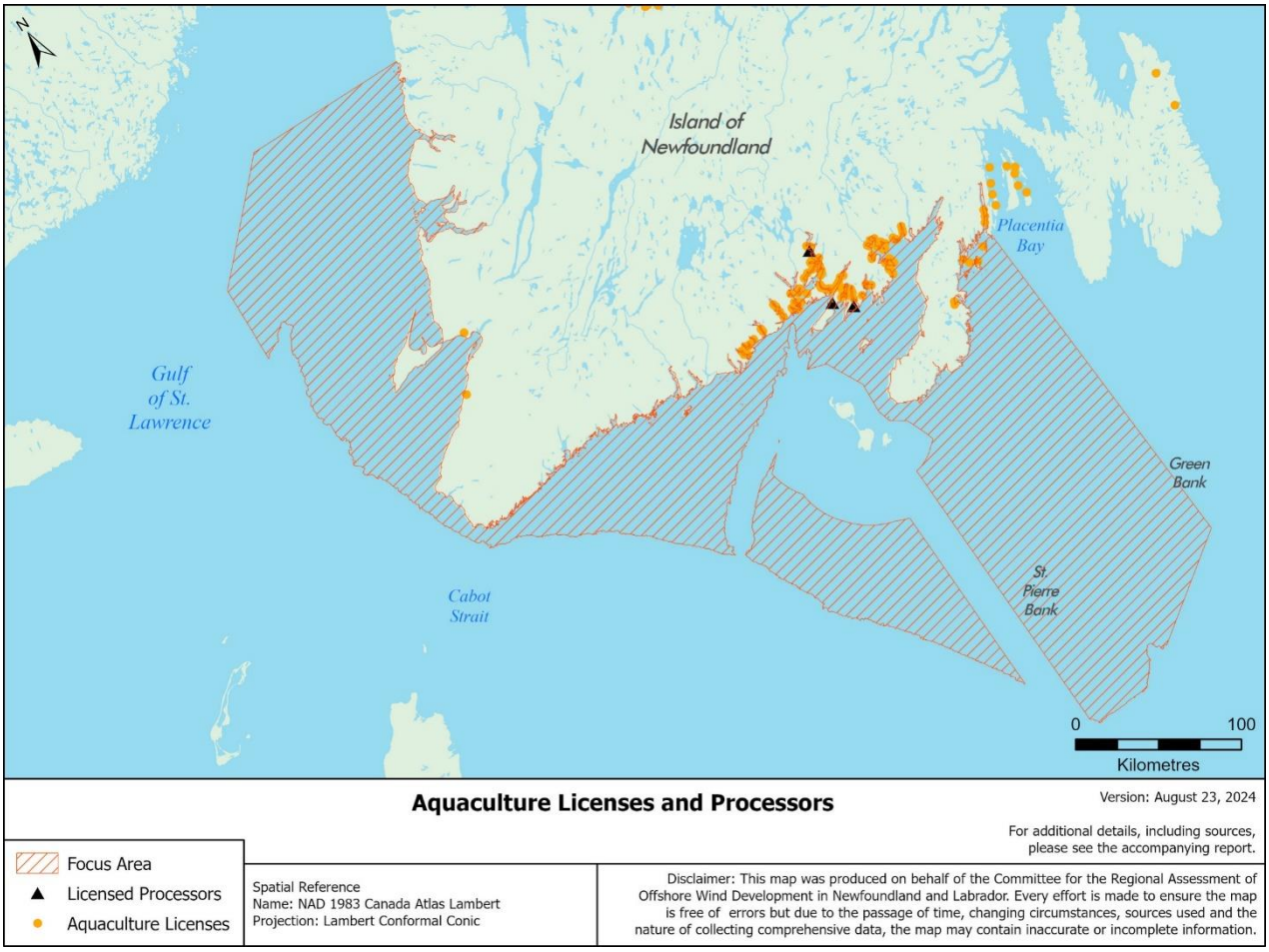


Figure Description: Map depicting aquaculture licences and processors within and adjacent to the Focus Area.

Data Source: FFA, n.d..

7.8.1.5 Military Use Sites and Unexploded Ordinances

The Royal Canadian Navy and Air Force both may conduct practice exercises and undertake planned military activities along Canada's coasts, including within the Focus Area. Activities may involve ships, submarines, aircraft, or other components. Canada's DND has designated areas for exercises that involve only sub-surface activities, and those that may involve live firing and testing of ammunition and explosives (DND, 2023). These activities are conducted to ensure the Canadian Armed Forces have sufficient equipment,

personnel trained in using equipment and infrastructure to detect, deter and defeat threats in, over and approaching Canada via air, land or sea (DND, 2024). Any exercises that pertain to the activities mentioned can occur in the Focus Area, within the areas seen in Figure 7.8.5.

Figure 7.8.5. Military Use Sites within or adjacent to the Focus Area

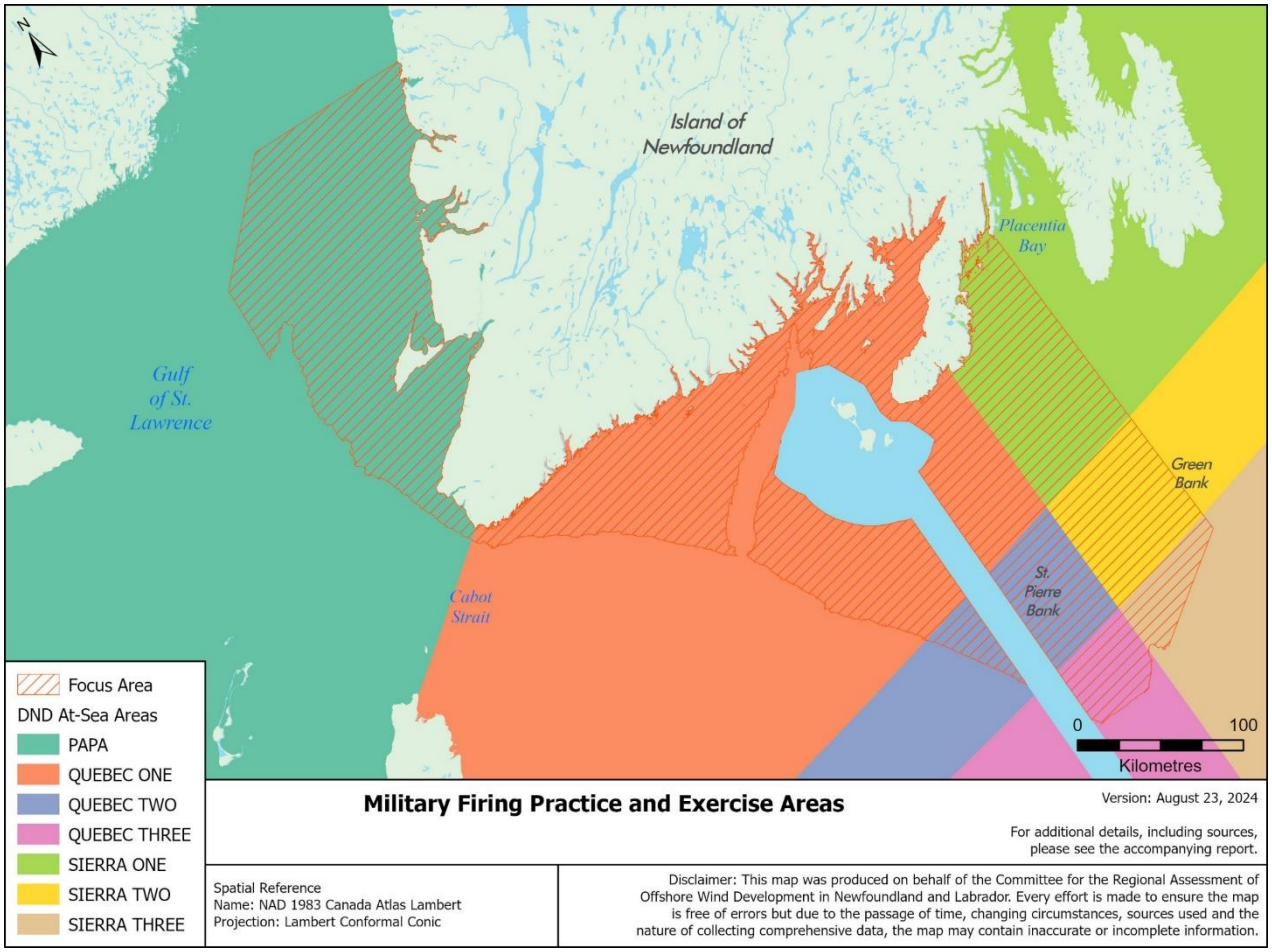


Figure Description: Map depicting military firing practice and exercise areas within and adjacent to the Focus Area.

Data Source: DND, 2023.

Some of these exercises have also resulted in the deposition of UXO in various locations. These are military explosives that did not explode or function as intended, which can include bombs, grenades, artillery shells, flares, mortars, and hazardous residues

resulting from partial or failed detonation (DND, 2021). There are currently no known UXO sites located in or around the Focus Area.[120]

7.8.1.6 Subsea Infrastructure

Within the Study Area there are both active and inactive submarine cables present. There is currently no publicly available data for all subsea cables, but some (e.g., Maritime Link) are known to exist throughout the Focus Area. There are telecommunications cables that extend between Nova Scotia and Newfoundland and Labrador (Emera, n.d.) as well as international cables between Europe and North America that may run through portions of the Focus Area (DFO, 2018g).

7.8.1.7 Tourism

Marine tourism is an important component of the economy of Newfoundland and Labrador, with a contribution of $1 billion or more annually, province wide, from 2011 - 2019, supporting about 20,000 jobs in tourism related industries. Tourism activities were impacted since the COVID-19 pandemic but is still a key industry to the province (Department of Tourism, Culture, Arts and Recreation, 2022). The Marine Atlantic Ferry between Nova Scotia and Newfoundland serves as an important gateway for both international and domestic tourism to the province.

There are approximately 662 tourism operators within and adjacent to the Focus Area, which include operators in accommodations, attractions, festivals or events, food and beverage locations, parks and campgrounds, shops and galleries, and tour operators (Government of Newfoundland and Labrador, 2024a). A full list of these operators and their locations can be found within the Government of Newfoundland and Labrador's Response to the Committee' Request for Advice #2. Some of these operators include marine-based tourism, which includes eco-tours such as kayaking, boat tours and scuba diving around the coastal areas of the province, as well as deep-sea fishing in more offshore areas. There is also significant cruise ship activity to and from the Bay of Islands (Corner Brook harbour) areas, that must also be considered. These are all important activities that generate economic activity within the marine sector of Newfoundland.

7.8.2 Potential Effects

The introduction of offshore wind developments within the marine environment will evidently impact other ocean uses, as seen in Table 7.8.1, while also having indirect effects shared by various other components, as seen in Table 7.8.2. For further understanding of these additional effects, please refer to the sections referenced.

[120] In response to the Committee's Draft Report, DND indicated for the Committee to contact DND UXO and Legacy Sites Program for updated information and presence of potential UXO sites within the Focus Area (DND, 2024). Due to time constraints, the Committee has added this information in their recommendations. DND's submission can be found on the Registry under document reference number 367.

Table 7.8.1. Impact Pathways and Effects of Offshore Wind Development on Other Ocean Uses

Project Phase	Impact Pathway	Description of Effects
Pre-Construction/Construction	• Vessel and equipment activity • Presence of infrastructure • Artificial lighting • Movement of turbine blades	• The construction phase did not lead to a decrease in tourism, visitor expenditures, or jobs related to tourism. On the contrary, many areas experienced greater growth in local employment compared to the broader region. • Co-location potential with aquaculture, but there are few experimental studies to test the technical and economic feasibility, proving there are many hurdles.
Operations	• Disruption in vessel navigation • Increased risk of collision, allision, and vessel/infrastructure damage • Rerouting • Conflicts with space	• Given the limited number of studies and geographic variability, the impact of offshore wind development on coastal tourism remains unclear. It is hypothesized that offshore wind farms along the U.S. Atlantic coast might face more opposition compared to less populated coastal regions, like Denmark, which are less tourism oriented. • Spacing between turbines that are less than 1km poses more constraints on vessels, impacts navigation. • Offshore wind development could affect coastal tourism and coastal uses if the turbines alter the seascape. • Floating cables and anchors, depending on water depth, type of mooring system and other factors, when connected to floating offshore wind farms may present obstacles to safe vessel operations and lighting used on

Project Phase	Impact Pathway	Description of Effects
		turbines can affect vessel navigation.
Malfunctions and Accidents	• Vessel and equipment activity • Presence of Infrastructure	• With the increase in space taken by offshore wind farms and increase in marine traffic and ship size, the safety risk is heightened due to limited available fairways. This could cause collisions between offshore wind turbines and ships, or vessel-on-vessel collisions.
Decommissioning	• Vessel and equipment activity	• Fishers expressed concern over the remnants of wind farm infrastructure and materials and the potential impact it could have on future fishing opportunities. • See Pre-construction/Construction, as similar effects are observed

Table Description: Table depicting impact pathways and effects of offshore wind development phases and accidents on other ocean uses.

Sources: Glasson et al., 2022; Gray et al., 2016; Lilley et al., 2010; Methratta et al., 2020; Rawson & Rogers, 2015; van Hoey et al., 2021; Weigell & Jahn, 2022.

Table 7.8.2. Potential indirect effects caused by or affecting Other Ocean Uses.

Component	Indirect Effects	Section
Marine Fish and Fish Habitat	Impacts to fish health and ecosystem within aquaculture setups.	7.4
Fisheries	Impacts to commercial fishing through changes in fishing areas that may overlap with other ocean uses, as well as changes to navigational routes. Most literature combines fisheries effects along with aquaculture.	7.7
Visual Aesthetics and Viewscapes	Impacts to viewscapes can affect tourism and coastal uses.	7.9
Physical and Cultural Heritage	Impacts to features that may draw tourism.	7.11
Communities and Economy	Impacts to coastal community jobs and economy.	7.13

Table Description: This table summarizes the potential indirect effects to other components if other ocean uses are affected by offshore wind development.

7.8.3Mitigation and Other Measures

Addressing offshore wind development impacts on other ocean uses is important as these effects can range from changes in navigation patterns to potential conflicts with fishing activities and recreational use. Effective mitigation strategies, such as proper siting, are essential to balance the benefits of renewable energy with the needs and concerns of existing ocean stakeholders. Table 7.8.3 below explores various approaches to minimize disruptions and promote harmonious coexistence between offshore wind energy and other ocean uses.

Table 7.8.3. Mitigation Measures for Impacts to Other Ocean Uses

Mitigation/ Enhancement Measure	Relevant Impact(s)	Description
Siting and Design	Minimizing the potential impacts of wind turbines on navigation and radar services	• Consideration to corridors between adjacent wind farm projects. Spacing should be greater than wind turbine spacing to easily distinguish between projects • Offshore wind farms should be developed at least 10km away from radar, and additional engagement and mitigation measures for installations within 60km of a radar.

Mitigation/ Enhancement Measure	Relevant Impact(s)	Description
Stakeholder engagement & Navigational Assessments	Minimizing the potential impacts of wind turbines on Shipping & Other Marine Vessel Navigation	• Engage with stakeholders to plan alternative routes around proposed offshore wind site, if applicable • Establish permanent traffic management measures with regulators to minimize rerouting impacts to vessels
Stakeholder engagement & proper siting	Minimizing the potential impacts of wind turbines on Recreation and Tourism	• Establish temporary exclusion areas around work areas to restrict the area of recreational use during construction • Establish construction work areas to avoid tourism hotspots/seasons to minimize conflicts with use of space • Coordinate with local municipalities to minimize impacts on popular events in the area (e.g., recreational fishing tournaments) • Protected species observers are recommended during construction and maintenance activities to reduce impact to marine sightseeing tours • Communicate with affected recreation/tourism parties the timing and location of construction and vessel movements • Consideration of impact to visitors when choosing lighting at wind farm
Proper Siting	Minimizing the potential impacts of wind turbines on Marine Mineral Extraction	• Avoid siting offshore wind projects near existing and proposed mineral extraction areas
Stakeholder engagement & Marine Spatial Planning initiatives	Minimizing the potential impacts of wind turbines on Scientific Research and Surveys	• Collaborate with regulators on offshore wind farm location • Creating survey space by removing groups of turbines could allow for surveying in those areas • Development of new survey technologies by researchers, changes in survey methodologies, and required calibrations to minimize impact to survey precision and efficiency

Mitigation/ Enhancement Measure	Relevant Impact(s)	Description
Stakeholder engagement & Marine Spatial Planning initiatives	Minimizing the potential impacts of wind turbines on Military Operation and Training Exercises	• Developers should identify military operating/training areas offshore and engage with affected parties

Table Description: Table depicting mitigation measures for other ocean uses. Additional mitigation measures to indirect effects can be found in the supporting mitigation sections to those outlined in Table 7.8.2.

Sources: BOEM, 2022c; ECCC, 2024NYSERDA 2017b; Wetra Lights n.d..

7.8.4Engagement Outcomes

Throughout the Committee's engagement activities, the Committee received feedback from the public highlighting the need for the effects of offshore wind development on tourism and aquaculture to be covered within the Regional Assessment. Feedback received in advisory group sessions and activities echoed the same sentiments, highlighting the importance of including various ocean users within the assessment, but little literature or other information was shared. In a letter received from MRC, they were supportive of the approach noted in the Interim Report for vessel routes and DND exercises and UXO sites but recommended that additional guidance be established specific to vessel routes and offshore wind development.

The Government of Newfoundland and Labrador provided some commentary on tourism in their response to the Committee's Request for Advice #2 (Government of Newfoundland and Labrador, 2024a). The tourism industry focuses heavily on natural areas, marketing these places to people who may not have regular access to such areas. These natural areas are therefore of critical importance for their intrinsic and economic value. They also provided information on the aquaculture industry and that their Department of Fisheries, Forestry and Aquaculture must be engaged on potential offshore wind developments if within areas suitable to aquaculture (Government of Newfoundland, 2024a). In a meeting with DFO Small Craft Harbours, it was emphasized that harbours with Harbour Authorities are primarily commercial fishing harbours. If certain harbours have the capacity to accommodate vessels from other industries, it could become an additional revenue source for a Harbour Authority. This would be dependent on the amount of commercial fishery activity in the harbour and how much Crown land could be available for use under a lease agreement with the Harbour Authority. Conversely, the additional vessels and industrial work that can be brought to these harbours can put additional strain on existing Small Craft Harbour facilities. The ability to accommodate this industry would need to be considered on a case-by-case basis, based on each harbour's level of capacity, after ensuring the needs for the commercial fishery are met.

7.8.5 Data Gaps and Limitations

Comparable to other components, there is a lack of data within the various ocean users. Some of the data gaps include:

- There is currently no reliable publicly available data for subsea cables.
- While the Committee is aware of the broad areas determined for DND firing practice and exercise areas, there is currently no public dataset of georeferenced UXO sites.

7.8.6 Committee Conclusions and Recommendations

To address information and data gaps related to other ocean uses:

- The Committee recommends that vessel routes and traffic be investigated further at the project level to impose appropriate buffers and management plans with that industry.
- The Committee recommends a pre-development survey to identify submarine cables to be avoided when siting a project.
- The Committee recommends that offshore wind project proponents collaborate with DND to ensure there are no conflicts with planned or future exercises, and specifically DND's UXO and Legacy Sites Program for updated information on presence of any potential UXO sites.
- The Committee recommends that marine tourism areas be evaluated and mapped before offshore wind developments proceed.
- The Committee recommends that proponents should collaborate with ECCC to conduct a preliminary visibility analysis and adhere to their case-by-case recommendations on turbine siting to enable offshore wind developments and weather radar to co-exist.[121]

[121] ECCC recommends proponents should write to radardmeteo-weatherradard@ec.gc.ca in order for ECCC to conduct a preliminary visibility analysis.

7.9 Visual Aesthetics and Viewscapes

This section describes existing information about regionally significant viewscapes in the Focus Area and the potential impacts of offshore wind development on visual aesthetics and viewscapes.

In an impact assessment context, visual assessments are used to determine whether the viewscape (i.e., landscape and/or seascape) can absorb visual changes caused by a project without significantly affecting scenic quality or viewer enjoyment. Both impacts to viewscapes and viewers' experiences of a place are considered. This means considering changes to the composition and quality of a view; whether the aesthetics of a proposed project fits, for example, the 'industrial landscape' or 'wilderness' that characterizes a place; and considering changes to how viewers connect to their surroundings (Inglis et al., 2022; Kaldellis et al., 2016; Sullivan, 2021; Vukomanovic et al., 2018). The Committee therefore decided "Visual Aesthetics and Viewscapes" and "Acoustic Environment" are distinctly separate components rather than one component. Information on existing conditions, effects, mitigation, engagement outcomes, data gaps and Committee conclusions regarding "Acoustic Environment" can be found in the subsequent Section 7.10.

7.9.1 Existing Conditions

Rugged wilderness is an important aspect of Newfoundland and Labrador culture and for commercial tourism. Particularly sensitive viewscapes within the Focus Area (e.g., areas with rare or high scenic quality, popular tourist areas, and natural or wilderness areas) include nationally and provincially protected areas, and other coastal views with high scenic quality and/or value.

National parks are established under the *Canada National Parks Act* (2000) and are managed by Parks Canada. National parks are "dedicated to the people of Canada for their benefit, education, and enjoyment…and…shall be maintained and made use of so as to leave them unimpaired for the enjoyment of future generations" (*Canada National Parks Act,* 2000). Parks Canada has not published any overarching policy, guidance, or regulations with information about protecting visual resources at national parks. However, management plans for individual parks may, on a case-by-case basis, include direction about managing visual resources.

Provincially protected areas include wilderness reserves, ecological reserves, provincial parks, wildlife parks, wildlife reserves and special management areas. The Government of Newfoundland and Labrador has also not published any overarching policy, guidance, or regulations with information about protecting visual resources. Section 4 of the *Wilderness and Ecological Reserve Act* (1990) includes the experience and appreciation of natural environment as a possible reason for establishing a wilderness reserve and the province lists recreation and ecotourism as some of the many reasons parks and reserves are maintained (DOECC, 2020). Furthermore, the province recognizes the benefits of

provincially protected areas include providing for the enjoyment and appreciation of outstanding scenery, landscape, and wildlife (DOECC, 2020).

The figure below shows federally protected (existing and proposed) areas within the Focus Area. As described under Section 6 of this Report, the Committee included a buffer around GMNP and removed the South Coast Fjords study area when identifying initial offshore wind energy licencing areas, as shown below. Avoiding development in these areas could protect viewscapes at GMNP and Sandbanks Provincial Park, as they are directly adjacent. As above, provincially protected areas and other coastal resources may also have important viewscapes. Provincially protected areas are shown visually on a map in Section 7.6 of this Report.

Figure 7.9.1. Federally Protected Areas Important for Viewscapes within the Focus Area

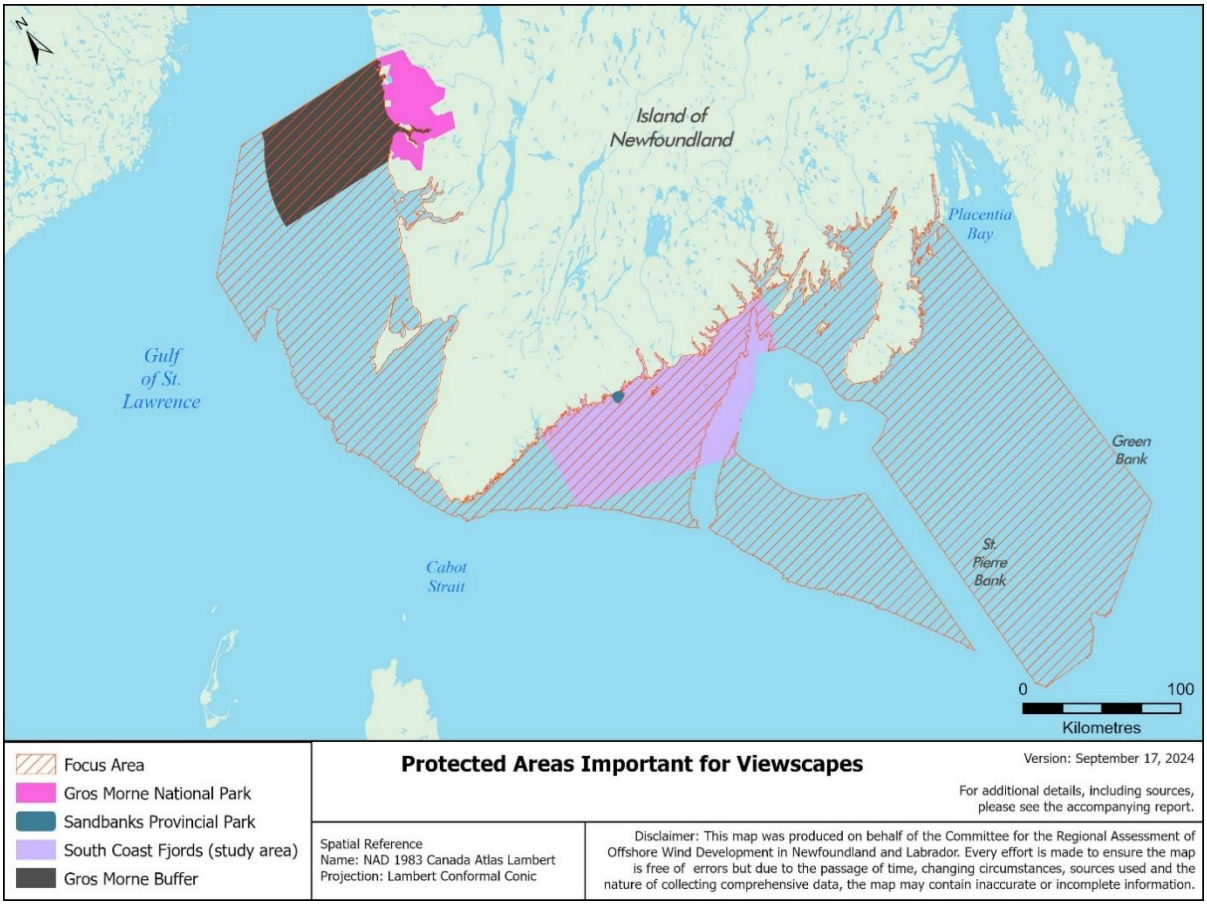


Figure Description: This map shows locations of existing and proposed federally protected areas along the coastal boundaries of the Focus Area, and the Committee's approach to avoiding important viewscapes from those areas. The protected areas shown are GMNP and Sandbanks Provincial Park. An 80 km buffer perpendicular to the coastal boundary of GMNP, and the South Coast Fjords study area (directly adjacent to Sandbanks Provincial Park) are also shown. Avoiding development within the Gros Morne Buffer area and South Coast Fjords study area could reduce impacts to viewscapes at GMNP and Sandbanks Provincial Park.

Sandbanks Provincial Park is not drawn to scale. The symbol was enlarged so that it would be visible on the map.

This map does not identify all areas with important viewscapes that could be impacted by offshore wind development in the Focus Area. Further work needs to be carried out during project-level impact assessments.

Data Sources: DOECC, 2022; IAAC, 2023a; NRCan, 2022a; Parks Canada, 2024; Regional Assessment Committee, 2024c.

7.9.1.1 Gros Morne National Park and World Heritage Site

GMNP was established in 1973 and protects the ecological integrity of the Western Newfoundland Highlands and an eastern portion of the St. Lawrence Lowlands natural region. The 2019 Park Management Plan outlines the significance of GMNP. Related to visual aesthetics and viewscapes, GMNP encompasses over 1,805 km^2 of mountainous and coastal areas characteristic of Western Newfoundland and is the only national park that represents the Western Newfoundland Highlands. The park hosts unique and varied geology and dramatic topography. For example, it is dominated by the Long-Range Mountains, which rise abruptly from the Gulf of the St Lawrence to a plateau with elevations of over 800 m above sea level. The park also includes over 190 km of diverse coastline with dramatic coastal views (Parks Canada, 2020).

The majority of Gros Morne is designated Zone II: Wilderness (60%) or Zone III: Natural Environment (33%) (Figure 7.9.2) (Parks Canada, 2020). Wilderness areas are characterized by remoteness and solitude while the Natural Environment designation is intended to maintain the natural character of an area while encouraging recreational activities that require minimal services and facilities of a rustic nature. Most coastal portions of the park with potential views of the Focus Area fall under these designations.

Figure 7.9.2. Gros Morne National Park Zoning Plan and Visitor Nodes

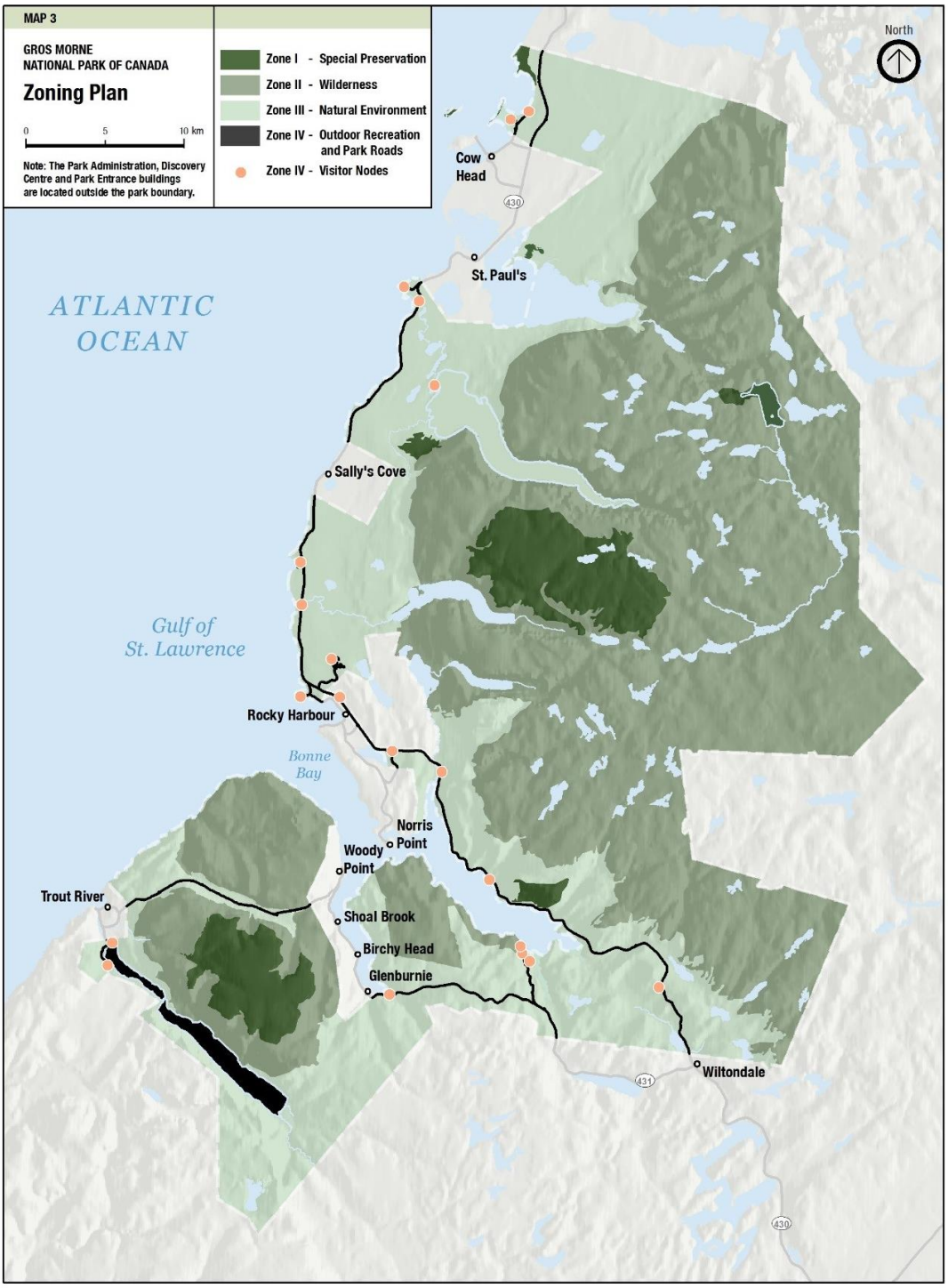


Figure Description: This map shows the GMNP Zoning Plan and locations of visitor nodes. The majority of Gros Morne is designated Zone II: Wilderness (60%) or Zone III: Natural Environment (33%).

Source: Adopted from Parks Canada, 2020.

On October 31, 2023, Parks Canada provided the Committee with expert advice on the potential impacts of offshore wind development to Parks Canada's protected heritage places.[122] In their recommendation report, Parks Canada identified several scenic lookouts at GMNP which are focused on or include coastal or ocean views. These include:

- Highway 430 that runs along coastal plains within the park and has views toward the GSL;
- Green Point Geological Site, with views toward the GSL;
- Green Gardens, with important vistas of the park;
- Lobster Cove Head, with views toward the GSL;
- Broom Point Fishing Premises with views toward the GSL;
- Gros Morne Mountain summit, North Rim of Western Brook Pond, with views out over Bonne Bay and the GSL; and,
- Lookout Hills, with views toward Bonne Bay and over the GSL.

Regarding tourism, GMNP is the most popular attraction in the western region of Newfoundland and Labrador and the second most popular destination for visitors in the province. More than 200,000 people visit Gros Morne per year and several local sightseeing tours offer coastal views around the park (Parks Canada, 2023a). The 2019 Park Management Plan reports visitation increased significantly in recent years, especially at popular attractions. People taking the boat tour at Western Brook Pond increased from 24,000 in 2014 to about 39,000 in 2018 and the number of visitors walking the Tablelands Trail increased from approximately 13,000 to greater than 35,000 in the same four-year period. This tourism is important to the provincial economy and significantly contributes to local economies in the park's eight enclave communities (Parks Canada, 2020).

7.9.1.1.1 UNESCO Guidance for Offshore Wind Development

GMNP is internationally recognized for its exceptional natural beauty and outstanding examples of major stages in the planet's geologic evolution. In 1987, GMNP was inscribed on the World Heritage List under Natural Criteria vii and viii.

The UNESCO World Heritage Committee issued the following statement of significance:

> Gros Morne National Park illustrates some of the world's best examples of the process of plate tectonics. Within a relatively small area are classic, textbook examples of monumental earth-building and modifying forces that are unique in terms of their clarity, expression, and ease of access. The property presents the complete portrayal of the geological events that took place when the ancient continental margin of North America was modified by plate movement by emplacement of a large, relocated portion of oceanic crust and ocean floor

[122] The Parks Canada Agency Recommendation Report to the Committee is available on the Registry under document reference number 182.

> sediments. The park also presents an outstanding demonstration of glaciation in an island setting. The fjords, waterfalls and geological structures of the park combine to produce a landscape of high scenic value.
>
> Criterion (vii): Gros Morne National Park, an outstanding wilderness environment of spectacular landlocked, freshwater fjords and glacier-scoured headlands in an ocean setting, is an area of exceptional natural beauty.
>
> Criterion viii): The rocks of Gros Morne National Park collectively present an internationally significant illustration of the process of continental drift along the eastern coast of North America and contribute greatly to the body of knowledge and understanding of plate tectonics and the geological evolution of ancient mountain belts. In glacier-scoured highlands and spectacular fjords, glaciation has made visible the park's many geological features (IUCN & UNEPWCMC, 2011).

In March 2023, UNESCO published Guidance for Wind Energy Projects in a World Heritage Context (UNESCO World Heritage Centre, 2023). According to this guidance, any potential impact from projects needs to be measured in relation to OUVs they may impact and any potential, irreversible negative impacts on OUVs should be avoided. Furthermore, projects in other jurisdictions proposed in proximity to WHS with important viewscapes have been subject to intense public debate, project cancellations and court rulings against projects that could threaten UNESCO WHS because of visual intrusions (Wieduwilt & Wirth, 2018).

7.9.1.2 Provincially Protected Areas

The Government of Newfoundland and Labrador did not provide the Committee with any information or recommendations about viewscapes at provincially protected areas. The following provincially protected areas are located within 10 km of the Focus Area boundaries: Bay du Nord Wilderness Reserve, Big Barasway Wildlife Reserve, Blow Me Down Provincial Park, Codroy Valley Provincial Park, and Fortune Head Ecological Reserve. The Government of Newfoundland and Labrador is also considering the designation of additional areas. The WERAC released a draft Protected Areas Plan for the Island of Newfoundland in 2020 for public review, then identified priority areas for protection (WERAC, 2020). In May 2023, the DOECC asked WERAC to move forward with consultations on these priority sites (DOECC, 2023). Three of these sites occur within 10 km of the Focus Area: Facheaux Bay Proposed Reserve, Facheaux Bay Transitional Reserve, and Cape St. George Transitional Reserve. A map showing locations of areas protected under legislation, including provincially protected areas is under Section 7.6 of this Report.

Sandbanks Provincial Park is also adjacent to the Focus Area. On June 23, 2023, a multi-party MOU was signed to launch an assessment of feasibility of a South Coast Fjords NMCA and the redesignation of Sandbanks Provincial Park as a national park. The South Coast Fjords NMCA Study Area surrounds the coastal border of Sandbanks Provincial Park (Figure 7.9.1 above).

7.9.1.3 Visibility

Multiple factors, including atmospheric conditions, influence the visual perception of a project (Sullivan et al., 2021; Wratten et al., 2005). As a part of the Regional Assessment, the MSC provided the Committee with information on fog occurrence in Atlantic Canada (ECCC, 2023i).[123] Incidents of fog differ throughout the Focus Area. The analyses of fog occurrence using both observed and modeled climatology for Atlantic Canada waters show consistent findings, including strong seasonal and geographic trends. Fog occurrence is greatest during summer months, followed by the spring, and diminishes during the fall and winter. During all seasons, maximum fog occurrence is centered over the shallow water of the Grand Banks, where the Labrador Current meets the Gulf Stream. The GSL experiences a lesser amount of fog compared to the northwest Atlantic and Labrador Sea. However, there is an increase in fog occurrence throughout the southeast section of the Gulf during the spring months and the northeast part of the Gulf continues to experience fog in summer. Therefore, the eastern portion of the Focus Area is more fog prone than the western portion.

The presence of fog at GMNP and south towards Bay St. George is relatively low. Based on fog climatology analysis, fog is highest during the months of April, May, June, and July. It occurs < 5% of the time at GMNP from October - March.

Section 9 of this Report has more information on visibility in the Focus Area as it pertains to the effects of environment on offshore wind development and potential safety/access concerns.

7.9.2 Potential Effects

Visual aesthetics and viewscapes could be impacted during all phases of offshore wind development. Impacts would predominately include changes to the seascape and visual aesthetics due to the presence of turbines and artificial lighting, as well as vessels, helicopters and equipment. Table 7.9.1 summarizes potential impact pathways and effects during each project phase.

[123] The ECCC (Meteorological Service of Canada) Response to the Committee's Request for Advice is available on the Registry under document reference number 185. Information on fog occurrence can be found under 'Visibility' in the submitted document.

Table 7.9.1. Impact Pathways and Effects of Offshore Wind Development on Visual Aesthetics and Viewscapes

Project Phase	Description of Impact Pathways and Effect
Pre-construction/ Construction	• Temporary changes to seascapes and visual aesthetics due to the presence of vessels, helicopters, equipment (e.g., jack-up barges and cranes), and unfinished wind turbines. • Vessel and helicopter use would be frequent during the construction phase including at, and between project sites and ports. Vessel numbers and types would vary depending on specific activities. • Construction activities mostly occur during daytime, when visibility is higher. Site work lights and navigational lights on vessels would cause additional impacts for any construction work taking place at night. • Temporary change to visual aesthetics due to sediment plumes visible on water surface during cable installation.
Operation and Maintenance	• Continuous, temporary and long-term (i.e., for the duration of the project) changes to viewscapes and visual aesthetics due to the presence of turbines. • Turbines could block or obstruct viewscapes, including sunset trajectory some days of the year. • Rotating turbines could cause shadow flickers when viewing the setting sun. • Turbine shadows may be visible. At large distances shadows are only seen as diffuse changes in the light. • Navigational lighting on turbines visible during nighttime. • Vessels and helicopters seen intermittently transporting employees to worksites for maintenance. • Occasional retrofits could cause impacts like those seen during the construction phase.
Malfunctions and Accidents	• Temporary, short-term (i.e., until damages repaired) increase in magnitude of effects.
Decommissioning	• Impacts like those seen during construction during the deconstruction of turbines • Change in viewscapes and visual aesthetics due to the removal of turbines. Given the limited number of decommissioned projects, it is difficult to conclude whether this effect would be positive or negative.

Table Description: This table summarizes potential effects of offshore wind development on visual aesthetics and viewscapes.

Sources: Bilén & Hallgren 2022a; b; Ecogain AB, 2021; Kaldellis et al., 2016; NYSERDA, 2017d; Public Institution Coastal Research and Planning Institute, 2023; U.K. BIS, 2008; White Consultants, 2020.

Most of the effects outlined in Table 7.9.1 (above) are adverse. However, several project-specific and receptor-specific factors influence the magnitude and type (positive, adverse or neutral) of effect that the presence of turbines has on visual aesthetics and viewscapes. Some of the factors known to influence the significance of turbine presence on seascape and visual impacts include (Wratten et al., 2005):

- Physical form of the development (e.g., height and massing of turbines, number of turbines, layout and volume, and geographic spread).
- Ambient conditions and basic modifying factors (e.g., distance, direction, time of day, season, and prevailing weather).
- Human perception and factors known to influence the apparent magnitude of effect (e.g., size consistency; depth perception; the proportion of the horizon occupied by the development; level of contrast because of siting, layout and design; visual cues available to the viewer; scene complexity; attention; familiarity; memory; and experience).
- Sensitivity of visual receptors (e.g., residents, visitors/tourists, outdoor recreationalists, recreational boaters, etc.).
- Sensitivity of seascape receptors (influenced by natural factors, cultural factors, landscape quality/condition, aesthetic factors, general visibility and population use).
- Value of seascape (influenced by landscape quality, rarity, scenic quality, etc.).

Moreover, impacts to visual aesthetics are complex, as subjective perceptions often play an important role. Qualitative studies show heterogeneous perspectives about the effects of offshore wind turbines on visual aesthetics. In some cases, residents and visitors consider the sight of a wind farm appealing and describe them as aesthetic, impressive, or positive symbols of clean energy (Firestone et al., 2018; Frantal & Kunc, 2011; Kaldellis et al., 2016; Landry et al., 2012; Smythe et al., 2020). Adverse views tend to focus on disruptions of existing viewscapes or sense of place and local identity. For example, the lost magic of the black sky or vast ocean; or the contradiction between a project's industrialized feel and a scenic, restorative environment that viewers feel connected to (Devine-Wright & Howes 2010; Landry et al., 2012; Smyth et al., 2020; Bilén & Hallgren, 2022a; b).

Effects to visual aesthetics and viewscapes could also have implications for other components assessed under the Regional Assessment, such as communities and economies (see Section 7.13 of this Report); other ocean users (e.g., tourism operators, recreation users) (see Section 7.8 of this Report); human health (see Section 7.12 of this Report); protected and special areas (see Section 7.6 of this Report); and physical and cultural heritage (see Section 7.11 of this Report), including Indigenous physical culture and heritage (see Section 7.1 of this Report).

Regarding impacts on tourism and recreation users, several studies have investigated the impacts offshore wind development could have on these components because of impacts to viewscapes and visual aesthetics. For example, Smythe et al. (2020), completed an exploratory qualitative study about the effects of the 30-MW Block Island Wind Farm on

tourism and recreation, operational since 2016. Tourism and recreation professionals and participants met in focus groups to discuss experiences with observations of the project. Overall, participants expressed diverse viewpoints (most neutral or positive) about the project's visual presence, and noted the project is currently an attraction for tourism (e.g., novel sight or destination for recreation fishing). Participants also cautioned that this interest may decline over time and suggested there may be less support for larger developments (Smythe et al., 2020). Research in Europe shows mixed results on whether offshore wind development would attract or deter visitors to coastal destinations (Ladenburg & Dubgaard, 2009; Westerberg et al., 2013). Regular or frequent visitors tend to be more concerned about impacts to viewscapes, whereas other prospective visitors do not tend to report the presence of turbines would influence whether they would visit a destination (Ladenburg, 2009; Landry et al., 2012; Voltaire et al., 2017).

7.9.3 Mitigation and Other Measures

7.9.3.1 Project Siting and Visibility Thresholds

Appropriate siting is the primary mitigation measure used to reduce impacts to visual aesthetics and viewscapes. Coastal residents, tourists and recreationalists consistently prefer siting wind farms further from shore to reduce visual impacts (Bishop & Miller, 2007; Krueger et al., 2011; Ladenburg & Dubgaard, 2007; 2009; Wasterberg et al., 2013). In other jurisdictions, recent offshore wind developments tend to be located further from shore. In 2022, the U.K. Department of Business, Energy and Industrial Strategy published the Offshore Energy Strategic Environmental Assessment Report, which is intended to inform the government's fourth round of offshore energy licencing and leasing decisions. The report outlines four projects that are at least 29km (15.5nm) from land in the Irish Sea, 53.5km (29nm) from shore in the southern North Sea, and the early commercial floating projects in the Bristol Channel are 35km (19.5nm) from land (U.K. BEIS, 2022).

Furthermore, several studies have been undertaken to investigate visibility thresholds and/or effects of turbines at different distances, and under various conditions (NYSERDA 2017j; Sullivan et al., 2013; Wieduwilt & Wirth, 2018; White Consultants, 2020; Wratten et al., 2005). As one example, in 2020, White Consultants analyzed Seascape Landscape Visual Impact Assessments (SLVIA) at twenty-eight different offshore wind farms (existing and proposed) in the U.K. The project impetus was to determine distances at which 'low' and 'medium' magnitude effects to viewscapes occur. Their analysis is summarized in Table 7.9.2 below. On average, White Consultants found a low magnitude of effect occurs at 19.2 km for turbines up to 145 m tall and at 38.6 km for turbines up to 300 m high.[124] Furthermore, they note that an approximate rule of thumb ratio between turbine height and distance for an average low magnitude effect is 1:133 and for an average medium

[124] Section 4 of this Report includes information on current and projected turbine size. In 2022, global average turbine height (total above water height) was 203.9 m and announced projects had a projected height up to approximately 280 m (Musai et al., 2023).

magnitude effect is 1:100. They caution that magnitude of effect is not equivalent to significance, which should be determined based on magnitude of effect and receptor sensitivity. These findings could, therefore, inform minimum buffer distances around some visual receptors but would not be sufficient for highly sensitive receptors (e.g., a coastal national park, a visitor to a WHS etc.) (White Consultants, 2020).

Table 7.9.2 below outlines key findings from other studies on visibility thresholds.

Table 7.9.2. Distances for Low and Medium Magnitude Effects to Viewscapes at 28 Offshore Wind Farms in the United Kingdom

Wind Farm	Leasing Round	Max. Turbine Height (m)*	Max. Number of Turbines	Narest Coast (km)	Viewpoints Assessed	Low Magnitude of Effect		Medium Magnitude of Effect	
						Avg. Distance (km)	Max. Distance (km)	Avg. Distance (km)	Max. Distance (km)
North Hoyle	1	107	30	7.5	12	18.3	21.8	11.2	13.5
Gunfleet Sands 2	1	128	22	8.5	8	12.1	19.6		
Kentish Flats	1	140	39	8	13	21.1	26.9	11.2	12.1
Gwynt y Mor	2	140	160	18	36	22.3	35.8	14.3	15.3
Docking Shoal	2	145	177	14	8	22.3	26.3	19.1	19.1
Thanet Sands	2	150	100	11	10	21.8	27.7	17.5	17.5
West of Duddon Sands	2	150	139	14	17	23.3	26.3	11.0	14.6
Greater Gabbard	2	170	141	23	6				
Sheringham Shoal	2	172	88	17	26	23.5	25.0	19.2	21.0
Westermost Rough A	2	172	110	8	9	18.9	32.6	15.3	17.5
London Array	2	175	271	21	18	21.0	21.0		
Kincardine	SFD	176	7	15	23	23.2	36.0	19.6	35.0
Hywind	Demo	178	5	23	7	25.9	29.0		
Atlantic Array	3	180	278	14	37	28.4	37.5	20.9	27.5
Neart na Gaoithe	Sco 1	197	128	15	18	32.9	39.0	28.0	28.0
Beatrice Offshore	Sco 1	198	142	22	16	29.7	33.1	22.2	25.6
Navitus Bay	3	200	121	14	12	24.9	28.2	19.5	23.1
Walney 1	2	202	93	15	17	23.2	23.4	16.5	18.8

Wind Farm	Leasing Round	Max. Turbine Height (m)*	Max. Number of Turbines	Narest Coast (km)	Viewpoints Assessed	Low Magnitude of Effect		Medium Magnitude of Effect	
						Avg. Distance (km)	Max. Distance (km)	Avg. Distance (km)	Max. Distance (km)
Rampion	3	210	175	13	29	26.4	29.5	19.9	30.0
Walney Extension		222	207	19	17	25.6	32.3		
Burbo Bank Extension		223	36	7	18	21.7	30.6	15.1	22.0
Thanet Extension		250	34	8	18	26.3	44.1	16.1	19.9
Seagreen	3	280	120	27	13	35.3	38.0	32.0	32.0
Moray East	3	280	137	22	22	42.0	49.0	27.0	34.0
Moray West	3	285	85	22	25	40.8	53.0	25.8	28.0
Inch Cape	Sco 1	291	72	15	26	42.0	52.5	29.7	34.8
East Anglia ONE North	3	300	53	36	17	42.9	48.8		
East Anglia TWO	3	300	60	31	22	40.6	47.7	34.2	37.6

Table Description: This table outlines distances at which visual effects of offshore wind farms in the U.K. were perceived for various project.

* Maximum height to blade tip.

A combination of modeling tools and observational data was used to inform the distances reported. Different methods may have been applied for different projects.

Source: Adapted from White Consultants (2020).

Table 7.9.3. Key Findings from Studies on Offshore Wind Farm Visibility Thresholds and Assessments in Other Jurisdictions

Wratten et al., 2005	
Project / Site Conditions	• 150 m tall turbine. • Considered viewers on a cliff (50 m) and viewers on a beach. • Evaluated visibility based on curvature of the earth only. • Separately evaluated nighttime thresholds for perception of red light.
Key Findings	• Visibility threshold at 75 km from a cliff and 55 km from a beach. • Only turbine tips are visible at 70 km from a cliff and at 45 km from a beach. • Only the tops of turbine tips are visible 55 km from the beach. • Minor visual effects of red light at 24 km.
NYSERDA, 2017j	
Project / Site Conditions	• Hypothetical project along the coast of Long Island (photorealistic visual simulations) • 100-turbine project with a total height of 187 m. • Various visibility conditions selected based on site specific weather data. • Different combinations of time of day (estimates sun angle) and clear/cloudy/overcast/less than 10-mile visibility. • Study focused on the influence of visibility conditions. Simulations do not represent what a particular project would look like from any particular onshore locations and do not take viewer height/surroundings (e.g., obstructions) into account.
Key Findings	• Project would only be noticed by viewers 25 miles away if viewers knew they were there or were actively looking for them • Starting at 20 miles from shore, turbines would become difficult or impossible to see in most conditions at Long Island • Turbines would be more noticeable at the 20-mile distance under very specific lighting conditions involving a dark cloudy horizon and intense morning or evening sunlight. Additionally, blade movement, although nearly impossible to discern at 25 miles, may draw the viewer's eye under specific particularly clear conditions

Sullivan et al., 2013	
Project / Site Conditions	• Assessed visibility of 11 offshore wind farms located in the Irish Sea and the English Channel, based on fieldwork and reporting of observations carried out in the U.K. • Some projects included Rhyl Flats, North Hoyle, and Walney 1, Greater Gabbard and Thanet. These use mainly 3.0MW and 3.6 MW turbines up to 150 m high (Walney) with arrays from 25 turbines (Rhyl Flats) up to 140 (Great Gabbard). • Three observers were involved in the study, including a landscape architect, a geospatial visualization developer, and an archaeologist. • Considered 49 daytime observations from 29 onshore locations, with six additional observations at night. • Most days were partly to mostly cloudy, and two days were sunny without fog. In general, visibility was judged to be good, although many observations included low contrast levels between shaded wind turbines and cloudy sky backdrops. • White Consultants (2020) provides commentary about this study noting: "Overall, at this time there was a greater separation between a series of smaller wind farms than is now the case and so the likely levels of effect may be correspondingly less than the same view now. The weather/visibility was also not very good or excellent, so the findings reflect normal scenarios, not worst case" (White Consultants, 2020).
Key Findings	• Small to moderately sized wind farms were visible to the unaided eye at distances greater than 42 km with turbine blade movement visible up to 39 km. • At night, aerial hazard navigation lighting was visible at distances greater than 39 km.
Wieduwilt & Wirth, 2018	
Project / Site Conditions	• 350 m tall turbines. • Non-elevated viewpoints.
Key Findings	• Visible at distances up to 50 km.

Table Description: This table summarizes findings on visibility threshold for offshore wind farms with different project and site conditions.
Sources: NYSERDA, 2017j; Sullivan et al., 2013; Wieduwilt & Wirth, 2018; Wratten et al., 2005.

Findings from White Consultants (2020) and the information in table 7.9.3 provides useful context and could be used to estimate possible visibility thresholds for projects of a given size. However, it is impossible to determine the distance at which offshore turbines would be visible without additional project- and site-specific information, viewshed modeling and field assessments.

7.9.3.2 Commonly Used Mitigation Measures

Literature drawing on experience from existing and proposed offshore wind development in other jurisdictions identifies several mitigation measures for the potential impacts of offshore wind development on visual aesthetics and viewscapes. Table 7.9.4 outlines a variety of these measures, including measures relating to project siting and design (also discussed above), structural design and materials used, installation and decommissioning practices, lighting and project maintenance. Mitigation measures need to be in place for daytime and nighttime, for each project phase, and should be monitored and maintained. It is also good practice to use visual impact simulations or photomontages to test various designs and mitigation measures. These can give an accurate representation of a project in a given viewscape under varied distances from shore, colours, lighting, arrangements, ambient conditions, etc. (Bilén & Hallgren, 2022a; BLM, 2013; Ecogain AB, 2021; Moray Offshore Windfarm (West) Limited, 2018; Sullivan, 2021; Sweden Offshore Wind AB, 2007; White Consultants, 2020).

Table 7.9.4. Common Measures Used to Mitigate the Effects of Offshore Wind Development on Visual Aesthetic and Viewscapes

Mitigation Measures	Description
Siting and Design	• Site as far from coastal resources as possible • Consider siting to avoid visual impacts to key ferry or tour boat routes and/or siting for tourist attraction • Select already developed seascapes • Keep consistent siting and layout with other existing or planned developments within the seascape • Use intervening headlands to block project views from sensitive areas • Place turbines at different distances along the same line to avoid visual clutter • Avoid placing structures next to or in front of headlands or peninsulas that are prominent from the mainland, to avoid visual clutter • Group or cluster turbines to break up lengthy lines or “walls” of turbines • Avoid obstructing “keyhole views” (i.e., do not site turbines where they would be framed by landforms) • Design windfarm layout to minimize horizontal spread, especially as seen from sensitive viewpoints

Mitigation Measures	Description
	• Consider positioning farms perpendicular to the coast and positioning individual turbines in lines • Avoid placing turbines between the setting or rising sun and important observation points.
Structure Design	• Install fewer turbines to limit horizontal spread • Ensure consistent structural design (e.g., turbine size, colour, and shape of rotor blades, nacelles, and towers)
Materials	• Use non-reflective paints and coatings to reduce reflection, blade glinting and glare • Use light grey colouring to reduce visual contrast • Prohibit use of commercial messages and symbols (e.g., logos, trademarks, etc.)
Installation / Decommissioning	• Limit the number of areas to be disturbed (turbines, cables, and electrical servicing platforms) • Avoid sensitive periods, like tourist seasons • Remove all structures to at least below the visible waterline
Lighting	• Minimize use of lighting wherever possible without compromising worker safety (number and intensity of lights, length of time turned on etc.) • Avoid illuminating the water's surface directly and avoid "floodlighting" by directing light only where needed • Use flashing lights instead of non-flashing lights • Use red coloured instead of white lights for Aviation Obstruction Light (AOL) • Use automatic timers and/or motion activated shutoffs for non-navigational lighting • Reduce AOL intensity for times when visibility sensors show it is safe to do so given the meteorological visibility • Navigational lighting should be conspicuous but should not disperse below the light's horizontal plane • All non-navigational permanent lighting should use luminaires with Illuminating Engineering Society backlight, uplight, glare (BUG) (U0) rating (formerly referred to as full-cutoff luminaires). These luminaires drastically reduce skyglow and potential light trespass by not emitting light above their horizontal level. Skyglow and light trespass will be further diminished by additional side screening. The correct angle should be used to mount all fixtures • Utilize aircraft detection lighting system technology. Aircraft detection lighting system is a radar-activated technology that turns AOL on only when an

Mitigation Measures	Description
	aircraft is within a specified distance of the offshore wind facility; otherwise, the AOL is not on
"Good Housekeeping"	• Regularly inspect and maintain wind farm infrastructure • Regularly inspect lighting fixtures to ensure proper aim, check for signs of damage, lumen depreciations, lens and reflection issues, and dirt buildup • Clean nacelles and towers to remove any spilled or leaking fluid and dirt/dust that accumulates • Nacelle covers and rotor nose cones should always be in place and undamaged • Turbines that aren't working should be fixed, replaced, or removed as soon as possible • Reduce unnecessary boat/helicopter traffic by combining activities, where possible

Table Description: This table summarizes common measures used to mitigate the effects of offshore wind development on visual aesthetics and viewscapes.

Sources: BLM, 2013; Cléirigh, 2000; Orr et al., 2013; Public Institution Coastal Research and Planning Institute, 2023; Sullivan, 2021; Sweden Offshore Wind AB, 2007; U.K. BIS 2008.

7.9.4 Engagement Outcomes

The Committee heard the following related to visual aesthetics and viewscapes throughout the Regional Assessment:

- During public feedback sessions about the Focus Area in September 2023, the Committee heard about concerns that offshore wind development could impact tourism operators' livelihoods. Participants indicated that visitors come to the Island of Newfoundland for the landscape and coastal views. Visible offshore wind turbines could be an issue. They recommended the province has information to identify specific tourism operators on a case-by-case basis. Project proponents should consult these operators to identify potential impacts. The importance of the tourism industry was again brought up in Corner Brook during June 2024 engagement sessions.
- During in-person engagement sessions in November 2023, a participant noted losing sight of land at 32 miles. Participants at June 2024 engagement sessions similarly raised concerns that a 10 km buffer would not sufficiently protect viewscapes.
- The Committee received some place-specific feedback during June 2024 engagement sessions. Participants noted the importance of sunset views at Bottom Cove, and to a lesser extent McIver's. They raised concerns about the reflection of the sun on turbine blades disrupting these views.
- During June engagement sessions, participants in Burgeo and Stephenville raised concerns about offshore wind development affecting views if visible from the shore. In Stephenville, participants also raised concerns about effects on property value because of impacts to viewscapes at Port au Port.

- In a written submission to the Committee dated August 23, 2024, the Port au Port Indian Band indicated they are deeply worried about the broader environmental and cultural impacts the offshore wind development could have in this region. They indicated the viewscapes from their coastal communities are of immense cultural value, as they have shaped their connection to the land for generations. Industrialization through offshore wind development would irrevocably alter the natural and cultural landscapes that are the foundation of their way of life, and ability to transfer Indigenous knowledge.

7.9.5 Data Gaps and Limitations

Understanding the sensitivity of a receptor is crucial for understanding the effects of offshore wind development on visual aesthetics and viewscapes. Some jurisdictions collect information on sensitive viewscapes independent from development projects. For example, several U.S. federal agencies have a visual resource inventory process or components whereby they monitor visual resource conditions and trends and proactively gather information that could be useful for siting and designing projects to minimize visual impacts. As a specific example, the Bureau of Land Management (BLM) Visual Resource Inventory is used for inventorying BLM-managed lands, and includes a scenic quality rating process, a sensitivity level analysis, and distance zone delineation (BLM, n.d.). These tools can support resource management and development planning.

Overall, these types of processes and baseline information on visual resources is lacking in Newfoundland and Labrador. Key visual resources are generally identified and assessed in the context of specific development projects (e.g., under an impact assessment).

As a part of this Regional Assessment, Parks Canada provided the Committee with expert advice about potential visual impacts of offshore wind development on the protected sites they manage. The Committee took this advice into account when identifying initial offshore wind energy licencing areas, and a precautionary approach was taken to avoid visual impacts to any location in GMNP and Sandbanks Provincial Park (see Section 6 of this Report). If other licencing areas are contemplated, more baseline data would be needed to understand where key viewpoints occur, and whether projects could be visible and adversely impact sensitive viewscapes. The same would be needed to understand where projects could adversely impact key viewscapes at provincially protected areas. The Government of Newfoundland and Labrador did not provide any input on this matter under the Regional Assessment.

In summary, data and information gaps related to visual aesthetics and viewscapes include:

- The Government of Newfoundland and Labrador has not provided the Committee with any information or recommendations regarding viewscapes to date and public information about viewscapes (e.g., visual quality, character, sensitivity, etc.) in Newfoundland and Labrador is scarcely available.
- There are no overarching policy, guidance, or regulations regarding protection of visual resources at nationally or provincially protected areas.

- No viewshed analyses were completed by Parks Canada, or the Committee, to identify areas where, if offshore wind development were to occur, development would be visible from sensitive viewscapes at GMNP or Sandbanks Provincial Park.

7.9.6 Committee Conclusions and Recommendations

To address data and information gaps:

- The Committee recommends that the C-NLOPB (C-NLOER), in collaboration with federal and provincial authorities, and Indigenous communities, complete visual assessments to identify and characterize the sensitive viewscapes that could be impacted by potential offshore wind development in offshore wind licencing areas before issuing a call for bids.
- The Committee Recommends offshore wind project proponents should be required to:
    - model the effects of any proposed offshore wind development projects on sensitive viewscapes using site- and project- specific characteristics, and
    - consult Parks Canada; DOECC; Indigenous communities; stakeholders, including tourism operators; and members of the public to determine how best to avoid or, where appropriate, mitigate potential impacts to sensitive viewscapes.

7.10 Acoustic Environment

Baseline ambient noise in the marine environment arises from natural and anthropogenic (human-made) sources. Natural sources include ice movements, wind and wave action, rain, thunder, earthquakes, and marine life. Human-made sources include industrial activities (including energy development and sonar and geophysical exploration), marine traffic, commercial fishing, military operations, and recreation (Hildebrand, 2009; McPherson, 2020). The contribution of human produced noise to the ocean soundscape has increased in recent decades, largely due to increased exploitation of the marine environment by sound-producing activities. Sound-producing activities (e.g., geophysical research, sonars, powered vessels, expanded shipping and oil and gas exploration and development worldwide) have resulted in concerns that these and other sources of underwater noise could have substantial effects on marine life (Petit, 2021; Popper et al., 2020). Sections 7.4 and 7.5 of this Report describe in detail the existing conditions within and close to the Focus Area respective to specific species and their status/vulnerability to offshore wind development activities.

A thorough understanding of baseline ambient noise in the marine environment goes beyond considering the sources. It also requires consideration of how oceanographic characteristics (e.g., sea floor physiography, water depth, temperature, salinity, and density differences) can influence the transmission of sound through water (Mooney et al., 2020; Richardson et al., 1995c). Such a description of the marine acoustic environment is beyond the scope of this Regional Assessment.

7.10.1 Existing Conditions

Within the Focus Area, shipping and commercial fishing are the prevalent human-made sources of baseline ambient noise. The Cabot Strait and Laurentian Channel are subject to heavier vessel density from shipping, passenger, and fishing vessels (Delarue et al., 2018). Sections 7.7 and 7.8 of this Report describes the fishing and other activities occurring within the Focus Area.

7.10.2 Potential Effects

Offshore wind development activities can have significant effects on the acoustic environment. The sections below discuss the sources and characteristics of underwater noise throughout the lifecycle of an offshore wind farm, the potential effects of these impact pathways on marine and human life as well as mitigation measures.

7.10.2.1 Sources and Characteristics of Underwater Noise Associated with Offshore Wind Development

Underwater noise is generated during the various phases of offshore wind farm lifecycles, including preconstruction surveys, construction, operation, and decommissioning. Section 4 of this Report provides information on each of these phases. Activities associated with each phase have different noise emission sources, intensity and duration levels (Mooney et al., 2020; SEER, 2022c).

During pre-construction surveys, seafloor mapping and investigations are carried out using a variety of sensors (e.g., sonars and echosounders) and associated vessels. Unlike the high-intensity air guns used in oil and gas exploration, these are low-energy sensors that penetrate the seafloor during preconstruction surveys (SEER, 2022c).

Despite its shorter timeframe, construction activities have the potential to generate high intensity noise (Mooney et al., 2020; SEER, 2022c). The installation of pile driven foundations (including monopiles, tripods, and jacket foundations) are known to generate more noise than other installation methods. Suction bucket, gravity-based, and floating foundations are alternative foundation technologies associated with reduced noise (Eickmeier & Vallarta, 2024; Mooney et al., 2020). According to Eickmeier & Vallarta (2024), the main source of underwater noise related to offshore wind development comes from pile driving monopiles and other seabed foundations and the use of vessels equipped with dynamic positioning systems.

Pile driving generates impulsive noise that can be transmitted over long distances and has high peak SPL (Hawkins et al., 2015; Mooney et al., 2020), and it is known to produce some of the most intense anthropogenic noises within the marine environment (Cerchio et al., 2014; Gordon et al., 2003; Hawkins et al., 2015).

Other sources of continuous noise include dredging, drilling, some naval sonar systems, as well as operating wind turbines (Hawkins & Popper, 2014). Nedwell & Howell (2004), provide a summary of windfarm related sources of underwater noise besides pile driving (e.g., rock laying, cable trenching, turbine structure installation, diver tools, etc.).

During the operations and maintenance phase, noise is generated by maintenance activities and by the turbines themselves. Underwater noise is generated at relatively low levels by the blade rotation and the nacelle operations and is transmitted to the water through the turbine and support structure. Generally, the operational noise emission from installed turbines is relatively low and does not significantly exceed natural noise levels (Hawkins et al., 2015; Madsen et al., 2006; SEER, 2022c; Thomsen et al., 2006).

At the decommissioning phase there can be noise generated from support vessels, and the specific processes that are involved in the dismantling of the wind farm components (e.g., turbines, embedded foundations, subsea cables, and offshore substations) (SEER, 2022c).

Vessels are used during all phases of offshore wind farm development. Underwater noise from vessels equipped with dynamic positioning systems is emitted from the propellers and thrusters of the vessels that are used to transport and install the wind turbine components, or to perform maintenance and repair work. Underwater noise from vessels is continuous noise that can vary in SPL and frequencies depending on the vessel's speed, size, and type (CSA Ocean Sciences Inc., 2023; Richardson et al., 1995a; Thomsen et al., 2006).

7.10.2.2 Effects on Marine Environment

Marine life can be adversely affected by high underwater noise levels and/or persistent anthropogenic noise in a variety of ways (Mooney et al., 2020; SEER, 2022c). A vibration of underwater objects creates a pressure wave that travels through the marine environment, including through water, the seafloor, and the air. Pressure and vibration are both components of underwater noise, which can travel long distances. Due to physical spreading and energy loss in the water column, seafloor, and on the sea surface, underwater noise decreases with distance from the source (SEER 2022c). As a result, the extent to which anthropogenic noise may adversely impact marine life depends upon how well the sound propagates underwater, its frequency characteristics and duration (Bailey et al., 2010; Richardson et al., 1995c).

Both impulsive and continuous noise from offshore wind development can interfere with the natural soundscape of the marine environment and cause acoustic masking, changes in behavior, physiological stress, impairment of hearing, or physical injury (Mooney et al., 2020; Popper et al., 2020). Sections 7.4 and 7.5 of this Report describe the potential impact of underwater noise and vibration on marine fish and fish habitats and marine mammals and sea turtles respectively.

Depending on the species, the hearing sensitivity, the exposure duration, the distance from the noise source and the ambient noise level, the impact of underwater noise from offshore wind development activities may differ. Marine mammals and fish have different hearing ranges and thresholds and may respond differently to underwater noise (Mooney et al., 2020; Popper et al., 2020).

7.10.2.3 Effects on Humans

Human exposure to very high sound levels for brief periods or to moderately high levels for prolonged periods sometimes causes permanent hearing impairment. While noise from wind turbines comprises an important siting criterion for onshore projects, offshore wind projects are unlikely to pose a noise issue for local populations. This is because offshore wind farms are typically located much further from inhabited areas resulting in the turbine operations being normally not audible from shore. With the coastal buffer (as discussed in Section 6 of this Report), the closest offshore wind farm will likely be at least 10 km from shore.

Although noise produced from wind turbines is not loud enough to cause hearing impairment (below health and safety limits) (Fortin et al., 2013), turbine noise has been shown to cause annoyance to many (Knopper & Ollson, 2011; Michaud et al., 2016). The impact of offshore wind development on human health have been described under Section 7.12 of this Report.

While the noise from offshore wind development can have direct impacts on marine life (e.g., potential hearing damage and behavioural changes of marine mammals and fish), indirect effects may alter their foraging success and distribution patterns (Mooney et al.,

2020; Thomsen et al., 2006). Table 7.10.1 below summarizes the indirect effects of noise associated with offshore wind development on other components.

Table 7.10.1. Summary of Indirect Effects of Underwater Noise on Other Components

Effect Type	Indirect Effects	Section
Aerofauna	• Reduced foraging success • Altered migration patterns	7.3
Fish	• Changes in distribution • Impacts on spawning • Impaired foraging and predator responses	7.4
Invertebrates	• Noise induced displacement of prey may indirectly alter predator-prey interactions	7.4
Marine Mammals	• Changes in prey availability	7.5
Humans	• Potential impact on fishing/tourism	7.7, 7.8

Table Description: This table provides a summary of potential indirect effects of noise associated with offshore wind development activities on aerofauna, fish, invertebrates, marine mammals, and humans.

Sources: Mooney et al., 2020; Thomsen et al., 2006.

7.10.3 Mitigation and Other Measures

Given the potentially high levels of sound associated with pile driving during offshore wind farm construction, a variety of mitigation measures have been developed to help reduce the impacts of underwater noise from the installation of monopile foundations, and to protect marine life during the installation of offshore wind turbines. Mitigation methods can be classified into four categories: source reduction, propagation reduction, receptor protection, and alternative foundations. There are different levels of effectiveness, feasibility, and cost associated with each method. A mitigation site may have unintended consequences, such as the displacement of marine life to less suitable habitats or the attraction of predators or competitors (Eickmeier & Vallarta, 2024). Sections 7.4 and 7.5 of this Report provide detailed description of mitigation measures to limit or prevent noise impact to marine fish, marine mammals and sea turtles. Mitigation measures to limit or prevent turbine noise impact on human health can also be found under Section 7.12 of this Report.

Alternative foundation types for traditional monopiles allow for different installation methods, often resulting in a reduction or avoidance of pile driving activities. The use of floating turbines (such as tension leg platforms and semi-submersible platforms), as

described in Section 4 of this Report, can reduce underwater noise emissions to what is generated from limited site preparation (dredging) and offshore support vessels to deploy floating wind turbine foundations, moorings, and anchors. Mooring line anchors for floating foundations could be installed using a relatively low-noise method, as there could be acoustic impact when impact pile driving is used (Eickmeier & Vallarta, 2024; SEER, 2022c).

7.10.4 Engagement Outcomes

During the Committee's in-person engagements in November 2023 and in June 2024, participants were specifically concerned about noise and or vibration impact on marine species and their habitats. Sections 7.4 and 7.5 of this Report elaborate on concerns raised.

7.10.5 Data Gaps and Limitations

- **Species-specific impacts**: Data on how noise associated with offshore wind development affects different marine species, especially those of ecological and economic significance, are lacking. The current state of research on various species' populations and life stages makes assessing the full extent of impacts difficult (Hawkins et al., 2015; Mooney et al., 2020).
- **Long-term effects**: Marine ecosystems are not well understood as to what extent continuous noise exposure from operating wind farms affects them. Most studies focus on short-term impacts during the construction phase, and less attention is given to operational and decommissioning impacts (Mooney et al., 2020).
- **Behavioural changes**: There are few detailed studies on how noise pollution affects marine species' behaviour. Research is needed to understand how noise affects feeding, mating, migration, and communication (SEER, 2022c).
- **Baseline data**: There is a need for more systematic baseline acoustic data collection to better determine large-scale, long-term shifts in marine mammal distributions, which could be caused by offshore wind development or climate change (Van Parijs et al., 2021).
- **Mitigation effectiveness**: More information is needed on the effectiveness of various mitigation measures in reducing acoustic impacts on marine life across different phases of wind farm development (Mooney et al., 2020; Van Parijs et al., 2021).
- **Effects on food webs**: Currently, there is little knowledge about how offshore wind farm noise may affect bottom components of the food chain, and how this may affect top predators (Pensieri & Širović, 2024).

7.10.6 Committee Conclusions and Recommendations

To address these gaps, researchers and stakeholders emphasize the need for long-term studies covering all phases of wind farm development, species-specific research on sound thresholds and impacts, as well as interdisciplinary approaches to assess ecosystem-wide effects. This is in line with the draft report recommendation on Canada's Ocean Noise Strategy (DFO, 2024r). According to the report, the implementation of the strategy's action plan will help to improve coordination and fill some of the many knowledge gaps. This will help to provide a more complete understanding of ocean noise impact on marine

life, and ultimately, help government to make informed management decisions to safeguard marine ecosystems while balancing economic prosperity and development.

The Committee recommends collaboration amongst government of Canada and regulatory authorities, Indigenous people, academic and research institutions, and industries to increase knowledge on species-specific impacts and long-term effects of continuous noise exposure from operating wind farms on marine ecosystems.

7.11 Physical and Cultural Heritage

7.11.1 Existing Conditions

A cultural heritage resource is considered a human piece of work or place that has historic value, spiritual or cultural meaning, or provides evidence of past human activity. These valued resources may not always have official designation, be formally recognized or documented. They can also include movable and immovable resources, above or below ground, on land or in water and can have features that are natural or fabricated (IAAC, 2016). Due to Newfoundland and Labrador's rich maritime history, there are many coastal features that are symbols of the province's past, holding great value for residents, tourists, and researchers alike.

7.11.1.1 Historical Monuments & Structures

7.11.1.1.1 Lighthouses

Being surrounded by the Atlantic Ocean, the need for ocean navigational aids is prominent along Newfoundland and Labrador's coastline. Established in the early 1800s, lighthouses provided navigational beacons for mariners and sometimes provided communication links between the ships and the shore (DFO, 2019a). While modern technology has advanced with GPS, coast guard, motors and even electricity, the lighthouses still stand to this day, even if some are no longer in use, they still hold stories of the province's rich maritime history. Tourists are also drawn to these structures for the incredible views the lighthouses host, looking over the coastlines (Newfoundland and Labrador Tourism, n.d.-a). There are approximately 40 lighthouses along the coast of the Focus Area (Anderson, n.d.). One notable lighthouse within the Focus Area is the Rose Blanche Lighthouse, a stone tower built between 1871 and 1873.

Figure 7.11.1. Lighthouses and Sailing Routes in Atlantic Canada (1915)

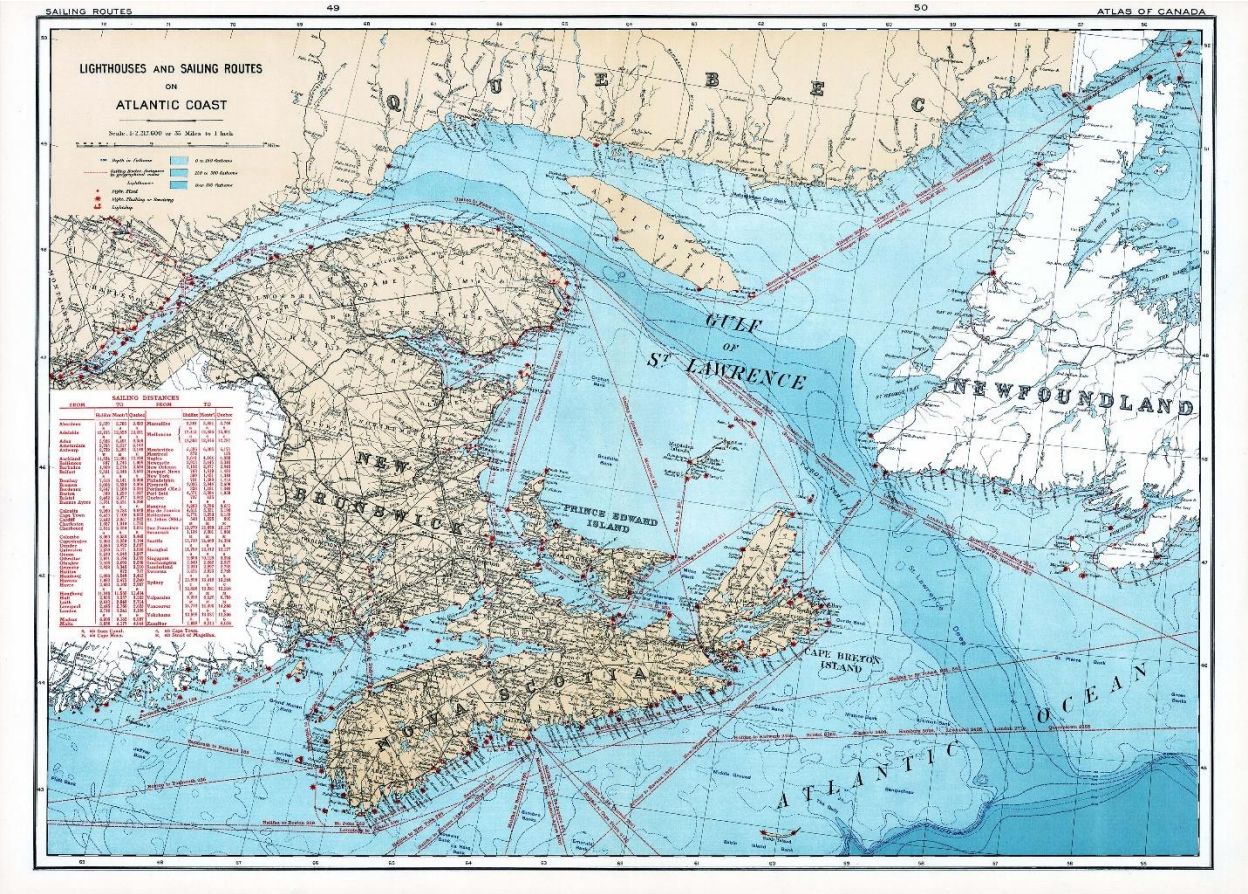


Figure Description: Map from the Atlas of Canada (1915) depicting lighthouses (red dots) and sailing routes in Atlantic Canada. While Newfoundland and Labrador was not a part of Canada at this time, they still indicated data from the region.
Data Source: NRCan, 2022c.

7.11.1.1.2 Historical and Archaeological Sites

The Government of Newfoundland and Labrador also designates Provincial Historic and Archaeological sites, through the *Historic Resources Act* (1990), and the *Archaeological Investigation Permit Regulations* under the Act, due to their historical or architectural significance (Tourism, Culture, Arts and Recreation, n.d.-b). These sites may be open to the public for interpretation purposes or may have access restrictions associated with them. Cultural and paleontological resources related to historic sites are protected under the Act and are not to be moved, damaged or altered. A number of these sites are found in coastal areas of Newfoundland and Labrador, none of which are located within the Focus Area.

In addition to historic sites, Newfoundland and Labrador has over 5,200 registered archaeological sites, which are protected under the *Historic Resources Act* (1990). These sites are linked to different points in history and related to various cultures that inhabited the Island: Maritime Archaic, Pre-Inuit Intermediate and pre-contact Indigenous, Beothuk,

Mi'kmaq, Inuit, Innu and European (Department of Tourism, Culture, Arts and Recreation, n.d.-a). There are at least 67 registered archaeological sites within the Focus Area, as seen in Table 7.11.1 below, however, the exact locations of these sites were not provided as it would not provide those sites with additional protection and could put them at heightened risk. This would also put undocumented sites at risk since it could be assumed that the listed ones are the only ones that exist (Government of Newfoundland and Labrador, 2024a).

Table 7.11.1. Archeological Sites on Islands within the Focus Area

Approximate Location	Number of Sites
Northern Peninsula/northern boundary, to the tip of the Port au Port Peninsula	7 sites • Wood Island (4) • Governors Island (1) • Fox Island (1) • Red Island (1)
Tip of the Port au Port Peninsula, to Cape Anguille	0 sites
Cape Anguille, to Hermitage Bay	55 sites • Codroy Island and Pikes Island not counted • "East" Island, Grand Bruit (1) • unnamed island, Pushthrough (1) • unnamed island, Captain Island (1) • Burgeo area (25) • Red Island (1) • Deer Island (1) • Fox Island (1) • Hermitage Bay/ Bay D'Espoir area (8) • Ramea (16)
Hermitage Bay, to west tip of Burin Peninsula	0 sites
West tip of Burin Peninsula, to Paradise Sound	5 sites Burin Island (2) Oderin Island (3)
Total	67 sites

Table Description: Table depicting known locations of archeological sites situated on islands within the Focus Area, 1 km or more from shore.
Source: Government of Newfoundland and Labrador, 2024a.

Within the Focus Area, there are also numerous Indigenous historical & culturally significant sites, both on land and underwater. It has been heard in meetings with MFN,

that the islands off the south coast of the Island of Newfoundland are of archeological significance and the Port au Port Indian Band specifically highlighted the Aguathuana Quarry, a carboniferous fossil sinkhole site. It is important to note that not all Indigenous historical & culturally significant areas or sites may be identified in this Report, and further engagement with Indigenous organizations would be required to accurately identify any other areas.

7.11.1.1.3 Underwater Sites

Newfoundland and Labrador's coastlines and surrounding waters have caused havoc for many ships and sailors, with many of these stories ending in tragedy. It is estimated that the shipwrecks surrounding the province are in the thousands (Newfoundland and Labrador Tourism, n.d.-b), as well as submarines from war times, with many of these located within the Focus Area. Shipwrecks within the Focus Area can be found in Table 7.11.2 below. Some notable shipwrecks such as the Truxtun and Pollux off St. Lawrence, the SS Ethie in GMNP, and the Despatch off Isle aux Morts are all located within the Focus Area.

Table 7.11.2. Shipwrecks within the Focus Area

Approximate Location	Number of Sites
Northern Peninsula/northern boundary, to the tip of the Port au Port Peninsula	10 shipwrecks
Tip of the Port au Port Peninsula, to Cape Anguille	6 shipwrecks
Cape Anguille, to Hermitage Bay	24 shipwrecks
Hermitage Bay, to west tip of Burin Peninsula	5 shipwrecks
West tip of Burin Peninsula, to Paradise Sound	23 shipwrecks
Total	68 shipwrecks

Table Description: This table depicts shipwreck locations within the Focus Area. These known sites are ana approximation and fraction of sites that exist in the Focus Area. The Government of Newfoundland and Labrador indicate that the number of known shipwrecks may dramatically increase in the future due to work they are currently commissioning through their Directed Research program (2024a).

Source: Government of Newfoundland and Labrador, 2024a.

Resettled Communities

Residents of Newfoundland and Labrador have been moving around the province in search of abundant fishing grounds, land sites or new employment since the province was first settled. Since the mid-1900s, there have been over 100 communities that have resettled, leaving these communities abandoned either seasonally or forevermore. These communities mark the passing of a previous way of life for Newfoundlanders and Labradorians (Pitt, 2015). There are a large number of resettled communities within the Focus Area, mainly on the islands in Placentia Bay and along the south coast of the Island of Newfoundland.

7.11.2 Potential Effects

The effects of offshore wind developments on areas of physical and cultural heritage are not as widely discussed or researched as other components within this Regional Assessment but are still potentially affected during the phases of offshore wind development. Table 7.11.3 below describes the effects that could be found in relation to physical and cultural heritage:

Table 7.11.3. Impact Pathways and Effects of Offshore Wind Development activities on Physical and Cultural Heritage Areas

Project Phase	Impact Pathways	Description of Effects
Pre-construction & Construction	• Benthic disturbance and suspension of sediment • Noise and vibration (pile driving, drilling and dredging operations) • Artificial lighting • EMF emissions • Vessel and equipment activity • Presence of infrastructure	• Vessel collisions with submerged archeological sites, shipwrecks or other submerged features. • Inadvertent removal, displacement or damage to cultural remains, historical item or property. • Introduction of visual, atmospheric, or audible elements that diminish the significance of historical features.
Operations and Maintenance	• Benthic disturbance and suspension of sediment • Noise and vibration • Artificial lighting • Movement of turbine blades • EMF emissions • Vessel and equipment activity • Presence of infrastructure	• Vessel collisions with submerged archeological sites, shipwrecks or other submerged features. • Visual impacts from historical areas. • Inadvertent removal, displacement or damage to cultural remains, historical item or property. • Introduction of visual, atmospheric, or audible elements that diminish the significance of historical features.
Malfunctions and Accidents		*Limited literature on these events. Effects may be similar to those listed in Operations and Maintenance.*
Decommissioning		*Same as Pre-construction/Construction*

Table Description: Table describing the potential effects of offshore wind development on areas of physical and cultural heritage.
Source: NYSERDA, 2017e.

For additional indirect effects caused by or affecting physical and cultural heritage sites and features, please refer to the sections referenced in Table 7.11.4 below

Table 7.11.4. Potential Indirect Effects Caused by or Effecting Physical and Cultural Heritage Sites and Features

Component	Indirect Effects	Section
Fisheries and other ocean uses	Impacts to tourism economy and location as well as recreation locations and opportunities.	7.7
Communities and Economy	Impacts to surrounding communities, involving their heritage or economy.	7.13

Table Description: Table summarizes potential indirect effects to other components if physical and cultural heritage sites and features are affected by offshore wind development.

7.11.3 Mitigation and Other Measures

While the impacts on physical and cultural heritage may not be considered as extensive as other effects on components, the primary mitigation measure remains the same: proper siting of projects and utilizing the precautionary approach. This along with strong legislation framework in place to guide developers in how to handle areas where physical and cultural heritage areas or structures exists paramount to ensuring these culturally and historically significant items are preserved. These mitigations are in line with what is followed in the U.S., as the developer must consider if a project is on a historic property, the Bureau of Ocean Management (BOEM) will ensure that offshore wind developments are in compliance with the *National Historic Preservation Act*. BOEM also references guidance to be followed on archeological and historic property, which is used in tandem with guidance for providing geophysical, geotechnical and geohazard information, when any survey work occurs in an area that a developer proposes to conduct for a project (NYSERDA, 2017e). Additional mitigation measures are outlined in Table 7.11.5 below:

Table 7.11.5. Description of Mitigation Measures in Relation to Protected Areas

Mitigation/Enhancement Measure	Description
Undergo a comprehensive site assessment	• Assessments and additional surveys of site-specific areas of potential development will help identify any archeological sites, shipwrecks, artifacts, etc.

Mitigation/Enhancement Measure	Description
Ensure qualified professionals in suitable fields participate in the surveying and pre-construction assessment process.	• Having underwater archaeology and architectural history or historic architecture professionals involved in the pre-construction surveys is necessary to evaluate the resources in question accurately and how these features or areas should be handled. • Additional professionals may be needed depending on the physical or cultural aspect being investigated, i.e., visual resource specialists may be required to assess visual impacts from historic sites.
Implement protective measures for both known and unknown physical and cultural areas and features	• During survey work, unanticipated discoveries of shipwrecks, archeological sites, etc. may occur, in which a plan should already be in place to address these discoveries. The utilization of sonar and ROVs can aid in determining its cultural significance. • Protective measures for areas and features of significance could include, but are not limited to, training for construction personnel on which significant areas should be avoided during construction, establishing and maintaining buffer areas and on-site monitoring by qualified professionals in an appropriate and relevant field to the feature or area in question. By persevering these areas and features ensures future generations can benefit from the knowledge and future research they can provide.
Utilization of Buffers	• Implementing buffers to avoid, minimize or mitigate physical or visual impacts around archeological or culturally sensitive areas. • Maintaining buffers used during construction throughout operation and maintenance activities can aid in minimizing impacts to significant areas.

Table Description: Table outlining mitigation measures in relation to physical and cultural significant areas.
Sources: Acteon, n.d.; NYSERDA, 2017e.

7.11.4 Engagement Outcomes

In their November 2023 meeting with the Committee, MFN indicated support for further consideration of historical and culturally significant areas, noting that islands off the south coast of the Island of Newfoundland are archaeologically significant. Port au Port Indian Band submitted a letter to the Committee (2024), indicating their concern with the natural and cultural landscapes in the waters surrounding Bay St. George and Port au Port areas, being affected by offshore wind development, as they are the foundation of their way of life

and ability to transfer Indigenous knowledge. They specifically highlighted the Aguathuana Quarry, and the concern of disturbing or destroying a carboniferous fossil sinkhole site. They also expressed the need to safeguard and protect cultural heritage, traditional knowledge, and practices of Indigenous peoples by involving them in decision making processes and respect their intellectual property rights, and to seek consent before using or commercializing their traditional knowledge. Flat Bay Band Inc. had similar concerns, as they noted their communities having deep spiritual and cultural connections to the ocean and coastline, and that offshore wind developments could interfere with sacred sites or culturally important areas. QFN also noted concern for traditional lands, especially on-land areas where transportation of building materials and other items of the development process have to pass through or will be used and requires developers to include them in their planning to reduce any effects to their traditional lands and persons.

In Committee's February 2024 engagement with public stakeholders, a participant suggested the consideration of culturally or historically significant Indigenous submerged areas. Throughout the Committee's advisory group activities, they received no input on the physical and cultural heritage component.

In response to the Committee's Request for Advice #2, the Government of Newfoundland and Labrador provided information regarding archeological sites and shipwrecks. Along with the information provided, they recommended that when proposals for specific developments occur, that the Provincial Archaeology Office is involved to review proposals to ensure that historic resources are considered and protected properly in advance to development occurring (Government of Newfoundland and Labrador, 2024a).

7.11.5 Data Gaps and Limitations

The Committee, to date, has not found any publicly available geospatial data on any components related to physical or cultural heritage. If such a data set exist, it could help in the planning phase of developments, so that developers and all stakeholders would have an idea of what culturally or historically significant features may be in potential project areas. Having these datasets would not preclude the need for pre-construction site surveys. It is also understood that supplying the exact locations of known sites would not provide additional protection and could put them at additional risk; therefore, this data could be shared confidentially with developers during their planning process. There is also very limited data on the effects and mitigations on these areas and features. Additional research in this area should be completed, as the waters surrounding the province, and in the Focus Area, have many areas and subsea features that are culturally or historically significant.

7.11.6 Committee Conclusions and Recommendations

Throughout the course of the Regional Assessment, the Committee has the following recommendations related to physical and cultural heritage areas and features:

- The Committee recommends that proponents conduct preconstruction surveys to accurately identify these features, so that these areas can be avoided.

- The Committee recommends that proposals are reviewed by the Provincial Archaeology Office, Parks Canada, Canadian Heritage, or other relevant departments to ensure adequate and proper protection and consideration is given to sites within proposed development areas.
- The Committee recommends that additional research be conducted on the effects of offshore wind development on these features and areas, as well as additional mitigations.
- The Committee recommends that Indigenous communities and peoples be engaged during all phases of project development to ensure the preservation and avoidance of their culturally significant areas.
    - It is also important that any information and knowledge shared by Indigenous peoples be utilized in the manner specified by the Indigenous person, group, or organization (e.g., not to be shared publicly, not to be mapped, etc.)

7.12 Human Health

The sections below describe the existing health conditions in Newfoundland and Labrador, the potential impact of offshore wind development on human health, including occupational health and safety considerations, mitigation measures, and data and information gaps.

In their literature review which focused on land-based wind turbine projects, Knopper & Ollson (2011), found that conclusions on health effects and wind turbines in peer-reviewed literature differ in some ways from those in the popular literature. They found that in peer reviewed studies, wind turbine annoyance has been statistically associated with turbine noise, with no articles demonstrating a direct causal link between people living in proximity to modern turbines, the noise they emit, and any resulting physiological health effects. Within the popular literature, they found that self-reported health effects are related to distance from turbines and the claim is made that infrasound is the cause of the reported effects, even though SPL are not measured.

7.12.1 Existing Conditions

The Government of Newfoundland and Labrador created a task force to develop a Health Accord for Newfoundland and Labrador (HANL) in November 2020. Its role was to 'reimagine the health care system' and was led by two co-chairs. At the time, the Province's health and health care situations were poor compared to the rest of the country: Newfoundlanders and Labradorians were the unhealthiest people in Canada, with a higher rate of deaths from heart diseases, cancer, and stroke, the lowest life expectancy, the highest level of complex health needs among children, and the highest proportion of older people with three or more chronic illness (HANL, 2022a). At the same time, the province had the worst health system performance. Despite these facts, when questioned during the 2015 - 2016 census, 62.0% (+/- 1.7%) of individuals aged 12 and over in Newfoundland and Labrador rated their health status as excellent or very good (Government of Newfoundland and Labrador, n.d.).

The co-chairs launched an intense, province–wide engagement process and a number of focused committees, addressing social determinants of health, community care, hospital services, aging population, quality health care, and digital technology. The co-chairs established an Indigenous Advisory Group, Community Sector Circle, Key Informant Group and Engagement Group, and initiated a research program to develop the factual basis for their work. After 15 months of effort, the completed report (HANL, 2022b) was issued. HANL spoke to the social determinants of health – these are described as the conditions in which people are born, grow, live, work and age. There are provincial (and federal) initiatives outside of health care per se that are addressing the social determinants that underlie HANL, such as seniors' well-being, mental health, affordable housing, poverty reduction, and the new mental health and addictions facility.

In June 2022, the co-chairs issued an implementation document (HANL, 2022b). The implementation document provides suggested timelines, estimated investments,

potential sources of funding, and integrating accountability structures. The recommendations of this document are divided into two sections, providing:

- A set of summaries for the major action areas, briefly outlining the rationale, responsibility, policy, structure, benefits, investments, and implementation timeline for each one.
- Detailed implementation ideas from each of the strategy committees and working groups of the Task Force.

Several steps have been taken and/or are ongoing by the Government of Newfoundland and Labrador in response to the HANL reports. Budget 2023 was titled Your Health. Our Priority. Our Largest Ever Investment in Health Care. The Budget indicates a planned expenditure of $3.9 billion to transform the health system, guided by the HANL (Government of Newfoundland and Labrador, 2023b). A Deputy Minister reporting to the Premier leads a transition team for this effort. Budget 2024 also commits $4.1 billion to health care and addressing many of the recommendations of the Health Accord (Government of Newfoundland and Labrador, 2024b).

Several actions have been initiated in response to the HANL recommendations, such as consolidation of four Health Authorities into one, expansion of virtual care, initiating the first Family Care Teams, development and implementation of a new health information system, and ongoing consolidation of the 60 separate ambulance services. In their advice to the Committee regarding progress on the Health Accord implementation the Government of Newfoundland and Labrador indicated the following:[125]

- Recruitment and retention of health care professionals have been challenging in recent years, especially in rural and remote locations such as those within the Committee's geographic Focus Area.
- Significant challenges exist in relation to primary health care (PHC) access in Newfoundland and Labrador including geographical disparities, increases in patient demand and complexity, use of Emergency Departments for PHC, as well as meeting unique needs of vulnerable populations. Health and Community Services continues to work and collaborate with Newfoundland and Labrador Health Services (NLHS) to reimagine and innovate solutions that increase and create access to PHC.
- Patient Connect NL is a provincial waitlist for those who have identified in the province as being without a primary care provider. Since its inception, 92,435 individuals have registered with Patient Connect NL with 59,901 residents connected to Family Care Teams as of June 2024. Additional information and updates on the status of Newfoundland and Labrador's health care action plan can also be found at https://healthcareaction.ca/.
- In 2022, HANL envisioned 35 community teams in three to five years. Today Family Care Teams are fulfilling the HANL recommendations with **23** teams announced to date. Family Care Teams are an innovative approach to re-imagine and re-design the health system in Newfoundland and

[125] The Government of Newfoundland and Labrador advice to the Committee regarding progress on the Health Accord implementation is available on the Registry under document 271.

Labrador that aims to improve access and continuity of PHC for individuals and families in their community. They represent a significant shift from solo-based community practice and program-based models of service delivery to an inter-disciplinary team-based model. Family Care Teams offer seamless access to multiple health care professionals that focus on meeting the health and social needs of individuals and families.

- Out of the 23 Family Care Teams announced for the province, 17 are currently operational or partially operational. The current location and status of Family Care Teams close to the Regional Assessment focus area include:
    - Western Region: Stephenville-Bay St. George, Humber Valley-White Bay, Port Aux Basques, Northern Peninsula are partially operational
    - Central Region: Grand Falls -Windsor, Coast of Bays are partially operational
    - Eastern Rural: Southern Avalon is operational while Conception Bay North, Clarenville, Bonavista and Burin are partially operational
- In collaboration with Newfoundland and Labrador Health Services (NLHS), additional efforts to increase access to primary health care include:
    - The launch of mobile clinics in the Central and Eastern Urban Zones of NLHS
    - The launch of Virtual Primary Care Services in November 2023 as part of the provincial virtual care strategy to increase access to health care for residents who do not have a primary care provider.
    - The incorporation of mobile and virtual care approaches by Family Care Teams while operating in hub and spoke models to ensure care is accessible regardless of location.
- Progress on the Health Accord implementation, to March 2024, can be found at: https://wellbeingnl.ca/resources/.

7.12.2 Potential Effects

As with the introduction of any new technology, concerns have been raised that wind power projects could lead to impacts on human health (Jeffery et al., 2013; Michaud et al., 2016). These concerns are primarily related to onshore wind turbine operational effects (i.e., EMF frequencies from transmission lines, shadow flicker, ice throw, structural failure, and wind turbine noise). Wind turbine noise would include levels of audible noise including low frequency noise and infrasound (Knopper et al., 2014; Knopper & Ollson, 2011). Several self-reported health symptoms have been attributed to wind turbine noise exposure. These include, but are not limited to, cardiovascular effects, vertigo, anxiety, depression, tinnitus, headache, stress, cognitive dysfunction, sleep disturbance and annoyance (Jeffery et al., 2013; Knopper & Ollson, 2011; Michaud et al., 2016).

Reviews of available scientific evidence (e.g., Bolin et al., 2011; Ellenbogen et al., 2012; Fortin et al., 2013; Knopper & Ollson, 2011) suggest that EMF, shadow flicker, low-frequency noise, and infrasound from wind turbines are not likely to affect human health (Crichton et al., 2014; Knopper et al., 2014; O'Neal et al., 2011).

Health Canada, along with the World Health Organization, monitors scientific research on EMFs and human health as part of its mission to help Canadians maintain and improve

their health. In their expert advice to the Committee on the potential positive and adverse effects (including cumulative effects) of offshore wind energy development on human health, Health Canada indicated that while EMFs at extremely low frequencies can cause weak electric currents to flow through the human body, the intensity of these currents is too low to cause any known health effects. [126] Also, EMFs are strongest when close to their source and as a person moves away from the source, the strength of the fields fades rapidly. These fields can often be shielded by metal, and things such as buildings and trees. Even the ground, when power lines are buried, can block electric fields. According to Health Canada, the evidence of a possible link between extremely low frequencies magnetic field exposure and cancer risk is far from conclusive and more research is needed to clarify this possible link. Health Canada (based on expert engagement) is of the opinion that shadow flicker is not expected to be a significant concern at the planned distances (i.e., beyond 10 km from the shoreline). However, if windfarms are situated within the 10 km coastal buffer, the potential for shadow flicker to impact human health becomes more relevant.

The Health Canada report (Michaud et al., 2016) concluded that self-reported health effects (e.g., migraines, tinnitus, dizziness, etc.), sleep disturbance, sleep disorders, quality of life, and perceived stress were not directly related to wind turbine noise exposure.

However, the most consistent evidence throughout scientific reviews supports an association between wind turbine noise exposure and community annoyance (Knopper & Ollson, 2011; Michaud et al., 2016). Both studies found an association between increasing levels of wind turbine noise (SPL greater than 40 A-weighted decibels (dB(A)) and annoyance towards several wind turbine features (i.e., shadow flicker, blinking lights, vibrations, visual impact, and noise). Pedersen et al. (2009) found wind turbine noise more annoying compared to industrial and transportation noise at comparable levels, and was attributed to the specific sound properties, such as a “swishing” quality, temporal variability, the lack of nighttime abatement, visibility of wind turbines from dwellings, and negative attitude towards the visual impact. According to the Health Canada study, annoyance due to wind turbine noise was found to be statistically related to several self-reported health effects including, but not limited to blood pressure, migraines, tinnitus, dizziness, and perceived stress. However, the associations for self-reported and measured health endpoints were not dependent on the particular levels of noise, or particular distance from the turbines, and were also observed in many cases for road traffic noise annoyance (Michaud et al., 2016).

Attitudes and psychological expectations are also linked to annoyance and have the potential to facilitate other health complaints via the nocebo effect (Crichton et al., 2014;

[126] The Health Canada advice to the Committee on the potential positive and adverse effects (including cumulative effects) of offshore wind energy development during all phases on human health is available on the Registry under document 270.

Knopper et al., 2014; Knopper & Ollson, 2011). [127] Therefore, it is possible that a section of the population may remain annoyed and/or report other health impacts based on individual differences other than attitude and sensitivity, even when noise limits are enforced (Knopper et al., 2014; Pedersen & Waye, 2004). Pedersen & Waye (2004), concluded that attitude to the impact of wind turbines on the landscaped scenery was more strongly related to annoyance than the general attitude towards wind turbines. Given that annoyance appears to be more strongly associated with visual indications and attitude, rather than to noise itself, self-reported health effects of people living near wind turbines are more likely attributed to physical manifestation from an annoyed state than from wind turbines themselves (Knopper et al., 2014; Knopper & Ollson, 2011). Section 7.9 of this Report has more information on visual aesthetics and viewscapes as it pertains to the subjective perception of offshore wind farms on human health.

Besides the acoustic exposure and its influence on annoyance, various individual and situational characteristics have been found to influence the level of annoyance. Thus, having direct economic benefit from the use of wind turbines, which include rent payments or other indirect benefits such as community improvements from having turbines in an area, have been shown to have a significantly decreased risk of annoyance, despite exposure to similar or higher sound levels (Bakker et al., 2012; Janssen et al., 2011; Michaud et al., 2016; Pedersen et al., 2009).

High SPL of audible noise and infrasound have been associated with learning, sleep and cognitive disruptions as well as stress and anxiety (Kristiansen et al., 2009; Leventhall et al., 2003; Mohamed et al., 2021; World Health Organization [WHO], 2009; Yuan et al., 2009). It is worth noting that studies where biological effects were observed due to infrasound exposure, were conducted at SPL much greater than what is emitted by wind turbines (Knopper & Ollson, 2011; O'Neal et al., 2011; van Kamp & van den Berg, 2021). According to Fortin et al. (2013), SPL associated with large turbines are normally between 35 - 50 dB(A) which is comparable to indoor background sound at 300 - 350 m, and not sufficiently high to damage hearing.

However, minimum setback distances have been implemented in many jurisdictions to reduce or avoid potential effects of noise for people living in proximity to wind turbines. Under the *Ontario Renewable Energy Approval Regulation* (O. Reg. 359/09 as amended by O. Reg. 521/10), a minimum setback distance of 550m must exist between the center of the base of the wind turbine and the nearest noise receptor (e.g., a dwelling or location on a vacant lot). This is a conservative estimate of the required distance to attain a sound level of 40 dB(A) (Ontario Ministry of the Environment, n.d.), which corresponds to the WHO (Europe) night-noise guideline, a health-based limit value "necessary to protect the public, including most of the vulnerable groups such as children, the chronically ill and the elderly, from the adverse health effects of night noise" (WHO, 2009).

[127] A situation where a negative outcome occurs due to a belief that an intervention will cause harm.

The primary considerations for offshore wind development setbacks relate to maritime navigation, environmental protection, and the efficiency of wind farm layouts (NYSERDA, 2018a). They are generally subject to fewer restrictions regarding setback distances from human settlements because they are located far from populated areas. As part of their expert advice to the Committee, Health Canada indicated that a project's location, particularly in relation to human receptors, is a necessary component to any review of potential positive or adverse effect on human. Given the 10 km coastal buffer for the initial offshore wind energy licencing areas (see Section 6 of this Report), Health Canada is of the opinion that there is negligible potential for adverse health effects from the turbines during the operational phase. However, there is the potential for adverse human health effects from activities closer to the shoreline, during both the construction phase (e.g., horizontal directional drilling for the installation of the transmission cable, onshore construction and assembly of wind turbines etc.) and the operational phase (e.g., marine and helicopter traffic, onshore substation activities, etc.).

In their advice to the Committee, the provincial government of Newfoundland and Labrador indicated that offshore wind development has the potential to expand populations in coastal communities across three of the five Zones in NLHS, as well as the greater Corner Brook and Stephenville areas. A population increase would put increased demand on local health services, including hospitals, health centers, family care teams, and possibly offshore medical rescue services. Health services in some communities would also be impacted by the temporary demands from a transient worker population during the building phase of a project. These temporary effects were experienced in smaller communities during previous projects such as building the Hibernia platform, Hebron platform, Long Harbour nickel hydrometallurgical processing plant, and the Muskrat Falls Power Plant, which were followed quickly by the shrinking of the communities once projects were completed. Local health services need to be prepared for a temporary increase of pressures as a result of offshore wind development.

By replacing fossil fuel energy sources, offshore wind energy can help avoid harmful pollutants such as NO_x, SO_2, and $PM_{2.5}$, that contribute to respiratory and cardiovascular diseases, and premature death (Buonocore et al., 2016; NYSERDA, n.d.). Offshore wind energy also helps to reduce GHG emissions that influence climate change, which has wide-ranging impacts on human health. Effects of offshore wind development on air pollutant and GHG emissions, and their subsequent impact on human health have been described under Section 7.2 of this Report

7.12.2.1 Occupational Health and Safety

The *Canadian Energy Regulator Act* (CER Act) which came into force in 2019 sets out the legislative framework for the oversight of the full life cycle of an offshore renewable energy project and offshore power line. While the CER Act (2019) specifies the factors to be considered in determining whether to issue an authorization to carry out any work or activity related to an offshore renewable energy project or offshore power line, it does not provide the detailed requirements that must be met by an operator to obtain that authorization. These requirements will be established in a comprehensive manner in the

proposed Canada Offshore Renewable Energy Regulations (the "proposed Regulations"). The proposed Regulations are also intended to provide the certainty needed to inform offshore energy development and investment decisions. A draft version of the proposed regulations was issued by NRCan for public review in May 2023. While the CER Act (2019) and the proposed regulations are wide ranging and cover all aspects of offshore renewable energy projects and offshore power lines, this discussion focuses on one component, the safety and security of persons.

A condition of every authorization will be the establishment and implementation of a Safety Plan and an Emergency Response Plan. The Safety Plan must set out the procedures, practices, resources, and the sequence of key safety-related activities necessary to safely carry out the authorized work or activities and includes, among other things, the following information (Government of Canada, 2024):

- A description of how the safety plan will integrate the relevant elements of the management system.
- Identification of the organizational structure and chain of command for ensuring the work is carried out safely.
- A summary of the studies the operator has undertaken to identify and assess the safety hazards and risks associated with the specific authorized work or activities.
- A description of the safety hazards and risks that were identified, and the measures that will be taken by the operator to anticipate, monitor, avoid, and reduce those hazards and risks.
- The methods for communicating with people directly affected by those hazards, informing them about the risks and mitigation measures.
- A description of the facilities, equipment, and systems that are critical to safety and a summary of the specific procedures and policies that will be put in place for their inspection, testing, and maintenance.
- The measures that will be taken for detecting, forecasting, surveying, and reporting any ice hazards that may exist, as well as measures for data collection and, if applicable, for ice avoidance or deflection.
- The training needed for those doing the work, including their required experience, qualifications, and competencies.
- How the operator will monitor compliance with the safety plan, including work subcontracted to other service providers, through data collection, inspections, audits, and how the operator intends to manage any changes in the work or activities that may affect safety.

Occupations associated with the construction, installation, operations, and maintenance of offshore wind farms and the prerequisite geotechnical and environmental evaluations of the prospective sites for the farms are many and each has both shared and specific occupational health hazards and safety risks.

Health hazards include noise (during installation and maintenance activities such as the use of power tools and power sources, vessel operations and equipment and turbine parts transfers, helicopters and pile driving activities), electromagnetic fields, shadow flicker, epoxy and styrene and physical stress. Safety risks include challenges related to sea

transport and operations (e.g., waves, drowning, loss of mooring/anchor), climbing ladders several times a day (often carrying tools and smaller equipment), working at heights and in limited spaces in awkward and uncomfortable positions, transporting and lifting operations of turbine components, expending considerable physical effort for extended periods of time. Working in windy conditions at heights of 100 m or more and exposure to environmental heat and cold magnify these safety-related risks (Cooper et al., 2014; Karanikas et al., 2021).

The types of occupational health and safety training that workers need in the offshore wind industry are many and reflect the variety of trades involved and situations that workers will encounter and their inherent risks. As a minimum, wind energy workers should receive training on (Duff, 2010; EU-OSHA, 2013):

- Competent climber/tower rescue,
- General industry or construction safety (wind specific, if possible),
- First aid, including cardiopulmonary resuscitation and automated external defibrillation,
- Electrical and electrical metering safety,
- Metering equipment practical evaluations,
- Mechanical safety,
- Torque equipment and other tools of the trade,
- Crane signal and rigging practices,
- Safe manual handling,
- Working at height,
- Working in confined spaces,
- Fire awareness,
- Offshore survival.

7.12.3 Mitigation and Other Measures

When wind turbines are sited properly with appropriate setback distances, they are generally not related to adverse health effects (Knopper et al., 2014; Tang & Kilpatrick, 2021). Given the coastal buffer distance of 10 km for the initial offshore wind energy licencing areas, and appropriate siting of projects, taking into account the visibility threshold, with the lowest magnitude of effects to viewscapes, a typical offshore wind farm established within the initial offshore wind energy licencing areas would be well in excess of the minimum setback distance to help minimize or alleviate most concerns associated with annoyance due to visual cues and any other concerns relative to human health.

Modern wind turbines are quieter than the first models of the 1970s and 1980s, mainly due to reductions of noise from gears and generators. To continue addressing the concern of wind turbine noise, manufacturers continue to examine ways to design quieter turbines. This includes the development of new blade designs that minimize turbulence, as well as

changes to mechanical components to further reduce noise (Ministry of Environment of Denmark, n.d.). Examples of such innovations include:

- The use of upwind designs, which are less impulsive and noisy than downwind designs.
- Streamlining towers and nacelles to reduce noise from wind passing the turbine.
- Increasing soundproofing in nacelles to deal with mechanical noise from moving parts.
- Redesigning turbine blades to improve efficiency and reduce aerodynamic noise.
- Using specially designed gearboxes with flexible gear wheels and sound-dampening buffer pads to reduce mechanical noise.

Involving communities in the siting process has been shown to lower annoyance. People are more willing to accept wind turbines if they can participate in decision making, investments by the owners in community infrastructure are made (e.g., payments to the municipality), the generated electricity is consumed in the region instead of being exported, and in general they experience a sense of control (Knauf & Wüstenhagen, 2023; van Kamp & van den Berg, 2021).

Table 7.12.1 provides a summary of potential health concerns/hazards relative to wind turbines and their mitigation measures.

Table 7.12.1. Summary of Potential Wind Turbine Concerns/Hazards and Mitigation Options

Hazard/Concern	Possible Sources	Evidence	Mitigation
Sound/Noise	Turbine mechanics or blade motion (aerodynamic)	Sound levels are below health and safety limits. Annoyance and sleep disruption may occur when sound levels are 40 - 45 dB(A). Noise perception is associated with visual impact, lack of direct economic benefit, and perception of turbines as intrusive.	• Utilize setbacks and land-use planning to minimize sound levels and sound propagation. • Conduct noise monitoring during construction and operations to ensure sound levels comply with modeled levels (described and accepted in IA) and are within required noise limits. • Ongoing community engagement during construction and

Hazard/Concern	Possible Sources	Evidence	Mitigation
			operations phases.
Low frequency sound and Infrasound	Turbine mechanics or blade motion (aerodynamic)	Evidence of health effects at levels > 80 dB. Lack of evidence regarding levels produced by wind turbines (< 70 dB).	• Install turbines with rotor upwind of turbine base. • Utilize setbacks to minimize sound levels.
EMF	Generators, Grid connection lines, Transformers, Underground cables	No community exposure from turbine EMF. No EMF generated at surface from underground cables because of the close placement of phase conductors and screening of cables.	• N/A
Shadow flicker	Blade motion when sun is low in sky	Flicker frequency (0.5 – 1 Hz) for large turbines is below range likely to induce epileptic seizures.	• Use of non-reflective and/or dark colored blades. • Maintain flash frequency below 3 Hz (< 180 rpm for 3-blade turbine).
Ice throw/Ice shed	Glaze or rime ice falling from stationary turbine or thrown from moving blades	Physical danger to people/workers. Ice tends to fall straight down; usually falls well within setbacks.	• Utilize setbacks to minimize the risk of injury from ice fall. • Cease turbine operation and maintenance during icing conditions.
Structural failure	Blade or tower cracking or falling	Physical danger to nearby vessels and occupants. Cases of failure are rare and normally contained within 500 m of base.	• Utilize setbacks to minimize risk of injury in the event of structural failure.

Table Description: This table summarizes the health hazards/concerns associated with offshore wind development, their possible sources, evidence associated with the hazards, and possible mitigation measures.
Source: Fortin et al., 2013.

7.12.4 Engagement Outcomes

Health and safety concerns relative to offshore wind development and its operations were raised on several occasions by different participants during the Committee's engagement initiatives (either virtual or in-person), with advisory group members and/or the public. Participants asked about:

- The accessibility of search and rescue teams to help fish harvesters or vessels once offshore wind farms are established.
- The consideration of human health impacts/issues associated with offshore wind development and operation (e.g., impact of sound and vibrations on coastal communities).
- The potential cumulative effect on coastal communities as well as people who will be working in the industry.
- The pressure on local hospitals because of the potential temporary or permanent increase in population during the construction phase.
- Air pollution and the potential impacts on human health, associated with the extraction, refinement of materials used to construct turbines.

7.12.5 Data Gaps and Limitations

- **Limited long-term studies**: Most of the existing research on offshore wind farms has been conducted in shallow waters/seas and during the operational phase, with focus on environmental impacts rather than health impacts (Galparsoro et al., 2022). There is a lack of long-term studies examining potential health impacts over extended periods. The focus of research on wind turbine effect on human health has been on onshore wind farms.
- **Cumulative impacts**: Few papers have looked at the interaction of pressures produced by two or more wind energy devices or their cumulative effects on both ecosystems and human health. This represents a major knowledge gap, as future wind energy developments will likely contribute to cumulative impacts alongside existing activities and climate change (Galparsoro et al., 2022). With the expected increase in demand for marine space, other ocean uses are likely to take place in the same area as offshore wind farm activities, with a likelihood of exacerbating local cumulative pressures.
- **Occupational health risks**: While some studies have examined occupational health risks for offshore wind farm workers, there is still limited information regarding potential long-term health consequences (Rowell et al., 2024). There is a need for further research into the physical strains, motion exposure, and other potential health risk associated with offshore wind farm employment (EU-OSHA, 2013).
- **Health and safety indicators**: There is a need for better-defined health and safety indicators specific to the offshore wind industry (Rowell et al., 2024). Health and safety as part of key performance indicators within the offshore wind industry is limited (Pfaffel et al., 2019).

Developing standardized metrics for monitoring and assessing health and safety performance in this sector could help identify and address potential risks more effectively.

- **Emergency preparedness**: Information gaps exist regarding emergency preparedness and response strategies for offshore wind farms, which could have implications for worker health and safety (Ahsan et al., 2019; Pedersen & Ahsan, 2020).
- **Noise and vibration effects**: More research is needed to understand the potential impacts of noise and vibration from offshore wind turbines on human health, particularly for nearby coastal communities.
- **Psychological impacts**: Ther are limited epidemiological data to assess physical and psychological health status before and after wind farm development (Fortin et al., 2013). Generally, the psychological effects of living near offshore wind farms, including visual impacts and perceived risks, are relatively unknown.
- **Comparative health impacts**: There is a need for more comprehensive studies to compare the health impacts of offshore wind energy with those of other energy sources, considering both occupational risks and the larger public health impacts.

7.12.6 Committee Conclusions and Recommendations

Future research should address both the human and occupational health, and safety gaps by conducting long-term, multidisciplinary studies that examine the full range of potential health effects associated with the development of offshore wind projects. A comprehensive assessment would include assessing both direct and indirect effects on human health, along with consideration of the complex interactions between environmental, occupational, and community health factors.

Collaboration amongst government of Canada and regulatory authorities, academic and research institutions, and industry will be necessary to increase knowledge regarding occupational health and safety hazards and risks in the wind farm sector.

The Committee recommends:

- Including an assessment of sound propagation from wind turbines, with the use of an appropriate noise model, during a project review.
- Offshore wind projects be assessed on a project-by-project basis, considering that the type of sound (e.g., impulsive, tonal, etc.) and human receptor locations will vary depending on project specific activities.
- Offshore wind activities occurring closer to shore (e.g., nearshore or onshore) during construction, operation and decommissioning phases be also assessed for project related effects.
- Baseline data on human health and the environment be collected by proponents to help gauge potential impacts on Indigenous communities and the environment.

7.13 Communities and Economy

This chapter provides an overview of offshore wind development effects to communities and economy in Newfoundland and Labrador, with a focus on areas adjacent to the Regional Assessment Focus Area. As per the Agreement, the scope of this Report considers the physical activities associated with the construction, operation, decommissioning and abandonment of an offshore wind power generation facility. It does not include the associated and eventual use of the electricity produced by that offshore wind power generation facility. Impacts to communities and economy are, therefore, discussed as they relate to things like turbine design, fabrication, installation, operation and maintenance, and eventually decommissioning of wind power generation facilities.

Furthermore, the Agreement directs the Committee to assess impacts on 'communities' and 'economy'. Throughout the engagement process, the Committee heard that broader economic benefits of a new industry cannot be considered without recognizing the impacts on local economies, structure, and values. The Committee agrees, and this is addressed in two ways in this Report:

1. The Committee opted to consider "Communities and Economy" as a single component to more clearly examine broader economic impacts in the context of local realities.
2. The Committee retained the services of The Canadian Research Institute for the Advancement of Women (CRIAW) to support addressing GBA Plus and intersectionality considerations for a potential offshore wind development industry in Newfoundland and Labrador.

CRIAW completed a literature review, analyzed existing data, and held interviews with people and organizations representing a variety of diverse populations and issues in Newfoundland and Labrador. They submitted a report to the Committee which examines the potential impacts that projects could have on diverse groups of people in Newfoundland and Labrador, the data needed to assess and monitor these impacts, and the potential indicators that could be used.[128]

While this Section of the Regional Assessment Report provides an overview of the potential impacts of offshore wind development on communities and economy based on available information in other jurisdictions, CRIAW's work more thoroughly applies an intersectional and local lens to the topic. Summary boxes throughout this Section highlight some of CRIAW's key findings. The Committee also re-laid some of CRIAWs recommended strategies under Section 7.13.3 Mitigation and Other Measures.

[128] Section 11 of this Report provides more details about GBA Plus and Intersectionality in this Regional Assessment, including work completed by CRIAW. CRIAW's report is available on the Registry under document reference number 386 and is also in Appendix G of this Report.

It is strongly recommended that CRIAW's report be reviewed in addition to this section.

7.13.1 Existing Conditions

7.13.1.1 Provincial Economy

7.13.1.1.1 Key Sectors and Industries

Newfoundland and Labrador's economy is resource-based, relying primarily on the extraction and processing of oil, minerals, fish, and forest resources. Overtime the province's economic history changed as the fishery declined, culminating in the declaration of the cod moratorium in 1992. Currently, Newfoundland and Labrador's economy remains based on natural resources but, as well, has diversified with industries such as tourism, the arts, clean technology, marine innovation and others all actively contributing.

Figures 7.13.1 and 7.13.2 show provincial gross domestic product (GDP) from 2013-2023 for select goods and service producing industries.

During that period, mining and oil extraction had the highest average GDP of all industries, at over 7,100 millions of chained 2017 dollars. Construction, followed by real estate, rental, and leasing, had the next highest average GDPs at over 3,100 and over 2,900 millions of chained 2017 dollars (Figure 7.13.3).

Figure 7.13.1 Provincial Gross Domestic Product for Goods Producing Industries (2013-2023)

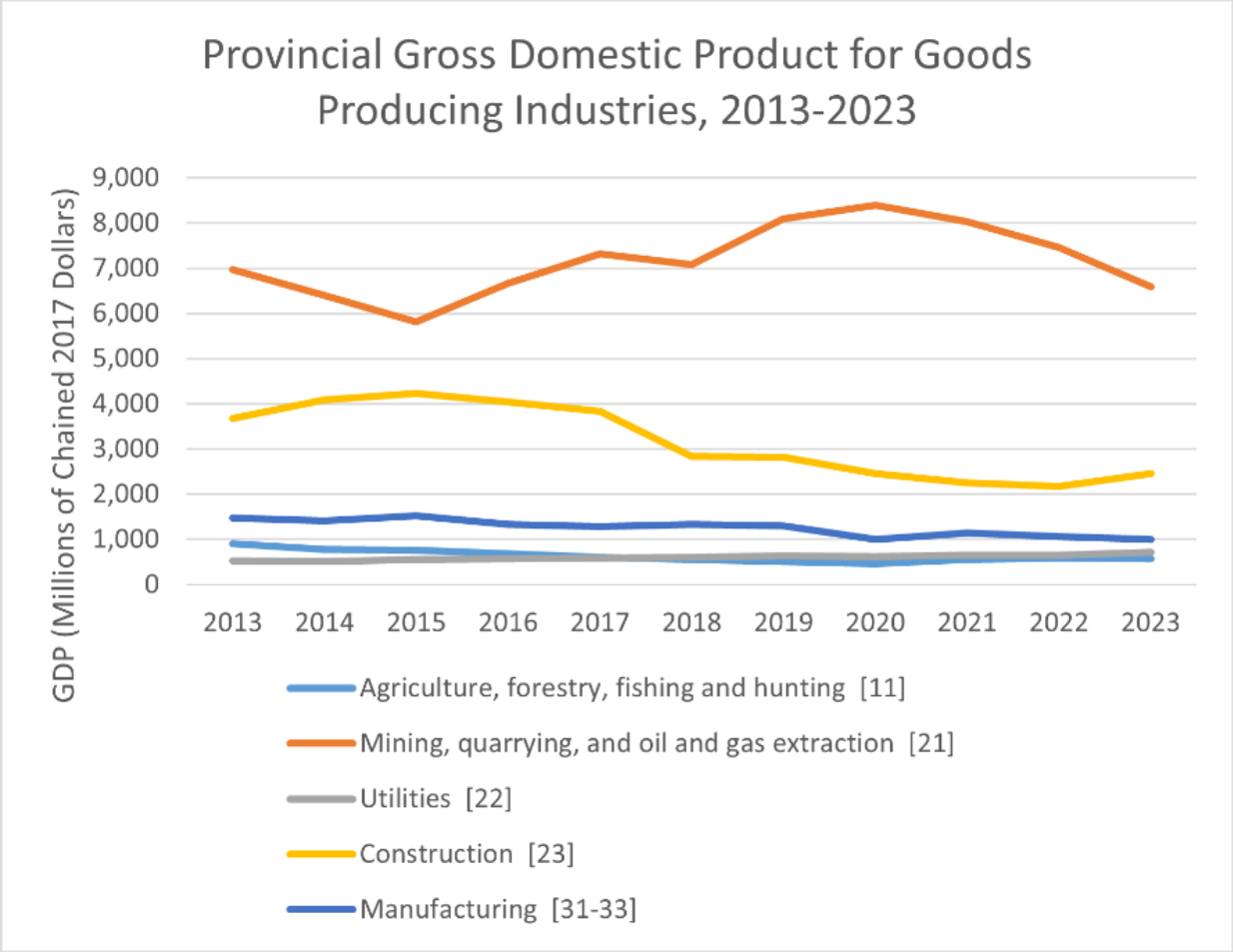


Figure Description: This figure shows GDP overtime for goods producing industries in Newfoundland and Labrador. Industries are listed by sector and code according to the North American Industry Classification System 2017 Version 3.0 (NAICS 2017 Version 3.0).

Sources: Statistics Canada, 2024b.

Figure 7.13.2. Provincial Gross Domestic Product for Select Service Producing Industries (2013-2023)

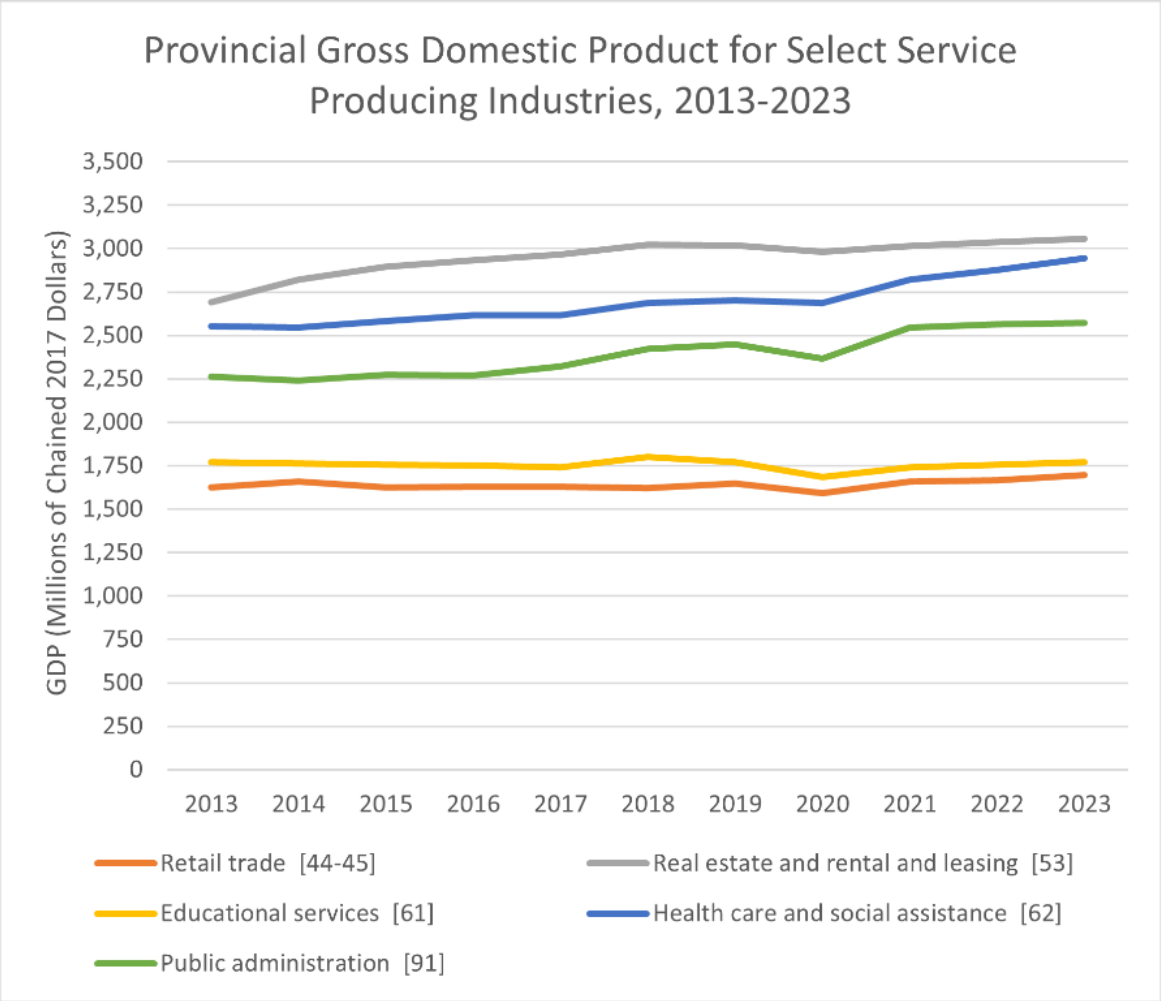


Figure Description: This figure shows GDP overtime for service producing industries in Newfoundland and Labrador. Only service producing industries with the highest average 2013 - 2023 GDP are shown. Industries are listed by sector and code according to the North American Industry Classification System 2017 Version 3.0 (NAICS 2017 Version 3.0).

Sources: Statistics Canada, 2024b.

Figure 7.13.3. Average Provincial Gross Domestic Product by Industry (2013-2023)

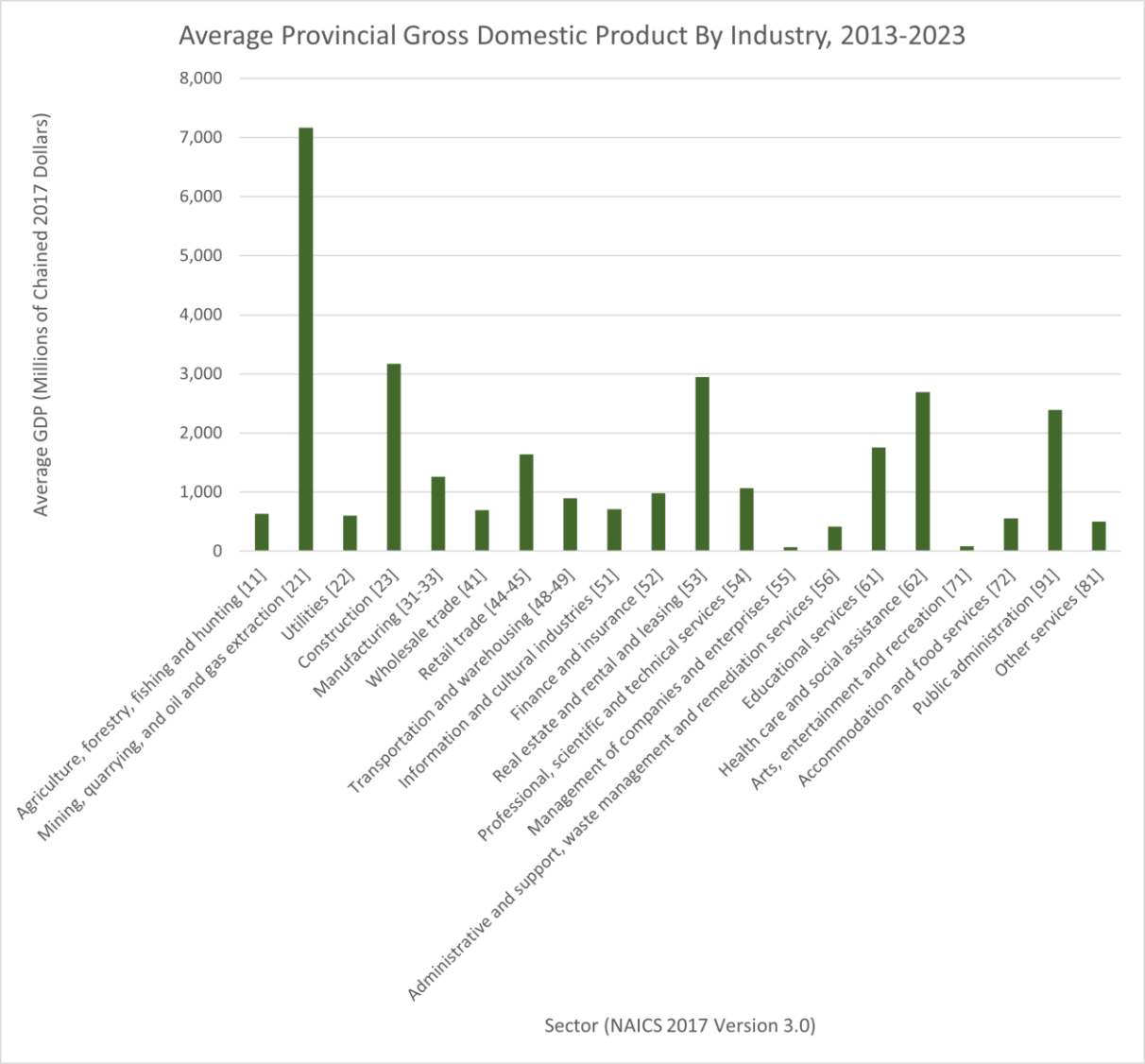


Figure Description: This figure compares average GDP by industry over the years 2013 - 2023 in Newfoundland and Labrador. Industries are listed by sector and code according to the North American Industry Classification System 2017 Version 3.0 (NAICS 2017 Version 3.0).

Sources: Statistics Canada, 2024b.

In terms of employment the provincial population was predominately employed in healthcare and social assistance, retail trade, and public administration in 2021 (most recent data available). Although this varies by gender (Figure 7.13.4) and area (Figure 7.13.5).

Figure 7.13.4. Newfoundland and Labrador Employment by Industry, 2021

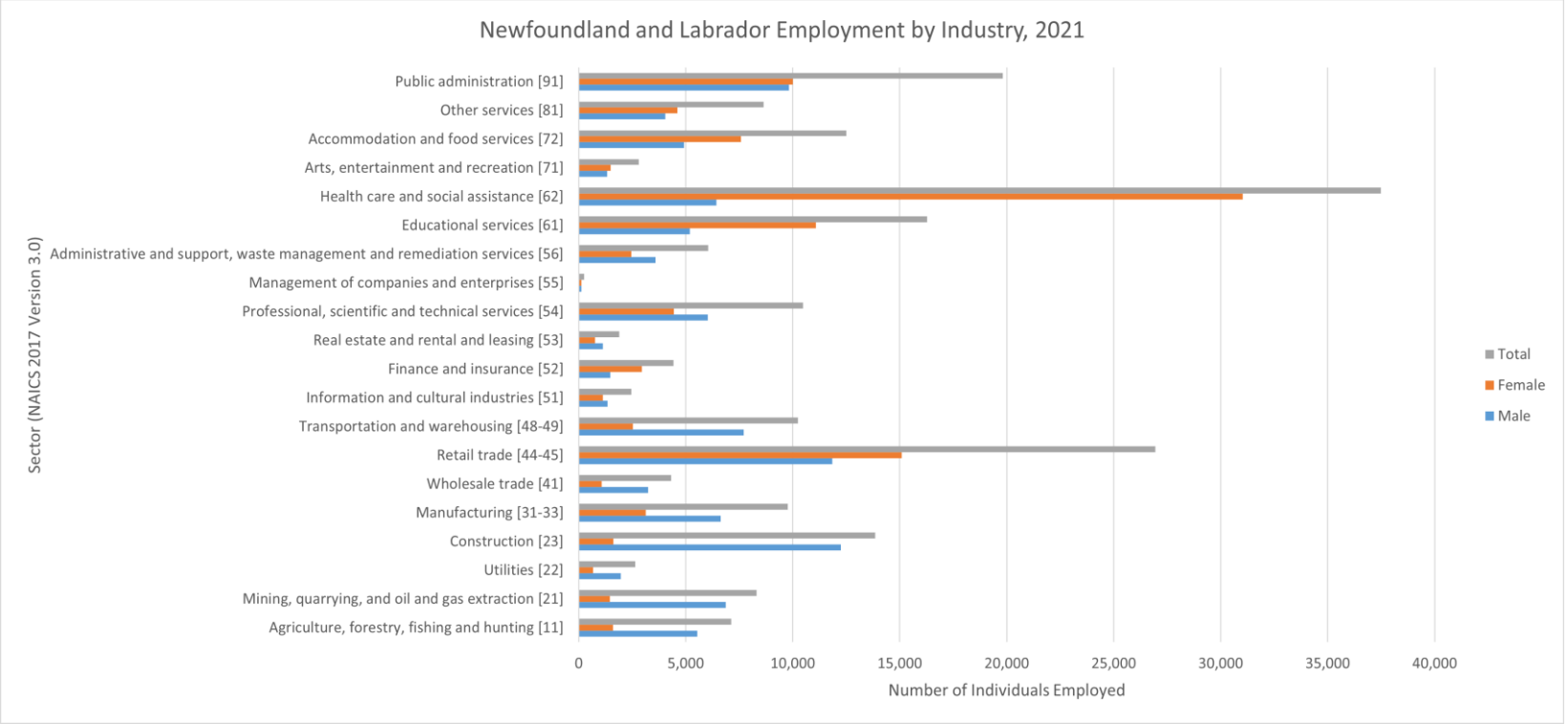


Figure Description: This figure shows the number of individuals employed across different industries in Newfoundland and Labrador, disaggregated by gender. Information is based on 2021 census data. Industries are listed by sector and code according to the North American Industry Classification System 2017 Version 3.0 (NAICS 2017 Version 3.0).

Sources: Newfoundland & Labrador Statistics Agency, 2023a.

Figure 7.13.5. Employment by Industry Across Rural Secretariat Region, 2021

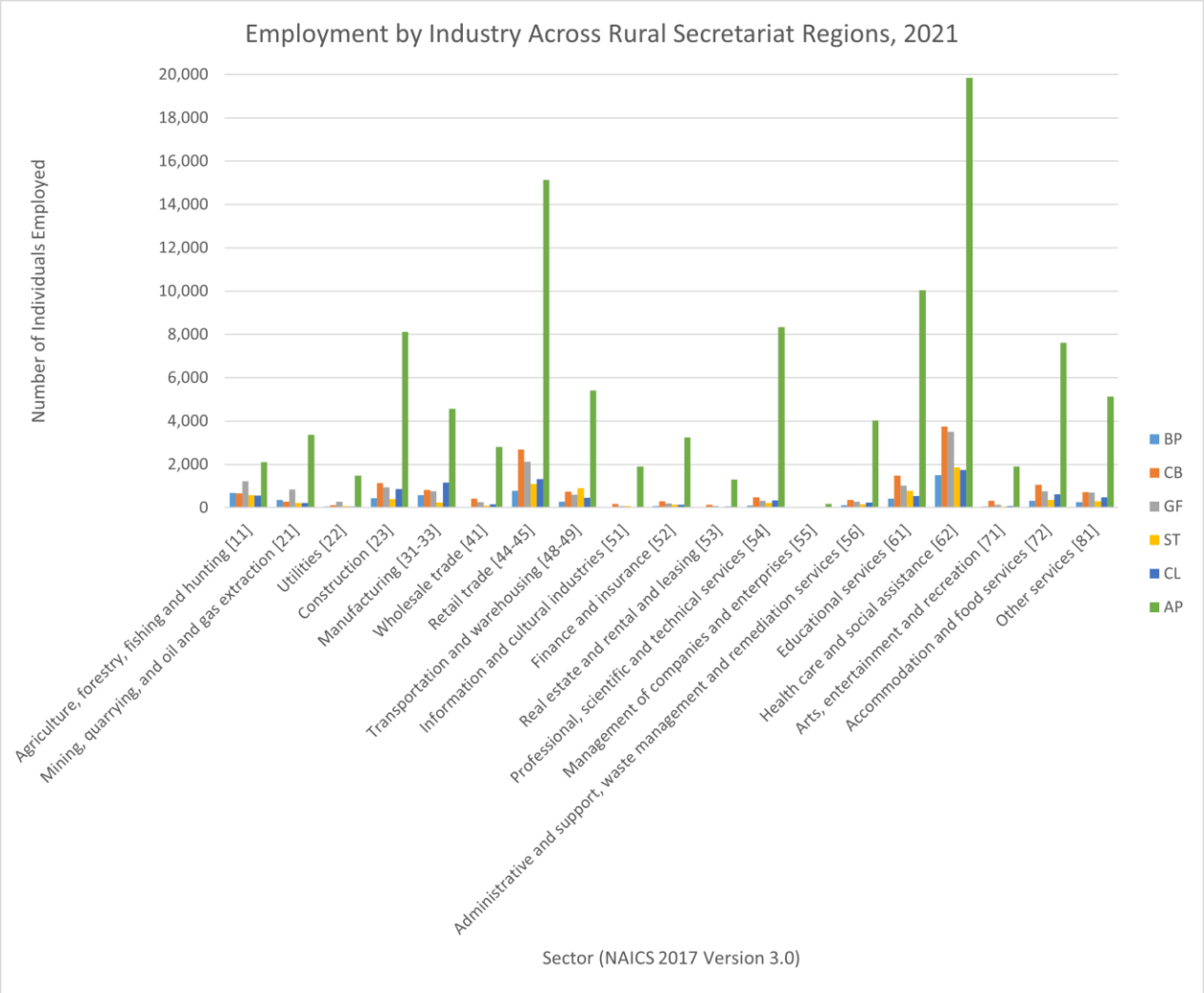


Figure Description: This figure shows the number of individuals employed across different industries in Newfoundland and Labrador rural secretariat regions. Information is based on 2021 census data. Gender disaggregated data is available. Industries are listed by sector and code according to the North American Industry Classification System 2017 Version 3.0 (NAICS 2017 Version 3.0).
Rural secretariat regions include:

- BP: Burin Peninsula Rural Secretariat Region
- CB: Corner Brook – Rocky Harbour Rural Secretariat Region
- GF: Grand Falls-Windsor-Baie Verte-Harbour Breton Rural Secretariat Region
- ST: Stephenville – Port aux Basques Rural Secretariat Region
- CL: Clarenville – Bonavista Rural Secretariat Region
- AP: Avalon Peninsula Rural Secretariat Region

Sources: Newfoundland & Labrador Statistics Agency, 2023a.

The following provides an overview of some key sectors. Fisheries has a dedicated section in this Report (see Section 7.7), although a brief section on fisheries and aquaculture is included below. The overview is based on numbers reported under *The Economy* in *Budget 2024, Transforming – Our Health. Our Economy. Our Province* (Department of Finance 2024b).

Oil and Gas

The offshore oil and gas industry remains an important economic contributor to the province in terms of royalties and employment. There are currently four developed oilfields in the province's offshore area, concentrated in the Jeanne d'Arc Basin on the Grand Bank. The value of production did decline by 27.0% in 2023, due to lower prices and refit work taking platforms out of full-time operation but was still responsible for 11.4% of the provincial revenues. There is a potential fifth offshore oil project, Bay du Nord. The project development concept is under review by the operator and a decision expected by 2026. An increase in production is anticipated for 2024 with the Terra Nova Floating Production Storage and Offloading vessel back in production and the Sea Rose is expected back from refit to resume production in late 2024. The four projects employed more than 6,000 residents of Newfoundland and Labrador in 2023.

Mining

Both mineral production and exploration are expected to increase in 2024. Iron ore prices are anticipated to rise due to demand in China. While nickel price may decline, this may be offset by an increase in demand for electric vehicles. The mine expansion project at Voisey's Bay (VBME) should be completed and into operation. Mining in Labrador generated over 7,000 person years of employment in 2023. Three mine projects on the Island are in development with changes in ownership during 2023, the Valentine Gold project and the Hammerdown gold project and the Green Bay Copper-Gold project. Limestone, dolomite and construction aggregate continue to be mined on the Port-au Port Peninsula. The construction aggregate sector shipped close to seven million tons of gravel, sand, crushed stone in 2023, valued at approximately $44 million and generated about 557 person years of employment. Mineral exploration is expected to increase to $223.2 million in 2024. Provincial incentive programs such as the Mineral Incentive Program and Junior Exploration Assistance along with the potential for critical minerals as discussed in 'Our Critical Minerals Advantage' (Department of Industry, Energy and Technology, 2023a), encourage exploration.

Manufacturing

Companies in the province manufacture and sell both durable goods (fabricated metal products and non-ferrous refined metals such as nickel) and non-durable goods (such as fish products and newsprint). Employment in manufacturing in 2023 was 9,500 persons, with most (5,800 persons) in non-durable goods. Both domestic and international exports declined in 2023, mainly the result of a decline in the price of nickel for durable goods and snow crab for non-durable goods. The value of international sales in 2023 was $ 2.5 billion. The manufacturing sector is exploring ways to increase productivity and transition to greener technology. A new manufacturing initiative in the province is the production and

export of renewable diesel at the converted Come By Chance refinery, in Placentia Bay, near the Focus Area.

Fishery and Aquaculture

Approximately 16,000 individuals were employed in fish harvesting, processing, hatchery and grow-out operations in 2023. Shellfish, especially shrimp, snow crab and lobster are the majority of both the landings and the value of the wild fishery, 66% and 84% respectively. It is expected that the landings of wild fishery will increase due to groundfish, as redfish has increased in abundance and a fishery will reopen in 2024. Aquaculture of both salmonids and shellfish is also expected to increase in 2024. The first harvesting of farmed salmon from Grieg operations in Placentia Bay started in the fall of 2023. Mussel farming continues and oyster farming was recently initiated. Aquaculture is expanding in the bays west of the Bay d'Espoir region through the Bays West Aquaculture Development Project announced in 2022.

Forestry and Agriculture

Demand and price for lumber and newsprint declined in 2023. As well, the industry faced equipment and workforce shortages and a spruce budworm infestation on the west coast of Newfoundland. The market weaknesses are expected to continue in 2024. The province will continue to collaborate with the federal government on Spruce Budworm control in 2024. There is a value-added wood product sector in the province, a diverse group of small to medium sized business, producing specialty products such as furniture, cabinets, and roof trusses. In 2023, this group generated approximately $120 million in market value. The focus in provincial agriculture is production of dairy, chicken and eggs. The provincial government is making efforts regarding increased food self-sufficiency, land available for agriculture, and secondary processing. Two programs are in place for 2024 and beyond: Agrifoods Assistance Program and National Sustainable Canada Agricultural Partnership.

Construction

High levels of activity in the provincial construction industry are linked with major project development as was experienced in 2023 with the resumption of work on the White Rose wellhead platform at Argentia and the VBME in Labrador. Activity is expected to increase in 2024 and beyond with major projects anticipated in many sectors.

Real Estate

Residential construction (housing starts) is anticipated to increase by 33% in 2024, as interest rates drop.

Tourism

In 2023 there were 20,000 people working in tourism related jobs (Hospitality Newfoundland and Labrador, 2023), Both resident and non-resident travel play an important role in this $1.2 billion industry. The increasingly high costs of travel, air in particular, may have some effect.

7.13.1.1.2 Cost of Living

Cost of living in Newfoundland and Labrador has been increasing year to year. From 1993 - 2020 rate of inflation fluctuated between approximately 0.25 - 3.50%. Rate of inflation spiked in 2022, reaching above six percent, but was still high, at above three percent in 2023 (Figure 7.13.6).

Figure 7.13.6 Newfoundland and Labrador Consumer Price Index 1993-2023

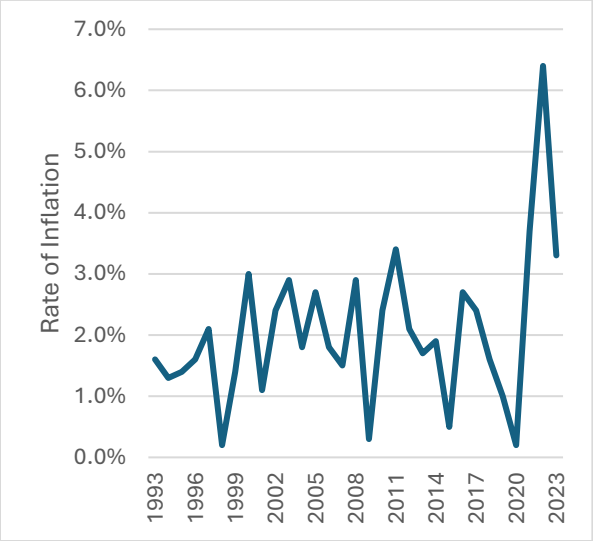


Figure Description: This figure shows provincial rate of inflation over time.
Sources: Statistics Canada, 2024a.

The following lists 2023 rate of inflation by category (Statistics Canada, 2024a):

- Food increased by 7.80%.
- Shelter increased by 4.90%.
- Household operations, furnishings and equipment increased by 1.20%.
- Clothing and footwear decreased by 0.60%.
- Transportation decreased by 0.30%.
- Health and personal care increased by 7.20%.
- Recreation, education and reading increased by 1.60%.
- Alcoholic beverages and tobacco products increased by 4.30%.
- Energy decreased by 4.20 %.
- Goods increased by 2.70%.
- Services increased by 4.00%.

Between October 2023 - October 2024,[129] consumer price index increased by 1.10%. The Government of Newfoundland and Labrador reports:

> Inflation for each month of 2024, thus far, has been below the average annual inflation rate of 3.30% for 2023.
>
> Overall inflation has been moderating in the province throughout the year, and in recent months has been near the lower bound of the Bank of Canada's target of between one percent and three percent. Inflation rates for essentials such as food and shelter have also been moderating, however, remained above the overall inflation rate (Department of Finance, 2024c).

7.13.1.1.3 The Big Reset

Two reports in the recent past are especially relevant to the existing socioeconomic environment in the province: The Big Reset (2021) and the Health Accord (2022). The Health Accord is discussed under Section 7.12 in this Report.

The Big Reset was the product of the Premier's Economic Recovery Team, established in fall 2020. The Team was to review government expenditures, the province's fiscal capacity, how services are delivered, and explore growth sectors such as clean energy and investments in technology. In May 2021, The Big Reset identified four key areas of strategic focus for immediate action:

- Improving accountability and transparency in decision-making,
- Building a greener, technologically advanced economy,
- Refocusing the social contract to concentrate on the challenges of today and tomorrow, and
- Implementing a solid fiscal plan.

Issues 2 and 4 are discussed below.

Implementing a Solid Fiscal Plan

The provincial government revenues in 2023 were mainly from taxation (43%), offshore royalties (15%) and federal sources (14%) (Table 7.13.1).

[129] More recent data may be available since publishing the Regional Assessment Report.

Table 7.13.1. Provincial Revenue by Source in 2023

Source	Percentage
Taxation	43%
Offshore Royalties	15%
Federal Sources (other)	14%
Health and Social Transfers	9%
Government Business Enterprises	8%
Other Provincial Sources	6%
Fees and Fines	4%
Investment	1%

Table Description: This table shows percentage of provincial revenues from various sources in 2023.

Sources: Department of Finance, 2024a.

Recent provincial budgets have focused on bringing the province's fiscal situation under control. The 2024 Budget, *Transforming – Our Health. Our Economy. Our Province.,* provides a positive economic outlook for Newfoundland and Labrador. Forecasts show the province with one of the highest rates of economic growth in the country in 2024, and the expectation that the province's GDP will increase by 5.1%. The 2024 Budget addresses specific efforts regarding fiscal responsibility:

- Focusing on balanced budgets in future years. The provincial deficit has decreased from $1.5 billion in 2020 - 2021 to $152 million estimated in 2024 - 2025.
- Contributing $72.4 million to the Newfoundland and Labrador Future Fund.
- Creating sinking funds when new bonds are issued to ensure money is put aside only for repaying the principal of the bonds at maturity.
- Lowering the cost of borrowing so the province has the option to issue bonds beyond the Canadian market.
- Strengthening liquidity to ensure cash reserves are available to meet obligations.
- Addressing the cost implications of the inherited Muskrat Falls Project through a $5.2 billion rate mitigation agreement with the Government of Canada.

The Premier's Economic Recovery Team report recommended a fund be established based on revenues from offshore oil and gas to address volatility in per barrel prices which is reflected in royalties to the province (Premier's Economic Recovery Team, 2021). The Newfoundland and Labrador Future Fund was established in 2022. The Fund is in place for long term management of provincial debt. It is built on portions of the provincial revenue from non-renewable resources and the occasional contribution from the sale of provincial assets greater than $5 million. As of November 25, 2024 the Future Fund is $359.1 million (Department of Finance, 2024d).

Green Energy and Technology

The Premier's Economic Recovery Team report's emphasis on building a greener, technologically advanced economy and strongly encouraged the province to take advantage of its natural resources (Premier's Economic Recovery Team, 2021). The 2024 Budget highlights opportunities in green energy as well as low carbon oil, mining and aquaculture.

There is significant effort within the provincial and federal governments and industry (e.g., MRC, EnergyNL, econext) to increase interest and investment in renewable energy and clean technology to address climate change and meet emissions reduction targets set by government and international organizations. The current joint federal-provincial Regional Assessment of Offshore Wind Development in Newfoundland and Labrador is one example.

The provincial government has been working aggressively to position itself for green energy within the last few years. A key step was taken in April 2022 when the provincial Minister of Industry, Energy and Technology announced the removal of the moratorium on wind energy. A process was put in place that enabled potential developers to propose on land wind energy projects, in some cases using provincial Crown Lands. At present, five onshore wind energy projects are under consideration, four accessing Crown Lands and one on privately owned land. The projects would use wind energy to support production of green hydrogen for export.

The province has developed a fiscal framework for onshore wind-hydrogen development. One assessment of the potential revenue from onshore wind-hydrogen indicates that a single project over a 30-year period, could provide the government of Newfoundland and Labrador $3.5 billion in taxes, royalties and fees (Department of Industry, Energy and Technology, 2023b).

The province is actively engaged in numerous climate change related initiatives including the Regional Energy and Resources Table, initiated by the federal government and involving provincial, territorial and Indigenous partners and relevant stakeholders. This group investigates clean growth opportunities in critical minerals; clean fuels and hydrogen; non-emitting electricity and transmission; carbon capture and removal (storage); sustainable forestry; and nuclear technology (NRCan, 2022b). The province's approach to Net Zero is outlined in the Newfoundland and Labrador Regional Energy and Resource Table, Framework for Collaboration on the Path to Net Zero (NRCan, 2024d). The focus is on four areas of action: critical minerals, wind and hydrogen, electrification, and carbon capture/use/storage.

The 2024 Budget document included a special feature on the technology sector, increasingly a significant part of the economy. In 2022, the sector contributed $1.7 billion to real GDP and almost 10,000 person years of employment. Four industries were responsible for 91% of the technology sector-related real GDP: telecommunications, architectural engineering and related services, computer systems design and related services, and support activities for oil and gas extraction. This sector is expected to

expand. There are already recognized successes in innovative technology in a wide range of activities: subsea imaging, fraud detection, energy efficiency, environmental monitoring, offshore and onshore geotechnics, airborne intelligence, surveillance and reconnaissance, and more.

7.13.1.2 Demography and Communities

The Canada Census 2021 showed a provincial population of 510,500 people, a slight decline since the previous census in 2016. However, in 2022, the province's population had increased by 5,520 persons, an increase of 1.1% (Department of Finance, 2024b). The median age is 48 years, with 60% of the population within working age (18-64 years) and16% of the population 17 years and younger.

Population on the Island of Newfoundland is concentrated on the Avalon Peninsula, primarily in the St. John's greater metropolitan area including the City of Mount Pearl, the Towns of Paradise and Conception Bay South, and the northern Avalon region. Outside of the Avalon Peninsula, most communities are small with several larger, informal, regional hubs, drawing residents from smaller, rural communities with the availability of services (e.g. health, education, retail) and/or family. Examples of these informal hubs include Clarenville, Marystown, Gander, Grand Falls-Windsor, Corner Brook, Stephenville, Deer Lake and Port aux Basque. Conne River is a community in Miawpukek Mi'kamawey Mawi'omi, a First Nation reserve at the mouth of the Conne River as it enters Bay d'Espoir on the south coast of the island of Newfoundland.

In Labrador, there are three Indigenous groups with members mainly residing in Band managed communities of Sheshashit and Natuashish (Innu Nation) and the several coastal communities in Nunatsiavut (Inuit), with members of NCC in a number of coastal communities mainly south of Lake Melville. Non-Indigenous residents also live in the coastal communities or the larger communities of Churchill Falls (a company community), Wabush, Labrador City and Goose Bay.

The larger communities within the Focus Area include Marystown, Burin, St. Lawrence, Grand Bank and Fortune, Harbour Breton, St. Alban's, Burgeo, Port aux Basques, Stephenville, and Corner Brook.

While not within the Focus Area, the port of Argentia and nearby communities, facing onto outer Placentia Bay, are already engaged in offshore wind development related activities. Arnold's Cove and Come By Chance are adjacent to the Come By Chance refinery and Whiffen Head crude oil transshipment facility with associated industrial lands and capability. This area also has potential onshore wind energy development (Hood, 2023). St. John's, the capital city, is also a business hub associated with wind energy. Three of the five onshore wind projects that are under active consideration are within or close to the Focus Area.

The sections below describe these communities and the regions in which they occur. Much of the information presented comes from the Newfoundland and Labrador Community Accounts information system. This system includes data on social and

economic indicators at various scales (e.g., communities, census consolidated sub-divisions, economic development zones, Rural Secretariat Regions, Health Authorities, School Districts, etc.,). The system also categorizes different types of information and data such that site users can review a singular 'Well-Being Account' for individual communities.

This Report mainly presents information at the provincial or Rural Secretariat Region levels. Some communities are also highlighted and described. Each section includes a map of the Rural Secretariat Region and an overview of some indicators.

Reviewing data at a more detailed level and engaging directly with potentially impacted communitas, will be important during project-level impact assessments.

INTERSECTIONALITY

CRIAWs Report (2024) analyzes the state of data for Intersectional Analysis. Appendix A of their report outlines potential indicators and available disaggregated data for education and training, labour market planning, and community well-being.

In general, CRIAW found Statistics Canada holds a considerable amount of data relevant for GBA Plus analysis and offers the most promising data source for this. However, data are usually aggregated at the provincial level.

Newfoundland and Labrador Community Accounts allows for the analysis of data at more specific geographic levels but would benefit from more disaggregated data: "The existing data is excellent and could be greatly enhanced by adding variables for sex, sexual orientation, age, income, disability or chronic illness, Indigenous identity, race and more. The more disaggregated data is available through Newfoundland and Labrador Community Accounts, the more possible GBA Plus will be for informing the development of the offshore wind industry in Newfoundland and Labrador" (p.71).

Recommendations put forward by CRIAW, and adopted by the Committee to address these data gaps are under Section 11 of this Report.

7.13.1.2.1 Corner Brook – Rocky Harbour

Figure 7.13.7 shows the Corner Brook – Rocky Harbour Rural Secretariat Region. One of the larger communities in this Rural Secretariat Region is Corner Brook. Located on the west coast of the Island, Corner Brook has a population of 19,260 people (Newfoundland & Labrador Statistics Agency, 2022b). Corner Brook is a regional center with a university campus, colleges, hospital, provincial social and health services, shopping, and retail. Industry includes forestry with a long-standing paper mill in the community and tourism associated with the immediate environment as well as nearby GMNP. Corner Brook is located at the end of a large inlet, Bay of Islands, and has an ice-free, deep-water port, accessible year-round. It serves recreational vessels as well as commercial vessels, container vessels, cruise ships and occasional oil or chemical tankers (City of Corner Brook, 2023).

Some social and economic indicators for the region are listed below. Most recent data available for the region was provided for each indicator.

Figure 7.13.7. Corner Brook – Rocky Harbour Rural Secretariat Region

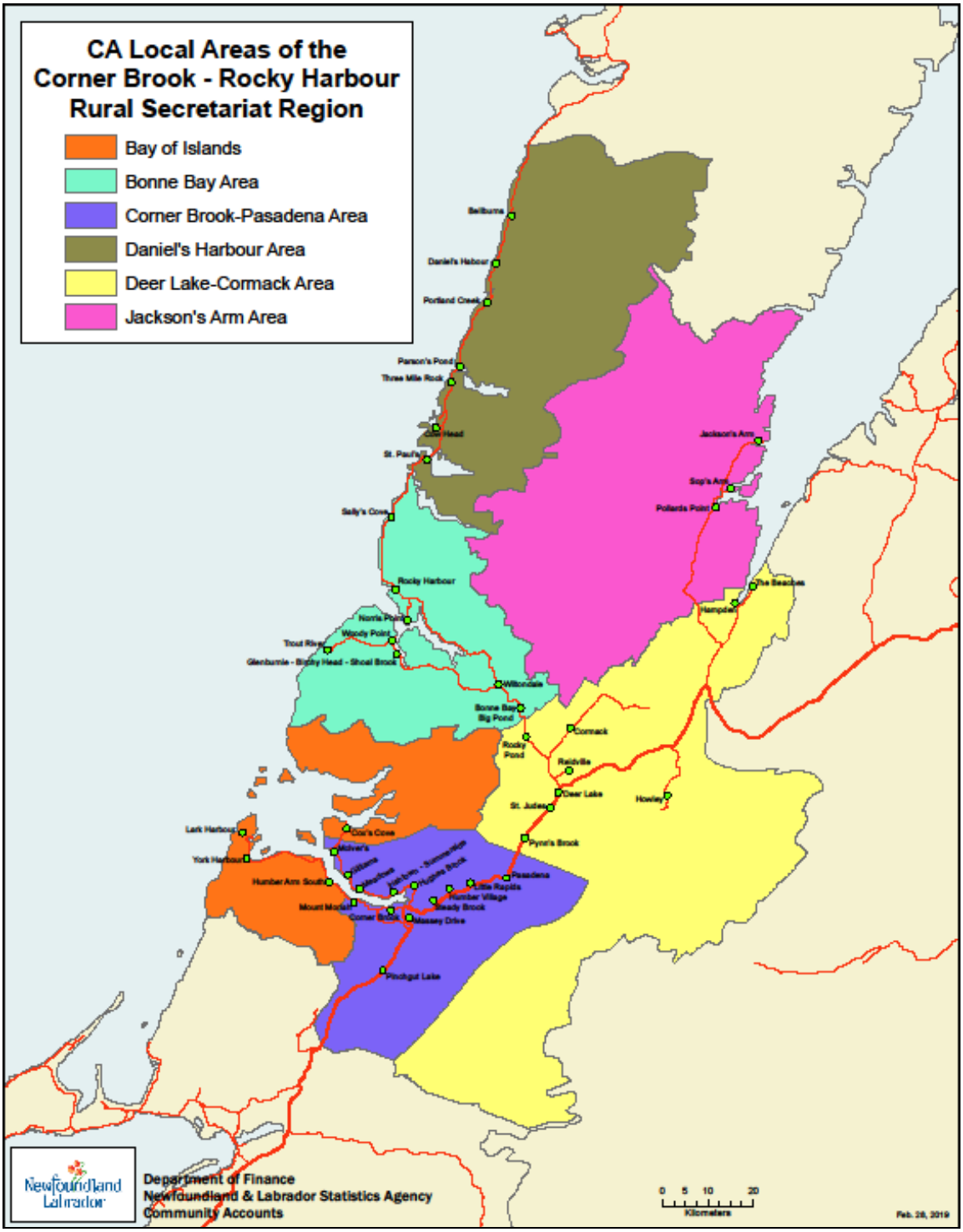


Figure Description: This map was adopted from the Newfoundland and Labrador Community Account Maps. It shows local areas for the Corner Brook – Rocky Harbour Rural Secretariat. Region.

Sources: Newfoundland & Labrador Statistics Agency, 2019.

2021 Demographics

- In 2021 the total population within this region was 44,300 people with a median age of 51 years. Of the population 48.63% indicated they identify as male, and 51.37% indicated they identify as female (Newfoundland & Labrador Statistics Agency, 2022b).
- Of the male population, 11.63% indicated they identify as Indigenous.[130] Of the female population, 12.88% indicated they identify as Indigenous (Newfoundland & Labrador Statistics Agency, 2024a).
- 57.90% of the population was within working age (18 - 64 years). This included 57.40% of the male population and 58.40% of the female population (Newfoundland & Labrador Statistics Agency, 2022b).
- The age dependency ratio[131] was 44.20% (Newfoundland & Labrador Statistics Agency, 2022b).

2021 Family Characteristics

- In 2021 the region included 3,600 married couples with children at home, 840 common law couples with children at home, 455 male lone parents with children at home, and 1,770 female lone parents with children at home (Newfoundland & Labrador Statistics Agency, 2022a).

2021 Economic Indicators

- In 2021 median income for males was $41,900 with market income contributing 76.80% of total income. Median income for females was $32,000 with market income contributing 68.80% (Newfoundland & Labrador Statistics Agency, 2024b).
- Low-income prevalence for all family types (e.g., couple family, male lone parent family, female lone parent family etc.,) was 12.20%. Low-income prevalence for non-family persons was 21.00% (Newfoundland & Labrador Statistics Agency, 2024c).

2016 Accommodations[132]

- In 2016 14,915 dwellings were owned by a member of household. Median monthly shelter costs for owned dwellings were $674 and average monthly shelter costs were $923. 4,900 dwellings were rented by a member of household. Median monthly shelter costs for rented dwellings were $756 and average monthly shelter costs were $794 (Newfoundland & Labrador Statistics Agency, 2018).

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[130] Indigenous identity refers to whether a person considers themselves an Indigenous person - that is, a member of the Indian, Inuit or Métis peoples of Canada.
[131] Age dependency ratio is the proportion of the population that is 65 years or older divided by the proportion of the population that is 15 - 64 years.
[132] More recent data is available at the provincial level. In 2021, 168,660 dwellings were owned by a member of household, median monthly shelter costs for owned dwellings were $750, and average monthly shelter costs for owned dwellings was $1,014. 53,616 dwellings were rented by a member of household, median shelter costs for rented dwellings were $870 and average monthly shelter costs were $903 (Newfoundland & Labrador Statistics Agency, 2022g). This compares to 167,330 owned and 50,420 rented dwellings in 2016, with $743 median monthly shelter costs of owned dwellings, $984 average shelter cost of owned dwellings, $802 median monthly shelter costs of rented dwellings, and $836 average shelter cost of rented dwellings (Newfoundland & Labrador Statistics Agency, 2018).

2021 Education and Employment

- Of the total population aged 15 years and over in 2021 (Newfoundland & Labrador Statistics Agency, 2023b):
    - 49.97% had a postsecondary certificate, diploma, or degree.
    - 10.79% had an apprenticeship or trades certificate or diploma.
    - 22.98% had a college, CEGEP or other non-university certificate or diploma.
    - 1.78% had a university certificate or diploma below bachelor level.
    - 14.42% had a university certificate, diploma, or degree at bachelor level or above.
- Most prevalent fields of study included architecture, engineering, and related technologies; business, management, and public administration; and health related fields (Newfoundland & Labrador Statistics Agency, 2023c).
- The labour market participation rate for males was 55.1% and employment rate was 44.4%. For females, labour market participation rate was 51.2%, and employment rate was 44.4% (Newfoundland & Labrador Statistics Agency, 2023e).
- Industries with the highest number of employed males included retail trade and construction. Industries with the highest number of employed females included healthcare and social assistance, and retail trade (Newfoundland & Labrador Statistics Agency, 2023a).
- Occupations with the highest number of employed males included trades, transport and equipment operators and related occupations; and sales and service occupations. Occupations with the highest number of employed females included sales and service occupations; and trades, transport, and equipment operators and related occupations (Newfoundland & Labrador Statistics Agency, 2023d).

2010 Personal Safety and Violence in Society

- According to the 2010 Survey of Attitudes Towards Violence (Newfoundland & Labrador Statistics Agency, 2012):
    - 91.1% of respondents in the region indicated they think their community and the surrounding area is a safe place to live. Others indicated they neither agree nor disagree.
    - 72.9% indicated they feel safe when they are at work. Others responded, ‘not applicable’.
    - 70.4 % indicated they feel safe when they engage in after work activities. Others responded, ‘not applicable’.
    - 76.2% indicated they feel safe when they walk outside alone. The remaining 13.8% disagreed with this statement.
    - 30.3% indicated they think violence and abuse against individuals in their community and the surrounding area has increased over the past four years. 56.7 % think it has stayed the same, and 7.1% think it has decreased. Others responded, ‘don’t know’.

2013-2014 Unmet Healthcare Needs

- Based on information from the Canadian Community Health Survey 2013 - 2014, it is estimated that between 2.4 - 8.2% of males and 7.8 - 15.2% of females experienced a time in the past 12 months (2013 - 2014) when they felt they needed healthcare and didn’t receive it. Between 15.6 - 42.8% of respondents indicated this was due to wait times while between 6.6 - 29.6% indicated it

was because care was not available in the area (Newfoundland & Labrador Statistics Agency, 2015).[133]

7.13.1.2.2 Stephenville - Port aux Basques

Figure 7.13.8 shows the Stephenville – Port aux Basque Rural Secretariat Region. Some of the larger communities in this Rural Secretariat Region include Stephenville, Channel – Port aux Basque, and Burgeo.

Located on the west coast at the head of the Port au Port Peninsula, Stephenville is a local service centre for the Bay St. George area (about 35,000 people). Stephenville itself has a population of 6,765 (Newfoundland & Labrador Statistics Agency, 2022b). Stephenville is known for arts and culture as well as a centre for recreation. There is a campus of the College of North Atlantic as well as a private post-secondary academy. Stephenville is the location of a salmon hatchery operated by one of the aquaculture companies active in the province and expansion is being considered. Stephenville has an ice-free, deep-water port, accessible year-round, capable of handling vessels up to 385 m length with 10 m depth at the berth. Stephenville has good road connections to the Trans Canada Highway, the main highway of the province. Nearby Port au Port Peninsula is the proposed site for an extensive wind energy/hydrogen project. The project is one of four that has been approved for further consideration by the province (Hood, 2023). Recently the town's airport was bought with the intent to make it into 'a world class aviation and technological hub for Eastern Canada' (Ratter, n.d.).

The coastal community of Port aux Basques is on the southwestern tip of the Island. It supports the Marine Atlantic ferry operations between the Island of Newfoundland and Nova Scotia for passengers, vehicles and cargo. The town, population 4,055, is a hub for services for the area providing shopping, recreation, education, and health services to the approximately 7,000 area residents. The harbour offers ten deep water berths and in addition to the ferries serves Canada Coast Guard, cruise ships, and tankers. There is industrial land available at both the inner and outer harbours. There is an existing large industrial facility, currently unused. (Channel-Port aux Basques, 2020).

The town of Burgeo, population 1,100, is located on the south coast of the Island of Newfoundland and since 1979 is connected by a secondary highway to the main TransCanada Highway. The town supports the ferry service between Burgeo and Ramea, and Francois and Grey River (the latter communities are reachable by water only). Burgeo has always been a fishing town. (Town of Burgeo, n.d.). At present there is a fish reduction (fish meal) plant. Adjacent to the town is a provincial park, Sandbanks Provincial Park. Burgeo, along with partners Parks Canada, Miawpukek First Nation, Qalipu First Nation and the Government of Newfoundland and Labrador, have recently initiated an investigation into a NMCA on the south coast (Parks Canada, 2023d).

[133] These numbers were reported with high sampling variability and should be interpreted with caution.

Some social and economic indicators for the region are listed below. Most recent data available for the region was provided for each indicator.

Figure 7.13.8 Stephenville – Port aux Basque Rural Secretariat Region

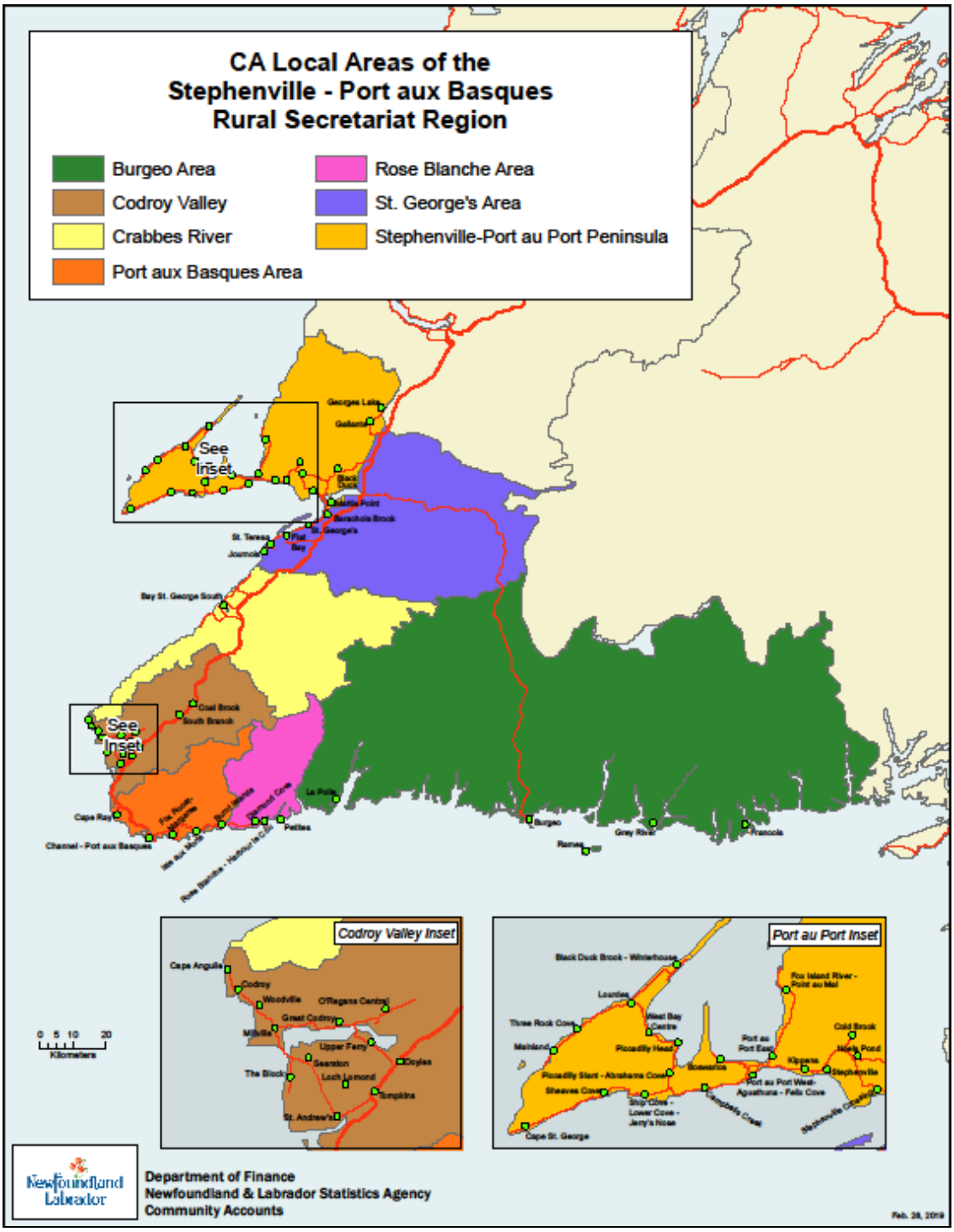


Figure Description: This map was adopted from the Newfoundland and Labrador Community Account Maps. It shows local areas for the Stephenville – Port aux Basque Rural Secretariat. Region.

Sources: Newfoundland & Labrador Statistics Agency, 2019.

2021 Demographics

- In 2021 the total population within this region was 26,790 people with a median age of 55 years. Of the population 49.20% indicated they identify as male, and 50.78% who identify as female (Newfoundland & Labrador Statistics Agency, 2022b).
- Of the male population, 16.69% indicated they identify as Indigenous. Of the female population, 16.94% indicated they identify as Indigenous (Newfoundland & Labrador Statistics Agency, 2024a).
- 56.00% of the population was within working age (18-64 years). This included 55.80% of the male population and 56.20% of the female population (Newfoundland & Labrador Statistics Agency, 2022b).
- The age dependency ratio was 51.50% (Newfoundland & Labrador Statistics Agency, 2022b).

2021 Family Characteristics

- In 2021 the region included 1,750 married couples with children at home, 490 common law couples with children at home, 310 male lone parents with children at home and 1,190 female lone parents with children at home (Newfoundland & Labrador Statistics Agency, 2022a).

2021 Economic Indicators

- In 2021 median income for males was $35,600 with market income contributing 68.60% of total income. Median income for females was $28,600 with market income contributing 60.10% (Newfoundland & Labrador Statistics Agency, 2024b).
- Low-income prevalence for all family types (e.g., couple family, male lone parent family, female lone parent family etc.,) was 14.30%. Low-income prevalence for non-family persons was 22.30% (Newfoundland & Labrador Statistics Agency, 2024c).

2016 Accommodations

- In 2016 10,190dwellings were owned by a member of household. Median monthly shelter costs for owned dwellings were $490and average monthly shelter costs were $684. 3,020 dwellings were rented by a member of household. Median monthly shelter costs for rented dwellings were $682 and average monthly shelter costs were $683 (Newfoundland & Labrador Statistics Agency, 2018).

2021 Education and Employment

- Of the total population aged 15 years and over in 2021 (Newfoundland & Labrador Statistics Agency, 2023b):
    - 43.12% had a postsecondary certificate, diploma, or degree.
    - 9.48% had an apprenticeship or trades certificate or diploma.
    - 22.95% had a college, CEGEP, or other non-university certificate or diploma.
    - 1.65% had a university certificate or diploma below bachelor level.
    - 9.01% had a university certificate, diploma, or degree at bachelor level or above.
- Most prevalent fields of study included architecture, engineering, and related technologies; business, management, and public administration; and personal, protective and transportation services (Newfoundland & Labrador Statistics Agency, 2023c).

- The labour market participation rate for males was 46.1% and employment rate was 34.0%. For females, labour market participation rate was 42.9%,and employment rate was 35.4% (Newfoundland & Labrador Statistics Agency, 2023e).
- Industries with the highest number of employed males transportation and warehousing; and agriculture, forestry, fishing and hunting. Industries with the highest number of employed females included healthcare and social assistance; and retail trade (Newfoundland & Labrador Statistics Agency, 2023a).
- Occupations with the highest number of employed males included trades, transport, and equipment operators and related occupations; and sales and service occupations. Occupations with the highest number of employed females included occupations in education, law and social, community and government services; and sales and service occupations (Newfoundland & Labrador Statistics Agency, 2023d).

2010 Personal Safety and Violence in Society

- According to the 2010 Survey of Attitudes Towards Violence (Newfoundland & Labrador Statistics Agency, 2012):
    - 84.4% of respondents in the region indicated they think their community and the surrounding area is a safe place to live. 7.8% disagreed with the statement.
    - 70.3% indicated they feel safe when they are at work. Others responded, ‘not applicable’.
    - 63.8 % indicated they feel safe when they engage in after work activities. Others responded, ‘not applicable’.
    - 78.6% indicated they feel safe when they walk outside alone. 13.6% disagreed with this statement.
    - 30.7% indicated they think violence and abuse against individuals in their community and the surrounding area has increased over the past four years. 55.5 % think it has stayed the same, and 8.0% think it has decreased. Others responded, ‘don’t know’.

2013-2014 Unmet Healthcare Needs

- Based on information from the Canadian Community Health Survey 2013 - 2014, it is estimated that between 2.8 - 9.6% of females experienced a time in the past 12 months (2013 - 2014) when they felt they needed healthcare and didn’t receive it. Numbers were not reported for males because of very high sampling variability. Between 23.8 - 59.8% of male and female respondents indicated this was due to wait times while between 14.5 - 48.3% indicated it was because care was not available in the area (Newfoundland & Labrador Statistics Agency, 2015).

7.13.1.2.3 Grand Falls-Windsor-Baie Verte-Harbour Breton

Figure 7.13.9 shows the Grand Falls-Windsor-Baie Verte-Harbour Breton Rural Secretariat Region.

The Connaigre Peninsula area is connected to the Trans Canada Highway by the 200 km Baie d'Espoir Highway. Harbour Breton is located on the south coast of the Connaigre Peninsula. Hermitage-Sandyville spans the peninsula. Hermitage is on the Hermitage Bay side and Sandyville is on Connaigre Bay. MFN's community of Conne River and the Town of St. Alban's are on the coast, further inland on Baie d'Espoir. The primary industries of the Connaigre area are fishing, aquaculture, and tourism. The coast is included in the feasibility study of the new NMCA, around the deep fjords of the coast (Parks Canada, 2023d).

Harbour Breton is the largest of the communities on the peninsula and serves as a local service centre for the approximately 6,000 area residents with a hospital, fish plant and support to the aquaculture industry.

Hermitage Harbour is a natural, deep harbour surrounded by high protective hills. It is managed by the Harbour Authority of Hermitage and with two wharves and several floating docks it caters to the fishing, aquaculture, recreational, and tourism industries. (Harbour Authority of Hermitage, 2016).

St. Alban's is a town of approximately 1,200 located in the Bay d'Espoir estuary, approximately 180 km (110 miles) south of Grand Falls-Windsor on the Trans Canada Highway . Two industries predominate in the local economy. There is significant hydro power generation and transmission centered in the St. Alban's area and aquaculture(Town of St. Alban's, n.d.).

Miawpukek Mi'kamawey Mawi'omi is a First Nation Reserve. The MFN is an *Indian Act* band that was established by federal Order in Council in 1984. In 1987, a federal Indian Reserve was established at Conne River. The community is located at the mouth of the Conne River that empties into Baie d'Espoir. Approximately 850 members of MFN live at Conne River, with an additional 2000 members living off-Reserve (Miawpukek Mi'kamawey Mawi'omi, 2023). MFN is actively participating in various commercial ventures in the province, (i.e., commercial fishery, vessel ownership, research initiatives, onshore wind energy partnerships, aquaculture servicing and potential offshore petroleum (gas and liquid natural gas projects). MFN has forest management initiatives underway and monitors resource development activity, such as mineral exploration in their traditional hunting areas. MFN is involved with the feasibility studies into creation of the NMCA (Parks Canada, 2023d).

Some social and economic indicators for the region are listed below. Most recent data available for the region was provided for each indicator.

Figure 7.13.9 Grand Falls-Windsor-Baie Verte-Harbour Breton Rural Secretariat Region

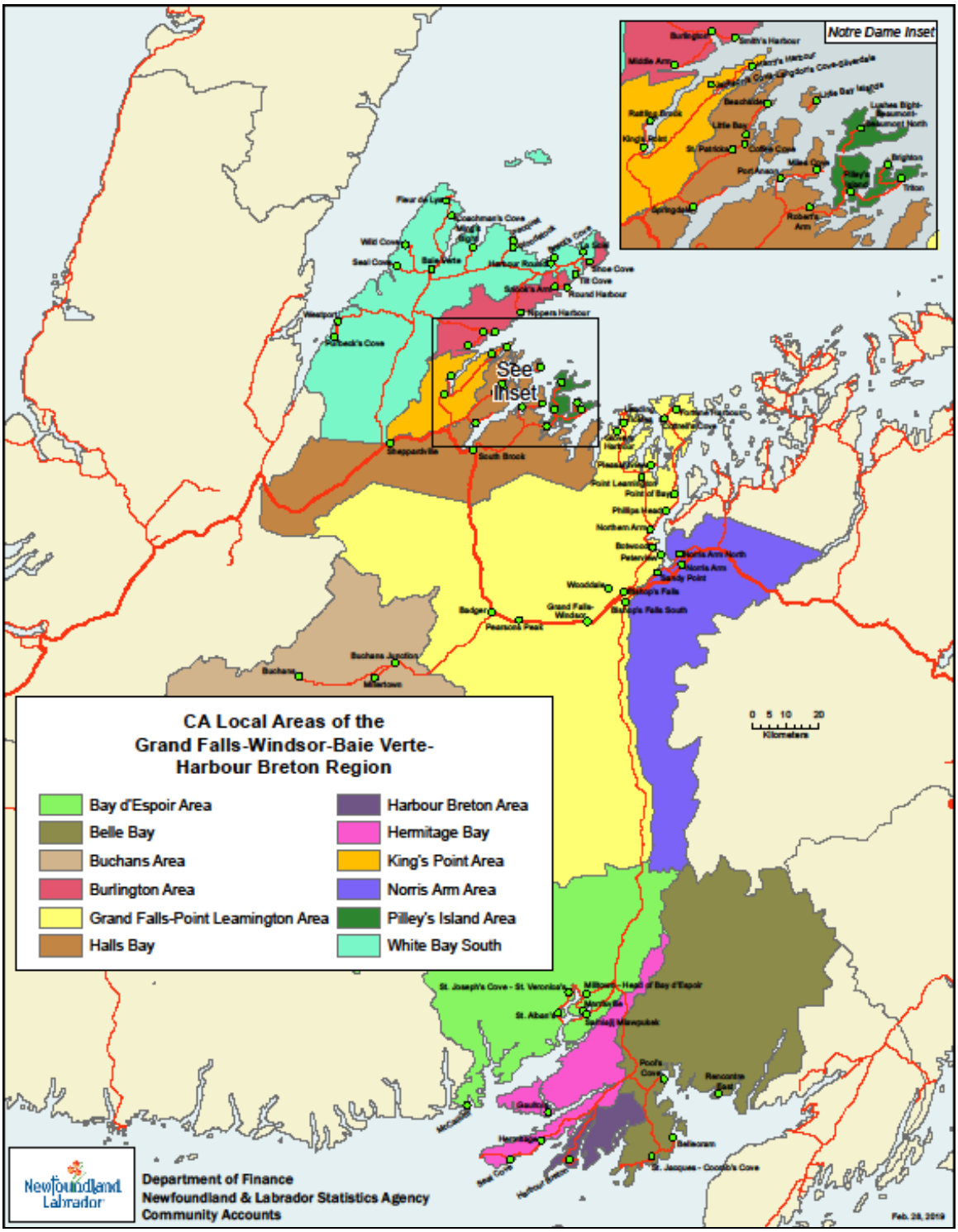


Figure Description: This map was adopted from the Newfoundland and Labrador Community Account Maps. It shows local areas for the Grand Falls-Windsor-Baie Verte-Harbour Breton Rual Secretariat. Region.

Sources: Newfoundland & Labrador Statistics Agency, 2019.

2021 Demographics

- In 2021 the total population within this region was 44,285 people with a median age of 54 years. Of the population, 48.96% indicated they identify as male, and 51.04% indicated they identify as female (Newfoundland & Labrador Statistics Agency, 2022b).
- Of the male population, 3.42% indicated they identify as Indigenous.Of the female population, 3.84% indicated they identify as Indigenous (Newfoundland & Labrador Statistics Agency, 2024a).
- 57.20% of the population was within working age (18-64 years). This included 57.10% of the male population and 57.20% of the female population (Newfoundland & Labrador Statistics Agency, 2022b).
- The age dependency ratio was 47.10% (Newfoundland & Labrador Statistics Agency, 2022b).

2021 Family Characteristics

- In 2021 the region included 3,510 married couples with children at home, 855 common law couples with children at home, 475 male lone parents with children at home and 1,495 female lone parents with children at home (Newfoundland & Labrador Statistics Agency, 2022a).

2021 Economic Indicators

- In 2021 median income for males was $39,700 with market income contributing 73.10% of total income. Median income for females was $29,000 with market income contributing 61.40% (Newfoundland & Labrador Statistics Agency, 2024b).
- Low-income prevalence for all family types (e.g., couple family, male lone parent family, female lone parent family etc.,) was 11.80%. Low-income prevalence for non-family persons was 20.30% (Newfoundland & Labrador Statistics Agency, 2024c).

2016 Accommodations

- In 2016 15,650 dwellings were owned by a member of household. Median monthly shelter costs for owned dwellings were $501 and average monthly shelter costs were $711. 4,100dwellings were rented by a member of household. Median monthly shelter costs for rented dwellings were $702 and average monthly shelter costs were $718 (Newfoundland & Labrador Statistics Agency, 2018).

2021 Education and Employment

- Of the total population aged 15 years and over in 2021 (Newfoundland & Labrador Statistics Agency, 2023b):
    - 41.25 had a postsecondary certificate, diploma, or degree.
    - 10.20% had an apprenticeship or trades certificate or diploma.
    - 21.04% had a college, CEGEP, or other non-university certificate or diploma.
    - 1.23% had a university certificate or diploma below bachelor level.
    - 8.79% had a university certificate, diploma, or degree at bachelor level or above.
- Most prevalent fields of study included architecture, engineering, and related technologies; business, management, and public administration; and health related fields (Newfoundland & Labrador Statistics Agency, 2023c).

- The labour market participation rate for males was 55.1% and employment rate was 38.9%. For females, labour market participation rate was 47.3%, and employment rate was 39.6% (Newfoundland & Labrador Statistics Agency, 2023e).
- Industries with the highest number of employed males included agriculture, forestry, fishing and hunting; and construction. Industries with the highest number of employed females included healthcare and social assistance; and retail trade (Newfoundland & Labrador Statistics Agency, 2023a).
- Occupations with the highest number of employed males included trades, transport and equipment operators and related occupations; and sales and service occupations. Occupations with the highest number of employed females included sales and service occupations; and occupations in education, law and social, community and government services (Newfoundland & Labrador Statistics Agency, 2023d).

2010 Personal Safety and Violence in Society

- According to the 2010 Survey of Attitudes Towards Violence (Newfoundland & Labrador Statistics Agency, 2012):
    - 92.5% respondents in the region indicated they think their community and the surrounding area is a safe place to live.
    - 69.3% indicated they feel safe when they are at work. Others responded, 'not applicable'.
    - 66.5 % indicated they feel safe when they engage in after work activities. Others responded, 'not applicable'.
    - 82.5% indicated they feel safe when they walk outside alone. 9.5% disagreed with this statement.
    - 27.5% indicated they think violence and abuse against individuals in their community and the surrounding area has increased over the past four years. 60.0 % think it has stayed the same, and 6.8% think it has decreased. Others responded, 'don't know'.

2013-2014 Unmet Healthcare Needs

- Based on information from the Canadian Community Health Survey 2013-2014, it is estimated that between 4.9-12.5%[134] of males and 12.1-21.7% of females experienced a time in the past 12 months (2013-2014) when they felt they needed healthcare and didn't receive it. Between 18.9-45.3% of male and female respondents indicated this was due to wait times. Estimates were not reported for the percentage of respondents who indicated this was because care was not available in the area because of very high sapling variability Newfoundland & Labrador Statistics Agency, 2015).

7.13.1.2.4 Burin Peninsula

The Burin Peninsula extends southward from the main mass of the island of Newfoundland. Small communities ring both east (Placentia Bay facing) and west coasts (facing Fortune Bay) with the most centrally located town of Marystown serving as a regional service centre. Both Placentia Bay and Fortune Bay are ice-free, deep-water bays.

[134] This number was reported with high sampling variability and should be interpreted with caution.

Communities on the Burin Peninsula have established several regional collaborations to provide a range of services. Examples include the Heritage Run Tourism Association, the Burin Chamber of Commerce, and the Regional Services Board. All communities on the peninsula are connected by road. In recent years, the economy of the Burin Peninsula has diversified with an increase in tourism, mineral exploration, mining, and onshore wind energy. Most recently, one of the wind-hydrogen projects identified for further consideration by the provincial government will be in several areas on the peninsula. Five communities on the Burin Peninsula are described.

The communities of Grand Bank and Fortune are five minutes apart by road. Both communities are on the western coast of the Burin Peninsula and face onto Fortune Bay, providing ice-free harbours for fishing and recreational vessels. Grand Bank, population 2,285 persons, has a centuries' long history in the fishery that is featured in the Provincial Seamen's Museum in the town. In Fortune, population 1,280 people, the fishery is the main employer. Fortune is also the ferry link with the French Islands of St. Pierre-Miquelon. Recently Fortune also gained attention with the establishment of Fortune Head Ecological Reserve, the geological boundary between the pre-Cambrian and Cambrian eras.

The Grand Bank fishery operations changed ownership in 2021and is now Indigenous owned by a partnership of Premium Brands and Mi'kmaq Coalition (including MFN) after being acquired from Clearwater Seafood Incorporated (Clearwater Seafood Inc., 2021). The company's focus is the shellfish fishery.

Ocean Choice International (OCI) operates out of Fortune and several other harbours on the Island. OCI, based in Newfoundland and Labrador, is the largest exporter of seafood in Atlantic Canada. OCI is focused on sustainable fisheries and sponsors a Research Chair at Memorial University's Marine Institute in Sustainable Harvesting (Ocean Choice International, n.d.).

St. Lawrence, population 1,055 residents, faces onto Placentia Bay and is near international fishing lanes. The active harbor is ice free and supports fishing and recreational vessels as well as some vessels associated with mineral export. Some berths have a water depth of 6 m.

Fishing and mining (fluorspar) have been the economic mainstays of the St. Lawrence. While the fish plant is currently idled, the mine's operation has been sporadic in recent years but has recently reopened under new ownership. There is a 9-turbine, 27MW wind farm in the community. St. Lawrence has a Municipal Habitat Stewardship Agreement that establishes a 400 m buffer along the coast of its boundaries.

The population of Burin (3,275 in the 2021 census) includes the communities of Burin, Epworth-Great Salmonier, Lewis Cove and Fox Cove Mortier (Newfoundland & Labrador Statistics Agency, 2022b).

Fishery activity ended with the declaration of the moratorium on cod fishing in 1992. The fish plant was recently re-purposed as a cannabis growing operation. Tourism is increasing in the community. With a depth of 9.4 m, the harbor can handle vessels of a range of size,

but the focus is pleasure craft. The Burin Peninsula Health Care Centre provides services to a catchment area of approximately 20,000 people. The facility provides a variety of inpatient and outpatient services. There is a College of North Atlantic facility and two private career academies in Burin.

Marystown, with a population of over 6,000 people (Newfoundland & Labrador Statistics Agency, 2022b), is the regional location for many government services, such as housing, health, and social services and is active in the various regional associations on the Peninsula. Public engagement in 2017 was used to develop an Integrated Community Sustainable Municipal Plan (Town Council of Town of Marystown, 2019). As part of the Plan, Marystown identified industrial parklands. There is also public interest in reusable energy production (Town Council of Town of Marystown, 2019).

Marystown has a history of responding to project opportunities. The extensive, deep water, well sheltered harbour has supported a fish plant, a ship building facility and, from the 1990s, fabrication facilities associated with the offshore petroleum industry (Marystown, 2024). The harbour has also sheltered and serviced offshore drill rigs. There is still active use of the harbour by fishing vessels. Recently, Marystown has become the center for a large aquaculture operation with an on land hatchery and support to the open pen farms throughout Placentia Bay. The Town is also hoping to participate in the potential on shore wind energy-hydrogen projects, on the Burin Peninsula and the Isthmus (Marystown, 2024).

Figure 7.13.10 shows the Burin Peninsula Rural Secretariat Region. Some social and economic indicators for the region are listed below. Most recent data available for the region was provided for each indicator.

Figure 7.13.10 Burin Peninsula Rural Secretariat Region

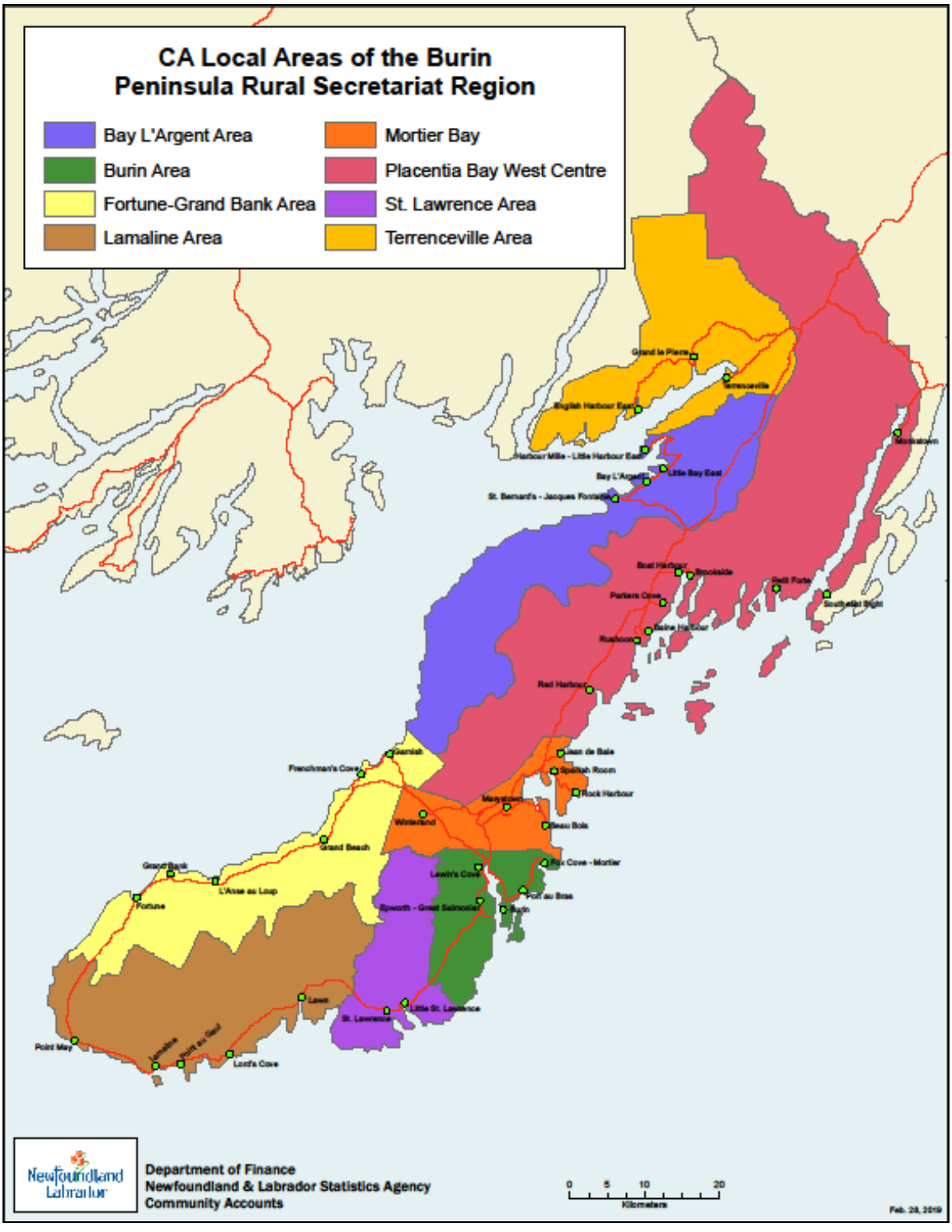


Figure Description: This map was adopted from the Newfoundland and Labrador Community Account Maps. It shows local areas for the Burin Peninsula Rual Secretariat. Region.

Sources: Newfoundland & Labrador Statistics Agency, 2019.

2021 Demographics

- In 2021 the total population within this region was 18,880 people with a median age of 54 years. Of the population, 49.28% indicated they identify as male, and 50.72% indicated they identify as female (Newfoundland & Labrador Statistics Agency, 2022b).
- Of the male population, 0.75% indicated they identify as Indigenous. Of the female population, 0.65% indicated they identify as Indigenous (Newfoundland & Labrador Statistics Agency, 2024b).
- 56.10%of the population was within working age (18-64 years). This included 55.40% of the male population and 56.80% of the female population (Newfoundland & Labrador Statistics Agency, 2022b).
- The age dependency ratio was 49.80% (Newfoundland & Labrador Statistics Agency, 2022b).

2021 Family Characteristics

- In 2021 the region included 1,505 married couples with children at home, 360 common law couples with children at home, 210 male lone parents with children at home and 705 female lone parents with children at home (Newfoundland & Labrador Statistics Agency, 2022a).

021 Economic Indicators

- In 2021 median income for males was $39.300 with market income contributing 71.60% of total income. Median income for females was $28,900 with market income contributing 60.90% (Newfoundland & Labrador Statistics Agency, 2024b).
- Low-income prevalence for all family types (e.g., couple family, male lone parent family, female lone parent family etc.,) was 9.40%. Low-income prevalence for non-family persons was 15.80 %(Newfoundland & Labrador Statistics Agency, 2024c).

2016 Accommodations

- In 2016, 7,275 dwellings were owned by a member of household. Median monthly shelter costs for owned dwellings were $480 and average monthly shelter costs were $677. 1,200 dwellings were rented by a member of household. Median monthly shelter costs for rented dwellings were$699 and average monthly shelter costs were $691 (Newfoundland & Labrador Statistics Agency, 2018).

2021 Education and Employment

- Of the total population aged 15 years and over in 2021 (Newfoundland & Labrador Statistics Agency, 2023b):
    - 46.33% had a postsecondary certificate, diploma or degree.
    - 12.63% had an apprenticeship or trades certificate or diploma.
    - 25.18% had a college, CEGEP or other non-university certificate or diploma.
    - 1.49% had a university certificate or diploma below bachelor level.
    - 7.03% had a university certificate, diploma or degree at bachelor level or above.
- Most prevalent fields of study included architecture, engineering, and related technologies; business, management, and public administration; health related fields; and personal, protective, and transportation services (Newfoundland & Labrador Statistics Agency, 2023c).

- The labour market participation rate for males was 53.0% and employment rate was 39.9%.For females, labour market participation rate was 46.0%, and employment rate was 39.3% (Newfoundland & Labrador Statistics Agency, 2023e).
- Industries with the highest number of employed males included agriculture, forestry, fishing and hunting; and manufacturing. Industries with the highest number of employed females included healthcare and social assistance; and retail trade (Newfoundland & Labrador Statistics Agency, 2023a).
- Occupations with the highest number of employed males included trades, transport and equipment operators and related occupations; and sales and service occupations. Occupations with the highest number of employed females included sales and service occupations; and occupations in education, law and social, community and government services (Newfoundland & Labrador Statistics Agency, 2023d).

2010 Personal Safety and Violence in Society

- According to the 2010 Survey of Attitudes Towards Violence (Newfoundland & Labrador Statistics Agency, 2012):
    - 89.6% respondents in the region indicated they think their community and the surrounding area is a safe place to live. 5.6% disagreed with this statement.
    - 75.1% indicated they feel safe when they are at work. Others responded, 'not applicable'.
    - 71.4 % indicated they feel safe when they engage in after work activities. Others responded, 'not applicable'.
    - 78.8% indicated they feel safe when they walk outside alone. 13.6% disagreed with this statement.
    - 25.7% indicated they think violence and abuse against individuals in their community and the surrounding area has increased over the past four years. 58.8 % think it has stayed the same, and 9.1% think it has decreased. Others responded, 'don't know'.

2013-2014 Unmet Healthcare Needs

- Estimates for unmet healthcare needs were not reported due to very high sampling variability. (Newfoundland & Labrador Statistics Agency, 2015).

7.13.1.2.5 Clarenville – Bonavista and Avalon Peninsula

While not within the Focus Area, the Port of Argentia, facing onto Placentia Bay, is already engaged in offshore wind related activities. In June 2022, Pattern Energy signed a lease with the Port of Argentia for land for a potential onshore wind energy to hydrogen project, citing the wind resources and the proximity to Europe as assets (Dean-Simmons, 2022b)

In August 2022, the Port of Argentia CEO announced a second, significant contract to support the development of clean energy projects in the Northeastern U.S.A. The initial work will be to provide a temporary storage site for monopiles before they are needed at the offshore windfarm. Port CEO said the contract will generate $65 million in work associated with contracts for land preparation, stevedoring, heavy ground transport, security and other services. (Dean-Simmons, 2022a). The first monopiles were delivered to Argentia in August 2023.

Arnold's Cove and Come By Chance, two communities at the head of Placentia Bay and not in the Focus Area, are adjacent to the Come By Chance refinery and Whiffen Head crude oil transshipment terminal with associated industrial lands and capability. This area also has potential onshore wind energy development (Hood, 2023). Across the Isthmus, in Trinity Bay, is the Bull Arm Fabrication site, also a deep-water port with significant wharf and infrastructure and open land. This facility was the site of construction and/or fabrication of offshore production facilities, such as the Hibernia and Hebron Gravity Base Structures and the Terra Nova Floating Production Storage and Offloading vessel.

St. John's, the capital city, is also a business and R&D hub associated with wind energy. South of St. John's is the Pennecon Marine Base at Bay Bulls. This 16-acre site provides heavy industrial and logistics services to marine vessels with extensive, wharf side laydown area and access to deepwater as well as major warehousing capability. An additional major facility in the area south of St. John's in the community of Fermeuse, has been proposed by Fermeuse Energy Limited (previously Fermeuse Enterprises Limited (FEL)). Environmental approvals are in place for a marine base and a spool base to support offshore oil and gas development and a contract for Front End Engineering Design has recently been awarded. Fermeuse Energy Limited has also indicated that the same area could be used as a wind energy-hydrogen site, as a hydrogen hub (Fermeuse Energy, 2023).

Figures 7.13.11 and 7.13.12 show the Clarenville – Bonavista and Avalon Peninsula Rural Secretariat Regions. Some social and economic indicators for each region are listed below. Most recent data available for the region was provided for each indicator.

2021 Demographics

- In 2021 the total population within this region was 26,775 people with a median age of 54 years. Of the population, 49.15% indicated they identify as male, and 50.87% indicated they identify as female (Newfoundland & Labrador Statistics Agency, 2022b).
- Of the male population, 1.17% indicated they identify as Indigenous.Of the female population, 1.40% indicated they identify as Indigenous (Newfoundland & Labrador Statistics Agency, 2024a).
- 56.40% of the population was within working age (18 - 64 years). This included 56.0%of the male population and 56.60% of the female population (Newfoundland & Labrador Statistics Agency, 2022b).
- The age dependency ratio was 50.10% (Newfoundland & Labrador Statistics Agency, 2022b).

2021 Family Characteristics

- In 2021, the region included 2,085 married couples with children at home, 505 common law couples with children at home, 260 male lone parents with children at home and 930 female lone parents with children at home (Newfoundland & Labrador Statistics Agency, 2022a).

2021 Economic Indicators

- In 2021, median income for males was $39,400 with market income contributing 72.80% of total income. Median income for females was $29,600 with market income contributing 63.00% (Newfoundland & Labrador Statistics Agency, 2024b).

- Low-income prevalence for all family types (e.g., couple family, male lone parent family, female lone parent family etc.,) was 9.50%. Low-income prevalence for non-family persons was 16.20% (Newfoundland & Labrador Statistics Agency, 2024c).

Figure 7.13.11 Clarenville – Bonavista Rural Secretariat Region

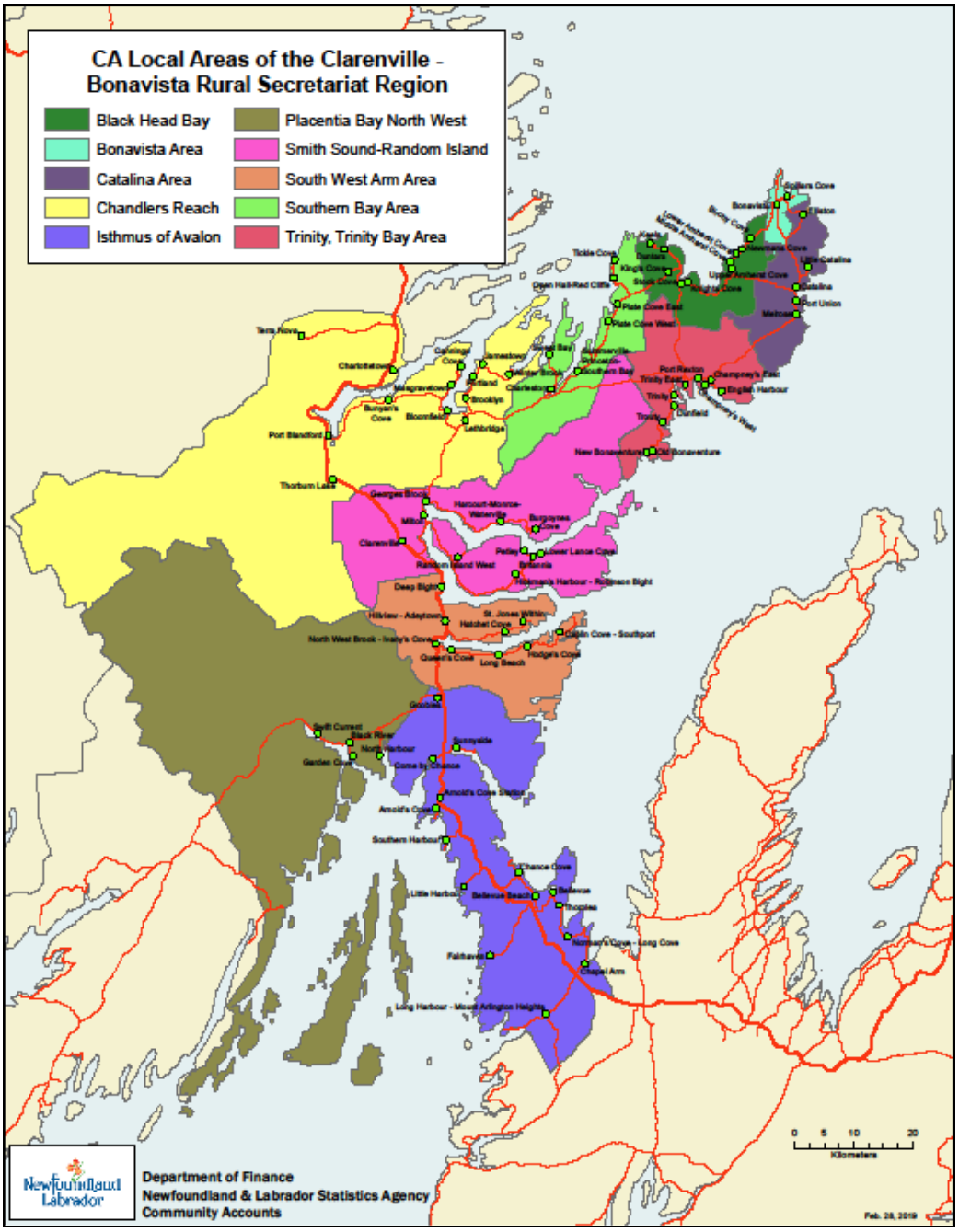


Figure description: This map was adopted from the Newfoundland and Labrador Community Account Maps. It shows local areas for the Clarenville – Bonavista Rual Secretariat. Region.

Source: Newfoundland & Labrador Statistics Agency, 2019c.

2016 Accommodations

- In 2016 10,065dwellings were owned by a member of household. Median monthly shelter costs for owned dwellings were $494 and average monthly shelter costs were $708. 1,810 dwellings were rented by a member of household. Median monthly shelter costs for rented dwellings were $728 and average monthly shelter costs were $769 (Newfoundland & Labrador Statistics Agency, 2018).

2021 Education and Employment

- Of the total population aged 15 years and over in 2021 (Newfoundland & Labrador Statistics Agency, 2023b):
    - 43.04% had a postsecondary certificate, diploma or degree.
    - 11.23% had an apprenticeship or trades certificate or diploma.
    - 22.01%had a college, CEGEP or other non-university certificate or diploma.
    - 1.50% had a university certificate or diploma below bachelor level.
    - 8.32% had a university certificate, diploma or degree at bachelor level or aboveMost prevalent fields of study included architecture, engineering, and related technologies; business, management, and public administration; and health related fields (Newfoundland & Labrador Statistics Agency, 2023c).
- The labour market participation rate for males was 53.0% and employment rate was 41.2%. For females, labour market participation rate was 49.0%, and employment rate was 41.3% (Newfoundland & Labrador Statistics Agency, 2023e).
- Industries with the highest number of employed males included construction and manufacturing. Industries with the highest number of employed females included healthcare and social assistance; and retail trade (Newfoundland & Labrador Statistics Agency, 2023a).
- Occupations with the highest number of employed males included trades, transport and equipment operators and related occupations; and sales and service occupations. Occupations with the highest number of employed females included sales and service occupations; and occupations in education, law and social, community and government services (Newfoundland & Labrador Statistics Agency, 2023d).

2010 Personal Safety and Violence in Society

- According to the 2010 Survey of Attitudes Towards Violence (Newfoundland & Labrador Statistics Agency, 2012):
    - 95.6% respondents in the region indicated they think their community and the surrounding area is a safe place to live.
    - 74.3% indicated they feel safe when they are at work. Others responded, ‘not applicable’.
    - 68.9 % indicated they feel safe when they engage in after work activities. 5.4% disagreed with this statement. Others responded, ‘not applicable’.
    - 79.5% indicated they feel safe when they walk outside alone. 13.6% disagreed with this statement.

  - 25.4% indicated they think violence and abuse against individuals in their community and the surrounding area has increased over the past four years. 62.7 % think it has stayed the same.

2013-2014 Unmet Healthcare Needs

- Based on information from the Canadian Community Health Survey 2013 - 2014, it is estimated that between 10 - 24.2% of females experienced a time in the past 12 months (2013 - 2014) when they felt they needed healthcare and didn't receive it. Estimates were not reported for males because of very high sampling variability. Between 21.2 - 67% of male and female respondents indicated this was due to wait times. Estimates were not reported for respondents who indicated it was because care was not available in the area because of high sampling variability (Newfoundland & Labrador Statistics Agency, 2015).

Figure 7.13.12 Avalon Peninsula Rural Secretariat Region

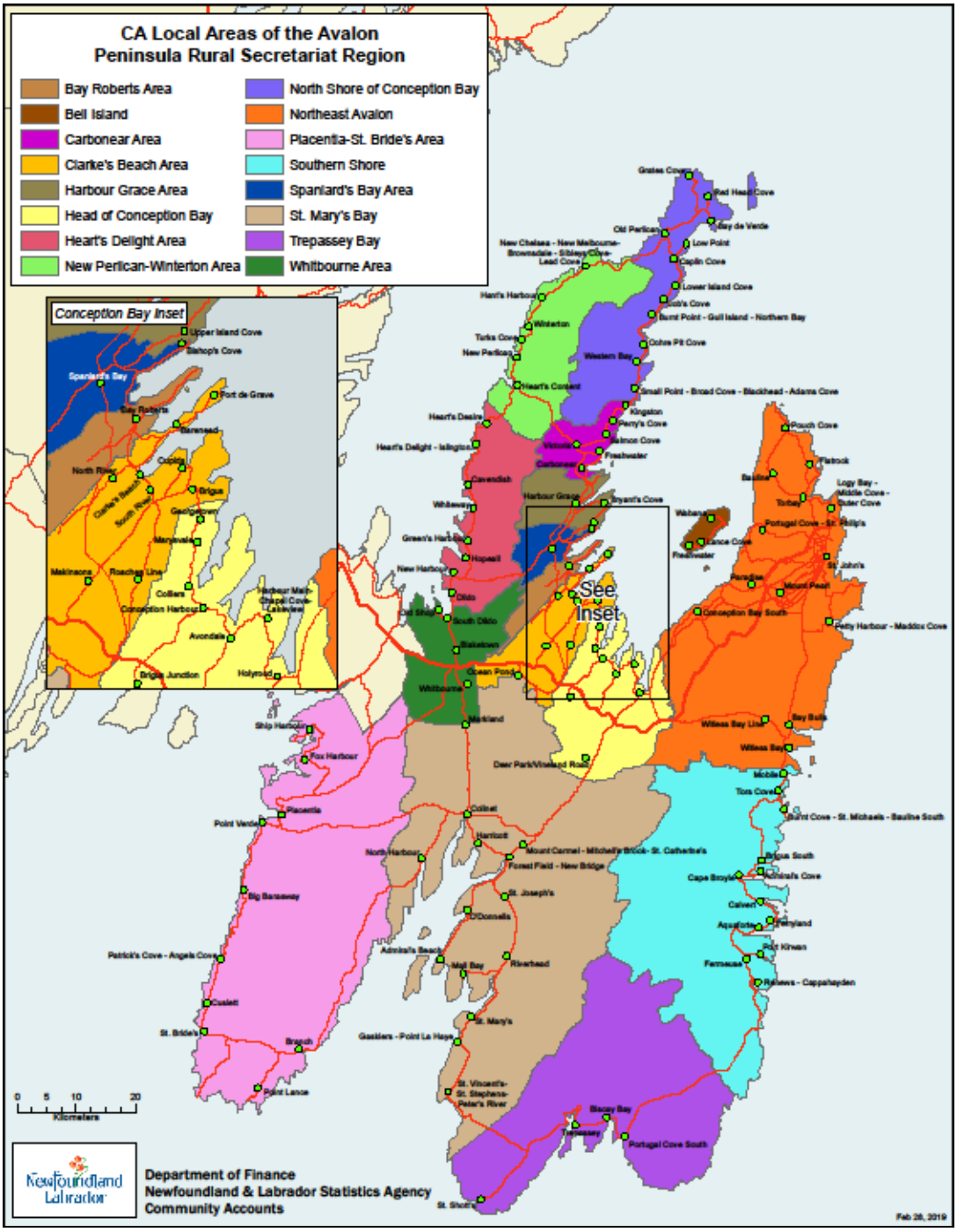


Figure Description: This map was adopted from the Newfoundland and Labrador Community Account Maps. It shows local areas for the Avalon Peninsula Rual Secretariat. Region.

Sources: Newfoundland & Labrador Statistics Agency, 2019.

2021 Demographics

- In 2021 the total population within this region was 276,870 people with a median age of 45 years. Of the population, 48.78% indicated they identify as male, and 51.22% indicated they identify as female (Newfoundland & Labrador Statistics Agency, 2022b).
- Of the male population1.46% indicated they identify as Indigenous. Of the female population, 1.63% indicated they identify as Indigenous (Newfoundland & Labrador Statistics Agency, 2024a).
- 62.30%of the population was within working age (18-64 years). This included 62.60% of the male population and 61.90% of the female population (Newfoundland & Labrador Statistics Agency, 2022b).
- The age dependency ratio was 31.40% (Newfoundland & Labrador Statistics Agency, 2022b).

2021 Family Characteristics

- In 2021 the region included 25,410 married couples with children at home, 4,670 common law couples with children at home, 2,810 male lone parents with children at home and 10,420 female lone parents with children at home (Newfoundland & Labrador Statistics Agency, 2022a).2021 Economic Indicators
- In 2021 median income for males was $46,000 with market income contributing 84.90% of total income. Median income for females was $37,100 with market income contributing 77.90% (Newfoundland & Labrador Statistics Agency, 2024b).
- Low-income prevalence for all family types (e.g., couple family, male lone parent family, female lone parent family etc.,) was 15.50%. Low-income prevalence for non-family persons was 25.60% (Newfoundland & Labrador Statistics Agency, 2024c).

2016 Accommodations

- In 2016 81,700 dwellings were owned by a member of household. Median monthly shelter costs for owned dwellings were $1,077and average monthly shelter costs were $1,211. 28,990 dwellings were rented by a member of household. Median monthly shelter costs for rented dwellings were $882 and average monthly shelter costs were $906 (Newfoundland & Labrador Statistics Agency, 2018).

2021 Education and Employment

- Of the total population aged 15 and over in 2021 (Newfoundland & Labrador Statistics Agency, 2023b):
    - 58.55% had a postsecondary certificate, diploma or degree.
    - 8.92% had an apprenticeship or trades certificate or diploma.
    - 24.33% had a college, CEGEP or other non-university certificate or diploma.
    - 2.51% had a university certificate or diploma below bachelor level.
    - 22.79% had a university certificate, diploma or degree at bachelor level or above.
- Most prevalent fields of study included architecture, engineering, and related technologies; business, management, and public administration; and health related fields (Newfoundland & Labrador Statistics Agency, 2023c).

- The labour market participation rate for males was 63.2% and employment rate was 54.2%. For females, labour market participation rate was 57.8%, and employment rate was 52.1% (Newfoundland & Labrador Statistics Agency, 2023e).
- Industries with the highest number of employed males included construction and retail trade Industries with the highest number of employed females included healthcare and social assistance, and retail trade (Newfoundland & Labrador Statistics Agency, 2023a).
- Occupations with the highest number of employed males included trades, transport and equipment operators and related occupations; and sales and service occupations. Occupations with the highest number of employed females included sales and service occupations; and business, finance, and administration occupations(Newfoundland & Labrador Statistics Agency, 2023d).

2010 Personal Safety and Violence in Society

- According to the 2010 Survey of Attitudes Towards Violence (Newfoundland & Labrador Statistics Agency, 2012):
    - 87.2% respondents in the region indicated they think their community and the surrounding area is a safe place to live. 6.2% disagreed with this statement.
    - 73.4% indicated they feel safe when they are at work. Others responded, ‘not applicable’.
    - 68.5 % indicated they feel safe when they engage in after work activities. Others responded, ‘not applicable’.
    - 72.0% indicated they feel safe when they walk outside alone. 17.4% disagreed with this statement.
    - 38.7% indicated they think violence and abuse against individuals in their community and the surrounding area has increased over the past four years. 51.0 % think it has stayed the same.

2013-2014 Unmet Healthcare Needs

- Based on information from the Canadian Community Health Survey 2013 - 2014, it is estimated that between 5 - 9.6% of males and 6.3 - 10.3% of females experienced a time in the past 12 months (2013 - 2014) when they felt they needed healthcare and didn’t receive it. Between 22 - 40.6% of male and female respondents indicated this was due to wait times. Estimates were not reported for respondents who it was because care was not available in the area because of very high sampling variability (Newfoundland & Labrador Statistics Agency, 2015).

7.13.2 Potential Effects

Offshore wind development in other jurisdictions has shown both positive and adverse impacts on communities and economy. Potential impacts can include, for example:

- Changes to local economy through changes in employment opportunities, influx of workers and population increase.
- Changes to infrastructure, including local services (education, health, visitor facilities), distribution of roads and property value.
- Changes to education through innovation, skills development and training.
- Changes to health and wellbeing due to vibration, noise, and increased traffic.
- Changes to quality of life due to effects on cultural heritage, the historical environment, recreation, and seascape.
- Impacts to other industries such as tourism, local businesses, commercial fisheries and other ocean users.[135]

The sections below provide an overview of offshore wind development impacts to communities and economy reported in other jurisdictions. The summary predominantly draws from four key sources:

1) Alem et al. (2020), completed a meta-analysis of socioeconomic impacts of offshore wind farms in several jurisdictions. They reviewed 45 peer-reviewed and 46 grey literature items (e.g., government documents, working papers, reports, white papers and evaluations) that reported on socioeconomic impacts of offshore wind development (or comparable, large infrastructure projects) over the previous 20-year period. Their review included projects in Australia, Canada, Denmark, the U.K. and the U.S. and focused on four issues: house prices, tourism, the catalytic effect of supply chain clustering, and influx of workers causing social change. For all topics, they reported on anticipated effects and actual findings based on monitoring and follow-up after offshore wind development.

[135] See the following sections of the Report for further discussion on these components:
- Section 7.7. Fisheries
- Section 7.8. Other Ocean Users
- Section 7.9. Visual Aesthetics and Viewscapes
- Section 7.11. Physical and Cultural Heritage
- Section 7.12. Health

2) Glasson et al. (2022), reviewed academic, industry and government literature on socio-economic impacts of offshore wind development, assessment methodology and mitigation/enhancement measures. The review focused on literature published between 2010 - 2020. The research was part of a Vattenfall/European Union (EU) scientific research program to understand the wider environmental impacts of offshore wind projects.

3) In 2015, the Crown Estate (Hattam et al., 2015) reported on impacts the U.K. offshore wind industry has had on well-being.

4) In 2021 the World Bank published the report *Key Factors for Successful Development of Offshore Wind in Emerging Markets*. The report is intended to help clients of the World Bank consider whether to develop offshore wind and how to do so successfully. It recounts good practices and lessons learned from other jurisdictions regarding strategy, policy, frameworks and delivery of offshore wind development which could help to enhance positive effects and avoid adverse effects.

As noted at the outset of this Section, an independent report on applying GBA plus to offshore wind development in Newfoundland and Labrador was prepared by CRIAW under this Regional Assessment. CRIAW's report more thoroughly examines differential impacts on diverse populations and community wellness topics. CRIAW's report should be reviewed for a fuller picture of potential effects that offshore wind development could have in Newfoundland and Labrador (Appendix G).

7.13.2.1 Employment Opportunities

In 2015 the Crown Estate reported 3,151 direct jobs and 7,000 indirect jobs (i.e., along the supply chain) were created in the U.K. because of the offshore wind development industry. They also reported considerable investment and knowledge generation through R&D; and dedicated training courses developed to meet the rising demand of appropriate skills (Hattam et al., 2015). Offshore wind development creates jobs to support the manufacturing, construction, operation and decommissioning of projects. For an individual project, some sources estimate a 500 MW project creates 2.1 million days of work over its lifetime (Offshore Renewable Energy Action Coalition, 2020). Others estimate that an installation rate of 1 GW of offshore wind per year typically uses about 25,000 full-time equivalents (FTEs) during the capital phase, and that during operation, each 1 GW of operating plant uses about 600 FTEs each year (BVG Associates, 2019). Table 7.13.2 below lists examples of projects and estimated job potential in other jurisdictions. In their Repot CRIAW additionally presents and discusses employment data from the Vineyard Wind offshore wind development project currently under development in Massachusetts (see Appendix G, p. 17 - 19).

INTERSECTIONALITY

CRAIW (2024) notes the importance of considering more than FTEs when analyzing economic benefits of new projects. For example, information on whether jobs are full-time or part-time, the duration of jobs, who is getting these jobs and what types of jobs they are, is all important. Many of CRIAW's interview participants acknowledged inequity associated with other industries in the province. They expressed hope that new offshore wind developments could mean expanded employment opportunities for women, Indigenous people, people with disabilities, and 2SLGBTQIA+ people -- in other word, those who have typically not benefited economically from jobs in resource development in the past.

Table 7.13.2. Estimated Number Jobs for Offshore Wind Projects

Project	Scale/Description	Estimated Jobs
Arkona Offshore Wind Power Plant, Baltic Sea Region, Germany	60 turbines 385 MW	• 400 construction and installation • 50 operations and maintenance
London Array, DONG Energy, Thames Estuary, UK	175 turbines 630 MW	• 1000 construction and installation • 90 operations and maintenance
New York Power Authority, Long Island New York City Wind Project (low-end development)	350 MW	• 2300 development, construction and installation • 85 operations and maintenance
LeedCo, Near Cleveland, Ohio	6 turbines 20 MW	• 525 fabrication and construction
EDP Renewables, Marble-River Land-Based Wind Power Plant, Clinton County, New York	70 turbines 215 MW	• 300 construction and installation • 13 operations and maintenance
Galloo Island Wind Farm, Jefferson County, New York	110 MW	• 449 construction and installation • 24 operations and maintenance
Beatrice Offshore Wind Farm, Scotland	84, 7MW Siemens Gamesa turbines 588 MW	• 19,110 years of employment across the U.K. for development and construction with 7,180 in Scotland • Estimated 62% U.K. content • 800 jobs each year for operations and maintenance, with 370 expected in Scotland • Transition of skill from oil and gas at Nigg Energy Park: retained and created 100+ jobs from local area

Project	Scale/Description	Estimated Jobs
		• Up to 90 people (majority from local area) based in the Wick O&M building. Jobs range from office administrators to offshore technicians.
Able Marine Energy Park (AMEP)	Base for pre-assembly and construction of wind farm components, and for installation vessels; then for monitoring and maintenance during operations	• 260 FTE jobs for construction of AMEP • 4100 direct FTE jobs on site (manufacturing of marine energy components) once AMEP completed • 5000 direct FTE jobs in the Yorkshire and Humber region and elsewhere in the UK • 3200 direct FTE jobs in total (i.e. locally, in the rest of the region, and the rest of the UK) in relation to the installation of the wind turbines. • Indirect jobs include several goods and services required to run premises, equip the workforce, and run the business
Green Port Hull Terminal and Facility	Facility used for the manufacture, assembly testing and shipment of wind turbines	• 345-445 jobs associated with construction of Green Port Hull • 700 - 800 jobs upon opening • 1020 -1230 during operation

Table Description: This table shows estimated number of jobs for offshore wind development projects of various scale in other jurisdictions. The table was adapted from Gould & Cresswell (2017). Additional examples from other sources were added.

Sources: Gould & Cresswell, 2017; Marine Management Organisation, 2014; SSE Renewables, 2019.

Types of jobs vary by project phase, and each phase differs in duration (Table 7.13.3). Overall, positions available throughout the development of offshore wind farms include project management and development roles, support staff, engineers, assemblers and trade workers, with trade workers and assemblers representing the majority of positions (NYSERDA, 2017k).

The skills required for project management and development roles and support staff are transferable across industries and may not require additional education or training. For trade positions, additional technical, safety, or industrial certifications and training may be required but existing experience with welding, mechanical and electrical maintenance, incoming material and final inspection, material testing, and quality control will be relevant. Similarly, assemblers are also likely to have transferable skills into the offshore wind industry such as mechanical and electrical assembly; surface preparation and application (e.g. sandblasting); composite fabrication (e.g. fiberglass molding); installing various subcomponents and connecting components (BVG Associates, 2017a; NYSERDA, 2017k).

Job functions requiring more extensive training include production of the turbines and substation foundations as these are considered skilled trades. Training can include general education on offshore wind farms, certification of basic safety and first aid standards, training on components and systems, or competency development (e.g., electric, hydraulics, mechanics etc.) (BVG Associates, 2017a; Danish Wind Power Academy, n.d.; NYSERDA, 2017k). Various examples of offshore wind workforce training and education programs exist in other jurisdictions (BVG Associates, 2017a; Danish Wind Power Academy, n.d.; Maryland Energy Administration, 2020; NYSERDA, 2017k). On May 11, 2023, Qalipu First Nation announced it's entered a partnership with the DOB Academy in the Dutch city of Delft as a first step to building wind energy training capacity for both Qalipu members and other workers interested in the green energy sector (CBC Newfoundland and Labrador, 2023).

Table 7.13.3. Types of Jobs Across Phases of Offshore Wind Development

Phase	Approximate Duration	Type of Jobs Available
Planning and Development	• Two years on average • Can last more than ten years depending on the project	Identifying potential sites; conducting surveys, data collection, and environmental reviews; obtaining permits, leases, and project financing; designing the wind power plant; producing components.
Manufacturing (designing, producing, testing, and selling components)	• Ongoing • Original Equipment Manufacturers can be involved in multiple	Engineering (aeronautical, civil, design, electrical, environmental, industrial, mechanical, quality, machinists, research, structural, production, sub-sea structure design, high voltage electrical), quality managers, control systems specialists, technicians, welders, attorneys, health and safety specialists, back office and

Phase	Approximate Duration	Type of Jobs Available
	projects or orders at the same time	administration professionals, assemblers, public relations and marketing professionals, logisticians, and site/plant managers.
Construction and Installation	• 3-5 years • Technical advancements aim to shorten duration	Electricians, painters, pile drivers, laborers, stevedores, millwrights, ironworkers, carpenters, welders, plumbers, vessel crews.
Operation and Maintenance (regular inspection and repair of turbines, foundations, and cables and any necessary remedial work)	• 20 years • Dependent on lease and energy agreements	Vessel crews, site or plant managers, executives, engineers, technicians, back office and administrative professionals, logisticians, public engagement or marketing specialists.
Training, Engagement, and Research	• Ongoing throughout all phases • Individual involvement can be months or years depending on factors like project specifics and funding	Technical services and advisement; environmental impact surveys and geotechnical analysis; oversight and certification on health and safety and engineering, industry R&D, training and credentialing in technical areas (offshore safety, industry best practices, and soft skills).

Table Description: This table summarizes the types of jobs available during different phases of offshore wind development projects. It includes information on the possible duration of these phases and jobs.

Source: Gould & Cresswell, 2017.

7.13.2.1.1 Local Opportunity

In their review of socioeconomic impacts of offshore wind development, Alem et al., (2020) found that communities tend to anticipate positive impacts for the local economy. They report that studies from Scotland, Ireland and Wales do show creation of direct and indirect employment available to local communities. However, literature on employment generation tends to focus on projections and there is limited empirical investigation of actual effects (Alem et al., 2020; Cameron & Zwaan, 2015; Hamilton et al., 2013). Alem et al. (2020), report the following insights from Munday et al. (2011) and Glasson et al., 1988: Turbines are the largest proportion of capital costs and are often imported and installed by specialist teams provided by the manufacturer. Furthermore, turbine makers tend to use their own staff for on-site maintenance and, with turbine management being largely automated, inspection needs are infrequent. Civil engineering work tends to be sourced locally and can involve substantial funding. Feasibility and planning work also sometimes involves regional consultants.

According to the World Bank (2021), local content is higher during the operation phase, but contributions to the capital phase typically increase as local suppliers mature (World Bank Group, 2021). Supply localization can occur through market entry from a local supplier, partnerships between local and international players and experienced international suppliers investing in a new facility. There are examples of each route to localization in other jurisdictions. For example, in the U.K. local suppliers, JDR and Temar, provided cable systems and array cable protection systems for projects, and in Korea, a local company, Dooson supplied turbines. In Taiwan, Century Wind Power and experienced supplier, Bladt Industries, manufactured foundations. Finally, international suppliers invested in EEW (foundations) in New Jersey. Industry purchasers generally prefer partnerships or an experienced supplier investing in a new facility as this decreases risk (World Bank Group, 2021). Furthermore, certain areas of supply tend to be more successful in early localization, and some are unlikely to be localized at all (Table 7.13.4).

Table 7.13.4 Opportunities for Supply Localization

More Successful Supply Localization	• Project development benefits from local knowledge • Construction ports (personnel close to sites reduce costs) • Manufacturing and services already supplied to other industries, if skills are transferable to offshore wind development (e.g., oil and gas platform foundations, subsea power cables, electrical equipment, and installation or operation vessels) • Manufacturing and assembly of items expensive to transport due to size (e.g., turbine towers, blades, foundations, and offshore substation topsides) * • Operation and maintenance services
Supply Not Localized	• Supply and assembly of turbine nacelle components may never be localized because: • There is much knowledge of how to ensure highly reliable products are held by experienced suppliers in other markets • Supply of many subcomponents needs to be localized to make it worth assembling nacelles locally • From a developer's perspective there is little value added through local assembly of turbine nacelles

Table Description: This table shows supplies more appropriate for early localization in a new offshore wind market. Some supplies may never be localized.
*Highly dependent on local manufacturing capability and the regional supply strategies of turbine suppliers and project developers.

Sources: World Bank Group, 2021.

Table 7.13.5 contrasts different approaches used in other jurisdictions to enhance local economic benefits of offshore wind development.

Table 7.13.5. Comparing Approaches for Enhancing Local Economic Benefits of Offshore Wind

Jurisdiction	Approach	Outcomes
France	Strong incentives to build local turbine component factories	• Slow progress, partly due to inexperience • Lead times lead to mismatch between French prices and those achieved in auction elsewhere • French facilities have been underutilized. Long-term viability will likely depend on a strong French market
Taiwan	Strict local content requirements in specific areas	• Approach drove establishment of local supply • Unclear if local supply will be sustained without government intervention • Requirements reduced in 2021
Netherlands	Competition between project developers based on cost and feasibility of projects deliver only	• Government claims significant cost savings are due to competition and lack of local content requirements
U.K.	No local content requirements early on. The 2019 "Sector Deal" shifts focus on volume and local economic benefits. Direction is non-prescriptive and incorporates sector-wide targets, allowing developers to decide the most advantageous ways to incorporate local content. Adjustment in policy was helped by significant ongoing communication between industry, stakeholders and policy makers.	• Outcomes to be determined. Targets include • 60% local content by 2030, and revised arrangements for how local content is considered in revenue support auctions • Industry-funded long-term business transformation program, *Offshore Wind Growth Partnership*

Table Description: This table compares approaches used by various jurisdictions to enhance local economic benefits of offshore wind development projects.

Sources: World Bank Group, 2021.

In Newfoundland and Labrador, the Port of Argentia, is an example both of opportunities offered by offshore wind development and of how quickly the offshore wind industry has progressed during the Regional Assessment time frame (i.e., March 2023 – September 2024). The Port of Argentia first took delivery of four monopiles in August 2023, in its

purpose-built marshalling yard. The monopiles will later be transferred to offshore wind development projects off the U.S. east coast. The Port, with government assistance, invested significantly in new equipment and facilities to have the capability to provide this business service. Since August 2023, there have been announcements of more monopile deliveries; an onshore wind energy project proposal; expansion of the Port to include Coopers Cove; and, on September 18, 2024, the announcement of a new contract to receive and store turbine blades for U.S. projects during 2024 and 2025 (Port of Argentia, 2024b). While not all due to offshore wind activities, the Port of Argentia expenditures to local businesses have increased almost three-fold from 2021 - 2023. Full time employment has increased from 271 in 2021 to 1346 in 2023 (Port of Argentia, 2024a).

7.13.2.1.2 Barriers to Women's Employment in Wind Development

In 2019, the International Renewable Energy Agency (IRENA) administered a survey across the wind sector (onshore and offshore wind) to understand women's representation and barriers in the wind industry.[136] Overall, only 21% of the global wind workforce is made up of women, and women tend to be better represented in administrative functions (35%), followed by non-science, tech, engineering and math (STEM) positions (20%). These findings are like the renewable energy sector overall where, on average, women account for 32% of the workforce, 35% of positions are non-STEM and 45% are administrative.

Women's employment also varies by activity with most women employed by developers or 'other' parts of the value chain. Manufacturing is lowest (17%) followed by service provider (24%) and operator (26%). Manufacturing typically offers better paying jobs than other segments of an industry (Mishel, 2018).

Survey respondents were asked whether they perceive gender-related barriers in the wind energy sector and if yes to rank specific barriers to entry, retention, and advancement. Barriers to entry presented in the survey were: perception of gender role, cultural and social norms, lack of gender target, prevailing hiring practices, lack of awareness of opportunities, self-perception, discouraging workplace politics and lack of STEM and non-STEM background. Barriers to retention and advancement presented in the survey were: cultural and social norms, glass ceiling, lack of gender targets, mentoring, childcare facilities, flexibility, limited mobility, discouraging workplace practices, and lack of STEM and non-STEM background.

In survey results, 65% of women responding to the survey perceived gender-related barriers. Among male identifying participants, 34% of respondents perceived gender barriers. The perceptions of gender role, and social and cultural norms were ranked highest barriers for entry into the industry. Other barriers were considered less relevant, with lack of educational background considered least limiting (i.e., women reported being

[136] The survey was administered across 71 countries and areas and across the value chain (i.e., operators, manufacturing, service providers, developers, other). 132 respondents completed the survey on behalf of the organizations they work for and 789 responded as individuals. Overall, 921 responses were submitted.

qualified and having appropriate educational backgrounds for positions). Regarding retention and advancement, fairness and transparency in internal policies and processes, and social and cultural norms were ranked the greatest barriers. Additional issues flagged included a lack of gender diversity targets, lack of mentoring opportunities, lack of childcare facilities, discouraging or inflexible workplace practices, and limited mobility (e.g., owing to family expectations).

Respondents considered the following important measures to reduce barriers: networking opportunities (73%), mentoring opportunities (65%), training (60%), sharing experiences (58%), gender policies (44%), internships (42%), and seminars (41%).

INTERSECTIONALITY

Sex and gender disaggregation are only part of GBA Plus. CRIAW (2024) considered different identity factors and analyzed barriers, data gaps and mitigation strategies related to access to training and education, employment and retention and labour market information.

Access to Training and Education

Status: Several relevant training programs exist including at the College of North Atlantic.
There are significant barriers to ensuring labour force diversity, and gaps in knowledge.

Barriers:

- Cultural and social assumptions that this training is not for women, people with disabilities etc.
- Masculine culture, experiences of violence and harassment
- Inadequate learning accommodations
- Costs of program and lost income
- Limited non-standard child care
- Language of delivery

Gaps: Data on education and training, including STEM and apprenticeships, are not available for Indigenous people, racialized people, people with disabilities, 2SLGBTQQIA+ folks. Data at community level or on experiences of these groups in training are very limited or non-existent.

Mitigation Strategies:

- Proactive inclusion of learning and workplace accommodations;
- Supports for childcare and other family responsibilities;
- Supports for cultural practices
- Long-term plan to address labour force gaps in early education and training

Employment and Retention

Status: While we have little statistical data about who gets which jobs in the resource industry generally, and in offshore resource industries specifically, the barriers to the participation of women, Indigenous people, racialized people, people with disabilities, and 2SLGBTQQIA+ folks in terms of recruitment and hiring, employment, and retention are well documented. These limit their participation in the offshore labour force.

Barriers:

- Recruitment and hiring
  - Few inclusion policies are evident within companies
  - Unconscious bias exists in hiring which leads to discrimination
  - Lack of specific employment targets in terms of total participation rate or types of position held by Indigenous and other women, or other historically marginalized groups, such as people with disabilities.
- Employment and Retention
  - Work location and schedules can worsen existing inequities including access to childcare, mental health, wage gaps, access to disability supports or required medications, and participation in cultural practices
  - Lack of safety in the workplace exists for women, Indigenous women and men, 2SLGBTQQIA+ folks, racialized people, people with disabilities, and people whose identities cross these groups
  - Discrimination, harassment, and bullying exist.
  - Discrimination exists in terms of policies and practices that assume heterosexuality, lack of care responsibilities, physical or mental abilities, cultural or religious practices etc.
  - Few policies and practices exist which ensure all employees understand and recognize how to support diversity in the workplace
  - Health and safety policies and practices fail to address the specific needs of diverse bodies including women, pregnant people, trans folks, people with disabilities.

Gaps: Data on employment reflecting gender, Indigenousness, disability, race, and sexuality are not often available. Data at community level or about the experiences of diverse groups with training are very limited or non-existent.

Mitigation Strategies:

- Recruitment and hiring
  - Create and advertise accommodation and inclusion strategies to address needs and concerns of women and diverse groups
  - Create and implement targeted employment strategies to ensure greater diversity
  - Enact anonymous recruitment to assist with countering unconscious bias and discrimination in hiring

- Employment and retention
  - Plan and budget with diversity in mind from the beginning of a project
  - Ensure pay equity
  - Provide flexible workplace policies
  - Create mentorship programs for women and members of diverse groups
  - Learn about and create spaces that respect and reflect Indigenous values and traditions
  - Provide DEIA training for all employees
  - Hire more diverse leadership reflecting underrepresented groups
  - Ensure regular check-ins and anonymous surveys about employees' wellness and sense of safety and inclusion

Labour Market Information

Status: While long-term planning for offshore wind is essential and a unique opportunity to increase diversity in the workplace, there is little intersectional or coordinated labour force data to help with planning.

Barriers: Lack of advance knowledge about labour market opportunities prevents training existing workers for different opportunities and new people, particularly those often left out of industry and trades in the past.

Gaps: Labour force data are generally not available for Indigenous people, racialized people, people with disabilities, 2SLGBTQQIA+ folks. Labour force data at community level are very limited or non-existent.

Mitigation Strategies: Data should be collected on direct and indirect employment. Companies involved in offshore wind development activities should provide public quarterly employment reports disaggregated by age, disability, Indigenous status, race/ethnicity, gender, and sexual orientation.

7.13.2.3 Broader Economic Impacts

Broader economic impacts of offshore wind development include increased financial and manufacturing capital. In 2015 the Crown Estate reported €4 billion in innovation support, supply chain programs and financing (on-going and unpublished investments not included); €2 billion in price support and subsidies per year; regional investments; and increased market stability. They reported limited, but positive impacts on manufacturing capital. They indicated that many turbine components are imported but supply chain support is seeing investment in turbine component manufacturing. Furthermore, there are new investments in port facilities to support offshore wind industry, but these are in line with other industry investments. The Global Bank also identified foreign investment and Corporate Power Purchase Agreements (CPPAs) with international companies as potential positive economic benefits (World Bank Group, 2021).

7.13.2.4 Social Change

Existing literature has limited information about the potential adverse impacts of offshore wind development (or port development related to offshore wind projects) on social structures. Alem et al., (2020) presents some findings from other energy sectors which suggest an influx of workers related to energy development could increase demands on local services or cause social disruption, but results vary or suggest that effects can be managed. As some examples:

- Some studies suggest there is a link between substance abuse and shift work, especially due to an enforced period of offshore abstinence (Mitchell, 1976; Parkins & Angell, 2011; Sutherland & Flin, 1989).
- A U.S.A. study in the early 1990's found communities involved in energy development experience changes in crime, mental health and community satisfaction (Seydlitz et al., 1993).
- During construction of the Sizewell B nuclear power station in the U.K., alcohol related arrests were observed early on but effectively managed. In 1990, 40 arrests due to drinking and driving and 15 arrests due to public disorder and drunkenness involving in-migrant workers were reported. The numbers were reduced to 5 arrests each in 1993. During that time measures like a free shuttle minibus and attractive facilities on site were applied (Glasson, 2005).

Perhaps most relevant to this Regional Assessment, Storey & Jones (2003), evaluated the social impact of constructing the Hibernia offshore platform in Newfoundland and Labrador. They show similar concerns to those identified above, expressed early on, but no increases in crime and drug/alcohol abuse materialized. Tables 7.13.6 and 7.13.7 below present results from participant surveys (originally published in Jones, 1998) about perceived social impacts of the project in 1985, 1992 and 1996.

In 1985, questionnaire surveys were administered in seven communities adjacent to the Bull Arm site and within which most of the site-related community impacts were expected to occur (Swift Current, Garden Cove, North Harbour, Goobies, Sunnyside, Come by Chance and Arnold's Cove). Surveys were administered just prior to the public review hearings for Hibernia. The survey included open-ended questions about the perceived benefits and adverse effects of oil related development and Likert-type scales of

community satisfactions and life. There was a total of 952 households in the area. 537 interviews were completed for a response rate of 57.4%.

Authors indicated that surveys in 1992 and 1996 had a comparable design but additionally included participants from Southern Harbour, Little Harbour East and Chance Cove. By 1992, site preparation had been completed, and many pre-development issues had been resolved. The 1996 survey was administered just after peak construction employment.

Table 7.13.6. Perceived Social Impacts of the Hibernia Construction Project

Perceived Impact	1985 (% respondents)	1992 (% respondents)	1996 (% respondents)
Benefits			
Employment in general	88.7	67.7	40.0
More municipal services	43.0	0.0	0.0
More people moving in	33.9	13.7	2.8
Employment for self/family	22.9	14.7	7.1
Economic benefits	3.8	16.7	0.0
Business opportunities	2.7	28.4	4.3
Community growth/development	1.8	8.8	0.0
Use site for future projects	0.0	0.0	10.0
Community use of site facilities after project finishes	0.0	0.0	10.0
Training Used for Future Employment	0.0	0.0	7.1
Adverse Effects			
Increased crime	51.2	51.4	2.6
Increased cost of living	33.8	16.2	2.6
Disruption of fishery	27.7	10.8	0.0
Increased housing costs	15.5	0.0	0.0
Overcrowded schools	9.2	0.0	0.0
Oil spills/pollution	6.2	2.7	5.2
People moving in	5.1	29.7	0.0
Alcohol/drug abuse	1.5	5.4	0.0
Low-income people will suffer	0.0	5.4	0.0
Unemployment/adjustment to lower incomes	0.0	0.0	43.8
Out-migration	0.0	0.0	17.5
Business losses	0.0	0.0	7.0

Table Description: This table summarizes results from participant surveys regarding perceived social impacts of the Hibernia Construction Projects. Surveys were carried out in the communities within which most of the site-related community impacts were expected to occur. Surveys in 1985 were administered just prior to the public review hearings for Hibernia. By 1992 site preparation had been completed and many pre-development issues had been resolved. The 1996 survey was administered just after peak construction employment. Participants were asked open ended questions about perceived impacts.

Sources: Jones (1998) from Storey & Jones, 2003.

Table 7.13.7. Perceived Impacts of the Hibernia Construction Project on Quality of Life

Dimension	1985 (Average Rating)	1992 (Average Rating)	1996 (Average Rating)
Sociability	3.70	3.70	3.95
Economic security	3.15	3.24	3.06
Political efficacy	3.03	3.07	3.03
Personal security	2.74	2.83	2.97

Table Description: This table summarizes results from participant surveys regarding perceived social impacts of the Hibernia Construction Projects. Surveys were carried out in the communities within which most of the site-related community impacts were expected to occur. Surveys in 1985 were administered just prior to the public review hearings for Hibernia. By 1992 site preparation had been completed and many pre-development issues had been resolved. The 1996 survey was administered just after peak construction employment. Participants were presented 14 statements depicting various aspects of community life and asked to rate them on a five-point Likert scale. For positive statements scaled values ranges from 5 (Strongly agree) to 1(strongly disagree). Scores were reversed for negatively worded statements. Statements were grouped into 4 quality of life dimensions. A mean rating above 3 was considered positive (quality of life improved).

Sources: Jones (1998) from Storey & Jones, 2003.

In addition to these survey findings, Storey & Jones (2003), also acknowledge impacts that occurred prior to 1985:

> "In response to the earliest information about the project, speculators bought or optioned property, interest groups formed or redirected their energies, stresses increased and a variety of other community impacts occurred, associated with overly optimistic perceptions and speculative actions. Occurring before the formal impact assessment process got underway and therefore effectively excluded from it, they were, nonetheless, quite significant impacts."
>
> (Storey & Jones, 2023).

Overall, researchers concluded that economic benefits are not as highly reported as participants anticipated. However, adverse negative social impacts were also avoided. The primary management measures used to avoid such effects was the construction and operation of a high-quality workcamp and organizing work around a roster system to allow workers to return home periodically. They reported the approach effectively avoided population-influx problems like demands on social and community services and infrastructure (health, education, policing, etc.); impacts to community composition (image, power structure), interactions (conflicts) and values and behaviour (traditional lifestyle). Researchers also emphasized the importance of early community engagement to identify concerns of residents in the area and to develop realistic solutions.

7.13.2.5 Housing Prices

Regarding property value, communities tend to anticipate a decrease in property value where offshore wind farms are in view. Alem et al., (2020) found one study assessing the impact of offshore wind development on housing prices. Findings show no significant effect of having an offshore wind farm in view of a property or the nearest beach (Jensen et al., 2018). Studies from onshore wind development have mixed results. Most research, (conducted at various locations in Australia, Canada, Denmark, the U.K. and US) also show no significant evidence of wind farms impacting property value (Canning and Simmons, 2010; Carter, 2011; Cox, 2017; Dupont and Etherington, 2009; FonnesbechWulf et al., 2011; Heblich et al., 2016; Hinman, 2010; Hoen et al., 2010; 2011; 2015; Hoen and Atkinson-Palombo, 2016; Lang et al., 2014; Laposa and Mueller, 2010; Magnusson et al., 2012; Ostwald et al., 2016; Paterson, 2013; Renewable UK, 2014; Sims et al., 2008; Vyn and Mccullough, 2014). A few cases in the U.S.A., Scotland, and Canada report increased house prices or mixed results (Barclay, 2012; Heintzelman and Tuttle, 2012; Hinman, 2010; Sterzinger et al., 2003) and others report depreciation ranging from about 3-14% (Dröes and Koster, 2016; Frondel et al., 2019; Gibbons, 2015; Heintzelman and Tuttle, 2012; Jensen et al., 2014; Sunak and Madlener, 2012; 2016; 2017). The devaluation effect is typically attributed to visual disamenities, noise, and shadow flickers and limited or effect is reported between 8 - 14 km. Therefore, distance from shore could avoid or significantly reduce this impact (Alem et al., 2020).

While research on onshore windfarms shows no/limited effect on housing prices, some studies do report “anticipatory stigma” resulting in lowered housing prices and people paying to have wind farms located further away (Dent and Sims, 2007; Ladenburg and Dubgaard, 2007; Walker et al., 2014).

7.13.2.6 Recreational Users and Tourism

Like housing prices, communities tend to anticipate offshore wind turbines will have a negative effect on tourism. However, polls and interviews from pre- and post- construction show turbines have no effect on decisions to visit or return to an area, number of visitors, or reported experience and expenditure in the EU, U.S.A., and Australia (Aitchison, 2004; British Wind Energy Association, 2006; Frantál *& Kunc, 2011; Glasgow Caledonian University, 2008). Similarly, Polecon Research (2013), reviewed data on accommodations, food services, recreational activities, traffic volumes and employment and found no decrease in tourism due to the Horns Rev development in Denmark.

In another example, some effects on visitation due to turbines was reported in the French Mediterranean. The same findings were not reported where turbines were located between 8-12 km (or more) from shore, or where an associated recreational activity exists (Cherry et al., 2012; Ladenburg & Lutzeyer, 2012; Ladenburg & Möller, 2011; Westerberg et al., 2013).

Offshore wind sites could displace some users and specific tourism activities, but co-location opportunities maybe available and should be explored during project-level impact assessments.

Section 7.9 of this Report includes more discussion on the impacts of offshore wind turbines on visual aesthetics and viewscapes and the indirect effects on tourism, communities, and economy.

INTERSECTIONALITY

CRIAW (2024) considered different identity factors and analyzed barriers, data gaps and mitigation strategies to provide a more equitable consideration of community wellness factors.

Community Wellness

Status: Many impact assessment reports fail to address the impacts on community wellness. As a result, many impacts are invisible or ignored. Those related to community wellness often have disproportionately negative impacts on women, Indigenous women and men, people with disabilities, racialized people, 2SLGBTQQIA+ folks and those in rural communities. There can be cumulative community wellness impacts as a result of onshore and offshore resource development projects.

Barriers:

- Changes to housing resulting from resource development projects have disproportionately negative impacts especially in terms of costs and access.
- Increased and intensified violence resulting from the influx of workers and money associated with resource development projects has negative impacts on women, Indigenous women, women with disabilities and 2SLGBTQQIA+ folks. Shelters and services to address violence are strained with these increases.
- Increased consumption of drugs and alcohol may lead to increased violence, need for services, stress, and challenges to mental well-being.
- Impacts on food, including reduced access to subsistence fisheries and increased costs can increase food insecurity and increase health concerns.
- Expansion of ports could lead to air quality issues and increases in noise, light and traffic.
- Eexcessive demand on physical and social infrastructure including roads, electricity grids, accessible and inter-urban transportation can result from resource development projects.
- Increased demand on social infrastructure, including schools, hospitals, healthcare facilities, and childcare centres can result from increases in population.
- Resource development projects can intensify demands on safety nets like shelters, food banks and informal support networks.

Gaps: Data on community wellness services and supports reflecting gender, Indigenousness, disability, race, and sexuality are not often available. Data at community level or on experiences of these groups are very limited or non-existent. Government data collection is not often coordinated with that collected by community organizations.

Mitigation Strategies:

- Employers can provide housing for short-term projects and work with communities to develop longer-term housing options.
- Recognize that the negative impacts are experienced by those who do not get the economic benefits, and redress this by alternative sources of income.
- Assess and monitor impacts from resource development using the broader social infrastructure and community wellness indicators.

7.13.3 Mitigation and Other Measures

There can be significant long term economic benefits from offshore wind development. The approach taken with the new offshore petroleum industry in the 1980s was effective in achieving considerable local and Newfoundland and Labrador benefits in both employment and business goods and services. These were achieved through legislation, regulations, politics, government programs (e.g., the Offshore Development Fund), hard work by local companies and industry associations, and individuals. They have proved to be sustainable (Community Resources Services, 2003; Stantec Consulting Limited, 2019).

The *Atlantic Accord Act*, which was the legislation instrumental in co management of the offshore petroleum industry, is being amended to address renewable energy as well. Under the regulations and guidelines, potential developers are required to develop a Benefits Plan that spells out how they will operate to ensure the development of capacity and capability in the local workforce, companies and industries.

While offshore wind development is a very different industry from the offshore oil industry, without large numbers of onboard personnel for operations, it is still both a marine industry and a highly technological one. The sheer huge capital costs of offshore wind energy facilities requires strong national government support and international financing (World Bank Group, 2021). The infrastructure, teaching, research, regulatory, engineering, and business capabilities in this province that have evolved to support offshore commercial fishing for 500 years and the offshore petroleum industry for more than 40 years, can be applied to offshore wind energy.

Table 7.13.8 summarizes some mitigation and enhancement measures that aim to promote positive effects and avoid or reduce adverse effects of offshore wind development. These are organized according to desired effects, although some measures relate to multiple categories:

- Increase local jobs and supply chain capabilities
- Equitable benefits
- Address adverse impacts to community wellness

Related to increasing local jobs and supply chain capabilities, The World Bank offers several recommendations, and overall, emphasizes the need to balance local economic benefits and remaining competitive.

Strategies related to equitable benefits and addressing adverse impacts to community wellness were predominately re-laid from CRIAWs (2024) report (and appear in summary boxes entitled 'Intersectional Lens' throughout this section). Some suggestions are measures used in other jurisdictions.

The 2024, Keepers of the Circle report Our *Sacred Responsibilities, MMIWG Calls for Justice in Impact Assessment and the Reclamation of Power and Place* is also an important source of information for suggested mitigation measures that could promote equitable benefits and address adverse impacts to community wellness. Keepers of the Circles' work involved developing a database of potential mitigation measures that can be implemented to address the increased risks Indigenous women, girls, and 2SLGBTQQIA+ people experience in relation to development projects, while also working to increase the potential benefits that may exist for them.[137] Mitigation measures described in Our Sacred Responsibilities are summarized in table 7.13.9. The report authors note that these strategies are non-exhaustive and a starting point. Each strategy must be tailored and adopted to the unique distinctions emerging from cultural, geographic, and lived realities of communities impacted by development. The full report, Our Sacred Responsibilities, should be referred to for more details on each of these measures and the specific effects they aim to address.

Table 7.13.8. Measures to Mitigate and/or Enhance Impacts of Offshore Wind Development on Communities and Economy

Desired Effect	Mitigation and Enhancement Measures
Increase Local Jobs and Supply Chain Capabilities (World Bank Recommendations)	• Engage with industry early and throughout development to understand requirements and maximize local supply benefits. • Especially early in industry development, it is important to involve both companies experienced in offshore wind delivery and local expertise and knowledge. Prior experience is valuable for sensitive project development, the establishment of new supply chains, and for efficiently managing complex construction and operation, while following the latest health and safety best practices.

[137] Our Sacred Responsibilities is intended to inform IAAC guidance for resource development projects on how Call for Justice 13.5 from the National Inquiry into Murdered and Missing Indigenous Women and Girls (MMIWG) can be implemented.
Call for Justice 13.5 states:

> We call upon resource-extraction and development industries and all governments and service providers to anticipate and recognize increased demand on social infrastructure because of development projects and resource extraction, and for mitigation measures to be identified as part of the planning and approval process. Social infrastructure must be expanded and service capacity built to meet the anticipated needs of host communities in advance of the start of projects. This includes but is not limited to ensuring that policing, social services, and health services are adequately staffed and resourced.
> (National Inquiry into Missing and Murdered Indigenous Women and Girls, 2019).).

Desired Effect	Mitigation and Enhancement Measures
	• Consider local supply in the context of a competitive regional and global market to ensure long-term benefits and use of local supply. Focus on areas of the supply chain where a country is likely to be competitive. Establish frameworks to drive an internationally competitive local supply chain. Enable cross-border supply between markets through reducing trade barriers and harmonizing standards between markets • Commission supply chain gap analysis in early years to identify gaps in global supply chain that could be viably filled in country of supply • Conduct local skills studies and career opportunity assessments. Work with industry to develop local skill sets including retraining from other energy sectors to support just transition. Examples of wind workforce training and education programs are available from various jurisdictions (BVG Associates, 2017a; b; 2018; Maryland Energy Administration, 2020; NYSERDA, 2017k). • Promote and support workforce training. For example, governments can forecast workforce needs and provide grants to local technical colleges, training centers and suppliers setting up offshore wind manufacturing facilities. A local example is the provincially funded Immigration, Population, Growth and Skills (IPGS) econext project “Clean Energy Initiative: Workforce Development and Innovation”. • Providing innovative solutions to new sector challenges can be a good entry point for local companies. Consider local expertise, and establish and/or support grants, loans, incubation programs and/or research and technology organizations to bolster innovation, research and development (R&D). • Facilitate the development of local industrial clusters around ports. The Esbjerg Port (Denmark) and Humber and Teesworks (UK) clusters provide examples where investing in port development attracted international company support to develop the offshore wind supply chain (Port Esbjerg, n.d.; U.K. BEIS, 2021; World Energy Cities Partnership, n.d.). • Coach suppliers from parallel sectors (e.g., oil and gas, marine engineering) and provide education regarding export opportunities). • Measure and report local content (e.g., percentage of project local content) and set targets.
Equitable Benefits	• Support equitable access to training and education through: ○ Proactive inclusion of learning and workplace accommodations

Desired Effect	Mitigation and Enhancement Measures
	○ Supports to childcare and other family responsibilities ○ Supports for cultural practices ○ Long-term plans to address labour force gaps in early education and training • Equitable recruitment and hiring by: ○ Creating and advertising accommodation and inclusion strategies to address needs and concerns of women and diverse groups ○ Creating and implementing targeted employment strategies to ensure greater diversity ○ Enacting anonymous recruitment to assist with countering unconscious bias and discrimination in hiring • Equitable employment and retention by: ○ Planning and budgeting with diversity in mind from the beginning of a project ○ Ensuring pay equity ○ Providing flexible workplace policies ○ Creating mentorship programs for women and members of diverse groups ○ Learning about and create spaces that respect and reflect Indigenous values and traditions ○ Providing diversity, equity, inclusion and accessibility training (DEIA) training for all employees ○ Hiring more diverse leadership reflecting underrepresented groups ○ Ensuring regular check-ins and anonymous surveys about employees' wellness and sense of safety and inclusion • Collect data on direct and indirect employment and provide public quarterly employment reports disaggregated by age, disability, Indigenous status, race/ethnicity, gender, and sexual orientation.
Address adverse impacts to community wellness	• Employers can provide housing for short-term projects and work with communities to develop longer-term housing options. • Recognize that the negative impacts are experienced by those who do not get the economic benefits, and redress this by alternative sources of income. • Assess and monitor impacts from resource development using the broader social infrastructure and community wellness indicators.

Desired Effect	Mitigation and Enhancement Measures
	• Set realistic expectations about projects and local benefits/adverse impacts. • Engage early with communities to understand particular social values, structures and concerns related to offshore wind development. Collaborate to develop effective and realistic strategies to avoid effects or implement mitigation measures. • Establish high-quality work camps and implement rotational work periods to avoid influx of temporary workers and resulting effects. • Draft legislation or clauses in contracts/agreements holding developers accountable for decommissioning and abandonment costs.

Table Description: Table depicting mitigation and enhancement measures for potential impacts of offshore wind development on Communities and Economy.

Sources: CRIAW, 2025; International Renewable Energy Agency,2020; Storey & Jones, 2003; World Bank Group, 2021.

Table 7.13.9. Mitigation Measures to Address the Increased Risks Indigenous Women, Girls, and 2SLGBTQQIA+ People Experience in Relation to Development Projects

	Mitigation and Enhancement Measures
Moving Beyond GBA Plus	• Apply Culturally Relevant GBA Plus. • Work to achieve Gender Transformative Change, that is, focus on creating or transforming systems that. • Conduct gendered baseline community assessments. • Address gender disparities and resource gaps. • Assess gendered implications in addition to gendered impacts.
Meaningful Consultation and Engagement	• Identify barrier to Indigenous women's participation early in planning. • Increased representation of Indigenous women in consultations. • Use trauma informed engagement practices. • Support Indigenous-Led Impact Assessments. • Validate diverse forms of knowledge. • Adopt a strength-based approach to research. • Seek opportunities for co-production of knowledge. • Collaborate with Indigenous women and two spirited people in all stages of the project.
Policies and Practices	• Requests for proposals that include gendered scoring. • Apply gendered considerations to internal and external codes of conduct. • Support Small and Medium Enterprises conforming to Community Relevant GBA Plus and mitigation strategies. • Apply gendered employment strategies at project planning outset. • Support Indigenous women role models in skilled trades for recruitment programs. • Uplift stories of successful Indigenous women and gender diverse people. • Clear grievance reporting and dispute procedures. • Key performance indicators. • Community reporting systems. • Culturally relevant proponent policies. • Distinct sexual assault and harassment policy. • Mandate sexual harassment and gender-based violence workplace safety and awareness training. • Develop site-wide culturally relevant training and education.

	Mitigation and Enhancement Measures
	• Proponent log and track grievances for public reporting.
On-Site Resources and Supports	• Implement career planning and employee development programs. • Support groups for Indigenous women and gender diverse people. • Mental health supports. • Substance abuse programs. • Culturally relevant spaces. • Designated spaces for cultural activities. • Acknowledge and honour cultural events and support programming. • Elder presence on site. • Traditional foods or country kitchens. • Implement Indigenous liaison programs. • Personal protective equipment and machinery. • Facility design. • Sexual health education and screening. • Language services and accommodations.
Off-site Resources and Supports	• Childcare services and youth programming. • Transportation and road safety. • Environmental monitoring and reclamation programs. • Community development and land use planning. • Cultural protection and revitalization programs. • Infrastructure to support community needs (e.g., healthcare centre).
Alternative Pathways for Non-Participating Community Members	• Scholarships and awards for non-sectoral based career pathways. • Community reporting systems for on- and off- reserve membership. • Family Information and Liaison Units and MMIWG Red Dress Alert. • Implement a crisis response system. • Increase external support networks (NGOs/local businesses/women's groups). • Gendered policy implementation in Indigenous communities around resource developments.

Table Description: This table summarizes mitigation measures identified in the 2024, Keepers of the Circle report Our *Sacred Responsibilities, MMIWG Calls for Justice in Impact Assessment and the Reclamation of Power and Place.* These measures are intended to address the increased risks Indigenous women, girls, and 2SLGBTQQIA+ people experience in relation to development projects, while also working to increase the potential benefits that may exist for them.
Source: Bridges & Skelding, 2024.

7.13.3.1 Engagement Outcomes

The Committee heard the following feedback over the course of the Regional Assessment:

- During an Indigenous Knowledge Advisory Group meeting in September 2023, a participant asked how the Committee is considering Impact Benefit Agreements and employment and training opportunities for Indigenous peoples, especially women. A participant also indicated that only able-bodied, healthy and physically fit individuals could benefit from maintenance jobs as they are physically demanding and dangerous.
- In Marystown on November 6th, 2023, a participant indicated that offshore wind is 5x the cost of onshore wind. Economic viability is questionable for Newfoundland and Labrador. In the Northeastern US, two developers just pulled out of development because of economics.
- In Corner Brook on November 18th a participant indicated that in terms of jobs, are mostly construction phase – few long-term jobs locally.
- In Stephenville on November 17th, 2023, a participant indicated offshore wind could not benefit Newfoundland economically because of its impacts to tourism and the fishing industry.
- During June 2024 engagement sessions, several participants raised concerns that new employment for local communities would be limited to minimum-wage jobs and that spatial conflict with existing marine users would adversely impact the local economy. They also indicated that specialized training should be offered to locals and could be provided through the Marine Institute.
    - Some participants indicated young people need incentive to come back or stay in the area.
    - Some participants indicated that offshore wind could introduce employment opportunities to the community via supply vessels.
    - Participants indicated the importance of considering service ports and transportation between ports to development sites. Not many ports can support the size of the boats needed and further infrastructure would be needed (e.g., roads leading to it).
    - Participants indicated a need for better profit sharing between industry and communities and that adjacent communities to any offshore wind development should have some stake or economic benefit from the projects.
    - Participants raised concerns about cumulative effects of onshore and offshore wind in the i Stephenville area.
    - A participant pointed out and raised concerns about offshore wind projects cancellations in the EU due to costs.
    - A participant indicated compensatory measures in the U.K. are still being discussed in earnest for offshore wind.
    - Participants indicated one of our identities in Newfoundland and Labrador is our connection to the ocean. Fisheries and tourism are important to the culture here and we don’t want Newfoundland turning into an industrial park.
    - Participants in Stephenville raised concerns that offshore wind projects could affect tourism if developed facing the Gulf of the St. Lawrence and Red Island. In Port aux Basque participants indicated that duck hunting tourism could be negatively impacted.

- In Corner Brook, participants reacted positively to the Committee's recommendations to avoid the proposed South Coast Fjords NMCA and GMNP. They also indicated efforts to designate the local geopark a UNESCO site and possibilities for offshore wind compensation funding such projects.
- Participants recommended engaging local tourism operators (license holders for ferry, cruise ships, etc.).
- Participants raised concerns about various social impacts like influx of temporary workers, increased cost of living and housing, concerns that decommissioning and cleanup costs would be left to communities.
- Participants in Marystown raised concerns about potential adverse impacts of offshore wind including issues related to work camps and increasing violence against women, impacts on housing and healthcare systems and heavy equipment uses increasing local taxes to repair roads. Participants also spoke about their lived experience regarding the fishing moratorium and White Rose. They recalled raising several issues related to White Rose (e.g., increased taxes, violence, drug abuse, organized crime) they never saw addressed.
- Participants suggested the Committee consider past boom/bust cycles in Newfoundland and Labrador when considering impacts on communities and economy. Hibernia reports should include this information.
- In Marystown, several participants indicated they don't want offshore wind to proceed, and that they don't trust the provincial government to respect that. They raised concerns about the province's approach regarding onshore wind including a lack of engagement, downplaying the size of projects, and engaging only unions and Municipal Councils who don't reflect citizens' views or defend their position.
- In Stephenville and Port au Port participants expressed they see no benefit for their individual communities form this type of development.

- In a written submission following June 2024 engagement sessions a participant indicated that offshore wind projects could provide substantial local benefits. They indicated that the region has extensive experience in energy project development and operations in a marine environment and, with little adjustment, is fully capable of participating in such activities for offshore wind (e.g., port upgrades, transfers of workers, transshipment of equipment/supplies, and specialized fabrication). They also indicated, that stemming from the experience from the offshore oil and gas industry, it will be extremely important for governments to include provisions for local benefits during offshore land/area sales for offshore wind development and for those benefits expectations to be applicable through the life of the project.
- In their written submission to the Committee, received September 2024,[138] MFN recommended:
  - "That in the spirit of the Truth and Reconciliation Committee (TRC) recommendations, Calls to Action, Section 92 – Business and Reconciliation, proponents of [offshore wind development] should engage adjacent First Nations as per the following:

[138] This submission is available on the Registry under document reference number 324.

  - We call upon the corporate sector in Canada to adopt the UNDRIP as a reconciliation framework and to apply its principles, norms, and standards to corporate policy and core operational activities involving Indigenous peoples and their lands and resources. This would include, but not be limited to, the following:
    - Commit to meaningful consultation, building respectful relationships, and obtaining the free, prior, and informed consent of Indigenous people before proceeding with economic development projects.
    - Ensure that Aboriginal peoples have equitable access to jobs, training, and education opportunities in the corporate sector, and that Aboriginal communities gain long-term sustainable benefits from economic development projects.
    - Provide education for management and staff on the history of Aboriginal peoples, including the history and legacy of residential schools, the United Nations Declaration on the Rights of Indigenous Peoples, Treaties and Aboriginal rights, Indigenous law, and Aboriginal–Crown relations. This will require skills-based training in intercultural competency, conflict resolution, human rights, and anti-racism.
- In a letter submitted to the Committee in Fall 2023, QFN indicated that while projects would operate offshore, they have concerns regarding the use of traditional lands for onshore construction, such as overland transportation of materials. QFN indicated that they would require any project developer to include QFN in planning discussions to reduce adverse effects to traditional lands or persons.
- In fall 2023, the Committee heard from Qalipu Development Corporation about their plans for educational opportunities, partnering with a European institute.
- In a letter to the Committee, Flat Bay Band Inc. raised the following concerns about proposals to install offshore windmills, related to communities and economy:
  - The construction of offshore wind farms may contribute to coastal erosion due to changes in water currents and sediment transport. This erosion can have long-term effects on coastal environments and human settlements.
  - Many Indigenous communities have deep spiritual and cultural connections to the ocean and coastal areas. The proposed offshore windmills may interfere with sacred sites, traditional fishing grounds, and other culturally significant areas, such as eel.
  - Indigenous communities often rely on fishing and other marine-based activities for their livelihoods. The disruption of marine ecosystems could lead to a decline in fish populations, directly affecting the economic well-being of these communities.
- In August 2024 Port au Port Indian Band submitted information to the Committee which indicated the importance of the Port au Port Peninsula and Bay St. George regions to commercial and communal fishing activities that are central to the Port au Port Indian Band culture, food security and livelihoods.
- In August 2024, Port au Port Indian Band submitted a compilation of member concerns and feedback regarding offshore wind development. The following concerns related to communities and economy:

- Offshore development or resource extraction poses a risk to our community's access to and use of traditional lands and resources. This will disrupt our traditional practices, such as hunting, fishing, and gathering, which are vital to our cultural identity and sustenance.
- Offshore wind development may generate employment in various sectors, such as construction, infrastructure development, and related industries. This can lead to increased income levels, reduced unemployment rates, and improved economic stability in the region.
- Any environmental risks associated with the offshore development, such as habitat destruction, water pollution, etc., will directly impact the natural resources that we as Mi'kmaq rely on for our subsistence and cultural practices. This will threaten our ability to maintain traditional way of life and pass on knowledge and practices to future generations.
- Large-scale Offshore wind turbine developments will bring socio-economic changes to the region, which may affect our Mi'kmaq communities. These changes can include increased costs of living, changes in employment opportunities, or shifts in the local economy. Such changes can pose challenges to our socio-economic well-being and our ability to sustain our traditional way of life.
- Offshore wind development could lead to social disruption and displacement of Mi'kmaw communities living in development areas. This can result in the loss of our traditional territories and disruption of our way of life. It can disrupt social relationships and community cohesion. This can have a significant impact on the Mi'kmaw way of life, as our cultural practices and traditions are deeply rooted in community connections and intergenerational knowledge transfer.
- Development will lead to an increase in traffic and the need for infrastructure development. This will result in congestion, noise pollution, and strain on existing infrastructure, impacting the quality of life for residents.
- An influx of workers from outside the local community, can lead to social and cultural changes. This can result in tensions, conflicts, and a loss of traditional cultural practices and values.
- A sudden population increase may strain local services and infrastructure, leading to challenges in providing adequate housing, healthcare, education, and other essential services for both the transient workers and the residents.
- Work camps and transient workforces can contribute to an increase in crime rates in the community. The presence of a transient population, often consisting of predominantly male workers, can lead to higher instances of substance abuse, alcohol-related issues, and other unlawful activities. This can have a negative impact on the community's safety and well-being.
- The presence of transient workforce can increase the risk of gender-based violence against women and girls in the community. This can include sexual harassment, assault, and exploitation. The lack of proper safeguards and support systems can exacerbate these risks.
- The presence of a large transient workforce can put significant pressure on local resources, including water, energy, waste management, and transportation infrastructure. Local communities may struggle to meet the increased demand, leading to resource shortages, environmental degradation, and increased costs for the community.
- The presence of a transient workforce can disrupt the local culture and social dynamics. The rapid influx and departure of workers can lead to a loss of community cohesion, as well as a decline in the preservation and transmission of local cultural practices, traditions, and

knowledge. This can have long-term impacts on the cultural identity and social fabric of the community.

- The transient nature of the workforce can result in limited access to education and healthcare services for children and women in the community.
- Offshore wind turbine development may support community development initiatives, such as social programs, cultural preservation efforts, and environmental conservation efforts.
- Communities that become heavily reliant on transient workforces may experience economic instability and vulnerability. The local economy may become dependent on Offshore wind turbine development, leading to a boom-bust cycle when Offshore wind turbine development ends or if there are fluctuations in the industry. This can result in job losses, reduced economic opportunities, and a decline in the overall well-being of the community. Women in the community may become economically dependent on the transient work opportunities. This dependence can lead to vulnerability, as women may face precarious employment conditions, limited job security, and lower wages. This can perpetuate gender inequalities and restrict opportunities for women's empowerment and economic independence.
- A transient workforce can disrupt the social support networks that women and children rely on for emotional and practical assistance. The transient nature of the workforce can lead to a loss of community cohesion and support systems, making it challenging for women and children to access resources and services they need.
- Offshore wind turbine developments often involve the development or improvement of infrastructure, such as roads, bridges, or transportation networks.
- Offshore wind development can provide opportunities for local residents to acquire new skills through training programs and capacity-building initiatives.
- Ensure that Offshore wind turbine development activities contribute to the improvement of their living conditions, education, healthcare, and access to basic services. Create opportunities for meaningful and equitable participation of Indigenous peoples in employment, training, and business development related to Offshore wind turbine development.
- Develop Benefit Agreements and equity stakes with all impacted Indigenous Communities including local bands.
- The increase of a transient workforce will impact available food supply in area. Inflation of a basic need is a concern based on supply/demand. During adverse weather conditions, the community transportation and delivery of goods would be especially impacted.
- Industry Controlled Access to waterways is a concern. This impacts our way of life and Indigenous people will be subject to unreasonable search and seizure through various security and surveillance methods used by industry.
- The opportunity for economic spin-offs is supported within the community.
- Offshore wind turbine development can have significant impacts on all aspects of the provincial economy, with a massive impact on the local region. Our current economy includes fisheries, and tourism, which will be impacted by this Offshore wind turbine development. For the current generation, and potentially those to come.

- A participant who requested they remain anonymous indicated any new wind project must be carefully considered and only approved after rigorous review and engagement with the affected

communities and bodies representing them, understanding that “affected” communities may include communities that are not adjacent, and may even be distant, from the proposed projects. Impacts on migratory species may be felt far from the place of initial impact by, for example, Indigenous groups who depend on those migratory species for country food harvesting and/or value them highly for cultural and traditional reasons.

7.13.4 Data Gaps and Limitations

Regarding existing conditions, there is a lack of disaggregated data for many identity and social factors (see Section 11 of this Report). Furthermore, a better understanding of the proportion of community members with skills and knowledge, transferable to the offshore wind development industry is needed. This could help to identify if/how much offshore wind development could benefit local communities, and the type of skills and training that should be made available in order to enhance potential positive effects of offshore wind development.

Regarding effects and mitigation, available socioeconomic information is largely focused on economic impacts. Broader reviews of existing literature, such as work by Glasson et al. (2022), found that existing environmental statements and monitoring work for offshore wind projects in the EU have very limited coverage of social impacts (e.g., strain on local services, changes in community structure). They also found limited evidence of public participation to assess social impacts. Evaluation of economic impacts also has gaps. For example, Alem et al. (2020) and Glasson et al. (2022) both reports limited follow-up and monitoring to determine actual socioeconomic impacts of projects for local communities. Most reported numbers include predictions and forecasts. While not directly comparable, the offshore oil and gas industry was introduced in the recent past in the province. Some research on the social impacts of this industry has taken place (Storey & Jones, 2003) but is fairly dated and has limited consideration of how diverse populations experience impacts.

7.13.5 Committee Conclusions and Recommendations

To address data gaps and limitations:

- The Committee recommends that Statistics Canada collect disaggregated data for information on identity and social factors, to improve GBA Plus considerations in impact assessments. Disaggregated data should be reflected in the Newfoundland and Labrador Community Accounts Repository once gathered.
- The Committee recommends that the province revisit initiatives undertaken to prepare for the introduction of offshore oil and gas development in Newfoundland and Labrador and consider updating and applying these in the context of offshore wind development. These could include, but are not limited to, establishing specialized programs at local colleges and institutes, programs to encourage Canadian ownership of new developments (e.g., similar to the National Energy Program enacted in October 1980), and offering offshore survival training programs throughout the province.
- The Committee recommends that the provincial and federal governments revisit the offshore development fund (established to help prepare the province for industrial growth as a result of

offshore oil development) and continue to support active industry associations (e.g., MRC, EnergyNL, econext, Oceans Advance, NetZero Atlantic, etc.).

- The Committee recommends that proponents, government agencies and the CNLOER support and collaborate with local communities. Proponents, government agencies and the CNLOER should be transparent and provide available information about potential locations for offshore wind development as soon as possible, using a free and publicly available repository so that towns can plan effectively.
- The Committee recommends implementing the Recommendations from the World Bank outlined in Table 7.13.8. above.
- The Committee recommends that proponents, government agencies and the C-NLOER consider mitigation strategies outlined in *Harnessing the Potential for a More Equitable Future in Newfoundland and Labrador: Applying Gender-Based Analysis Plus to Offshore Wind Development* (CRIAW, 2024) and *Our Sacred Responsibilities, MMIWG Calls for Justice in Impact Assessment and the Reclamation of Power and Place* (Bridges & Skelding, 2024) as a starting point for developing strategies to mitigate impacts and enhance potential benefits of offshore wind development on diverse populations in Newfoundland and Labrador. Specific measures should be developed in collaboration with, and in consideration of the unique communities potentially impacted.

8. Cumulative Effects

The term "cumulative effects" generally refers to the combined effects from past, present, and reasonably foreseeable future activities and natural processes. Cumulative effects may be individually minor but collectively significant and can be adverse or positive (Government of Canada, 2023). The effects of an offshore wind project can overlap and interact with each other, with effects of other anthropogenic activities (e.g., other offshore wind projects, offshore oil and gas projects, commercial fishing), and with natural (e.g., hurricanes) and human-induced processes (e.g., climate change) in a region to bring about cumulative effects.

The Agreement had multiple references to the identification, consideration, and analysis of cumulative effects within this Regional Assessment and gave the Committee flexibility in determining how to address cumulative effects. To set the context for the Committee's decision on how to approach this topic, this section first summarizes available guidance on consideration of cumulative effects in regional assessments under the IAA, acknowledges the challenges of cumulative effects analysis, and presents federal authority input and Indigenous and public engagement outcomes relevant to cumulative effects. This section then describes the Committee's constraints analysis approach and resulting initial offshore wind energy licencing areas for consideration as the primary means of considering cumulative effects in this Regional Assessment. Finally, the Committee makes recommendations in support of planning, licencing, and impact assessment processes that improve cumulative effects knowledge and management.

8.1 Guidance on Cumulative Effects in IAA Regional Assessments

While the IAAC has issued guidance on assessing cumulative effects under the IAA, it is specific to project assessments and does not address regional assessments (IAAC, 2023d). The Committee requested the IAAC provide advice on how to assess cumulative effects in a manner that fulfills the Agreement.[139] In their response, the IAAC confirmed the Committee had considerable discretion for how to consider and analyze cumulative effects, and that no specific guidance existed for consideration of cumulative effects in regional assessments. The IAAC suggested policy documents, research, and data sources that may be useful for the Committee to consider in determining approach to cumulative effects (IAAC, 2024).

The Government of Canada has issued an interim message on cumulative effects (Government of Canada, 2023), but it does not provide guidance for regional assessments. Instead, it speaks to overarching efforts to develop and implement a plan to explain and provide additional detail on how it will understand, consider, and support the management of cumulative effects. It also identifies regional assessments as contributors to that plan.

[139] The Request for Advice can be found on the Registry under document reference number 210.

The Government of Canada acknowledges that the responsibility for and management of cumulative effects requires cooperation between all levels of government, and recognizes the importance of input from Indigenous peoples, industry, stakeholders, and the public to the shared understanding, consideration, and management of cumulative effects.

8.2 Challenges to Cumulative Effects Analysis

The following section describes several challenges the Committee considered when determining their approach to cumulative effects analysis.[140]

8.2.1 Complexity of Cumulative Interactions Across Space, Time and Knowledge Systems

Cumulative effects analysis already presents a practical and theoretical challenge (e.g., Blakley & Franks, 2021). The spatial, temporal, natural, and anthropogenic dynamics of the marine environment creates further complexity. The variability makes it challenging to predict how ecological systems will react to significant changes. Even within a single government agency methods and management strategies can be inconsistent, stemming from lack of data, unclear definitions of spatial and temporal scales, uneven application of assessment tools, a focus on single-sector or single-species management, and limited understanding of social-ecological interactions in marine environments (Curren et al., 2022; Griffiths et al., 2020; Judd et al., 2015; Murray et al. 2014; 2020). One of the primary challenges in conducting a cumulative effects assessment (CEA) at a regional scale is accounting for the complex interactions between various stressors that accumulate over vast geographic areas and extended timeframes to impact valued ecosystem components. Regional assessments must consider not only the direct impacts of individual projects, like offshore wind energy developments, but also how these impacts interact with other human activities (e.g., shipping, fisheries) and natural processes (e.g., climate change, interannual or decadal cycles). These combined effects can lead to outcomes that are greater than the sum of their parts, making it difficult to predict and assess long-term ecological, social, and economic consequences.

Additionally, the spatial scale often includes multiple ecosystems, jurisdictions, and diverse ways of knowing, such as Indigenous knowledge and local community insights. Respecting and incorporating Indigenous and local knowledge into the assessment can provide valuable context and historical perspectives, but integrating these systems with Western scientific approaches remains challenging (but see Tulloch et al., 2024).

The Regional Assessment for Offshore Oil and Gas Exploratory Drilling East of Newfoundland and Labrador, the first and only regional assessment completed to date,

[140] Section 8.2 of this Report has been expanded upon (relative to the same section in the Draft Report), largely due to feedback provided by experts at ECCC during the public review and comment period on the Draft Report. The submission from ECCC can be found on the Registry under document reference number 275.

offers a particularly relevant example. Assessment of cumulative effects understandably proved challenging, even with a specific development goal and timeline on which to model development scenarios, and decades of research and data on local effects and mitigation effectiveness (Bangay et al., 2020).[141] When considering the offshore wind sector will be new to the province, and therefore no history of baseline data, these challenges become even more daunting. Even jurisdictions with offshore wind industries contend with knowledge and data gaps. In areas where offshore wind energy is new, there is limited knowledge about the localized environmental impacts when the first projects are developed. Where offshore wind energy is more established, most studies continue to be carried out at the single project or single farm level. Where onshore wind or offshore oil and gas industries are established, the effectiveness of mitigation measures from those industries in offshore wind energy may remain untested in the offshore wind development context.

8.2.2 Data Gaps, Limited Baseline Information, and Knowledge Sharing

A significant hurdle for regional CEAs is the lack of comprehensive, high-quality data across the entire region being assessed. In many cases, baseline information about the condition of ecological and socio-economic systems is incomplete or outdated, making it hard to measure changes over time or identify cumulative impacts accurately. However, federal government initiatives relevant to cumulative effects are underway to help address this challenge (e.g., NRCan Offshore Wind Predevelopment Program; Table 8.3.2)

In addition, there may be gaps in knowledge-sharing processes that hinder the inclusion of Indigenous knowledge and other community-based insights. Ensuring that all available knowledge systems—whether based in western science, Indigenous ways of knowing, or local community insights—are accessible and used meaningfully can be a key challenge in filling these gaps.

8.2.3 Data Collection Challenges, Mitigation Testing, and Knowledge Sharing

Given the comparatively harsh and inaccessible nature of offshore environments, it is both challenging and expensive to collect data and test mitigation strategies. Even in regions with established industry, the effectiveness of mitigation measures from those industries may remain untested, particularly as most studies focus on individual projects rather than adopting a regional approach. This issue has been raised by stakeholders in the EU, where a lack of comprehensive data on impacts and mitigation measures makes it difficult to assess cumulative effects (Caine, 2022; Declerck et al., 2023; Gill and Hein, 2022; Rezaei et al., 2023; Gulka et al., 2024; Regional Synthesis Workgroup of the Environmental Technical Working Group, 2023). Without coordinated efforts in data collection and

[141] Advance 2030: A Plan for Growth in the Newfoundland and Labrador Oil and Gas Industry was released in February 2018 and indicated the province's goal to drill more than 100 new exploratory wells by 2030.

sharing, identifying trends and making informed decisions becomes more challenging, hindering the ability to accurately assess cumulative impacts at a regional scale.

8.2.4 Time Constraints, Resource Limitations, and Inclusive Engagement

Resource limitations—such as time, funding, technical expertise, and administrative capacity—can significantly undermine efforts to complete a comprehensive CEA. CEAs at the regional scale, require collaboration between various partners, including federal and provincial government agencies, industry, Indigenous governments, and local communities.

Additionally, meaningful engagement with Indigenous and local communities requires time to build trust, co-develop management objectives, and ensure the shared knowledge is treated with respect and integrated effectively (Adams et al., 2023).

8.2.5 The Project Envelope Approach and the Challenge of Assessing Future Scenarios

The Project Envelope Approach poses a unique challenge for cumulative effects analysis.[142] The Project Envelope Approach is necessary to accommodate the rapid evolution of offshore wind energy technology. This approach allows developers to describe their projects using broad parameters to accommodate rapid technological advancements, including various technology options (e.g., different foundation types such as fixed versus floating, monopile versus gravity-based). While this flexibility is required from an evolving project design and engineering standpoint, it poses a challenge for analyzing cumulative effects. As described in Section 4 of this Report, there are multiple technology options for offshore wind development, and those technologies are ever-changing. Section 7 of this Report ties project effects to technology used (e.g., fixed versus floating, gravity based versus monopile foundation, etc.). A project assessment therefore considers the potential effects of all project design options. While modelling the “worst case” (i.e., the project design with the potential for the most significant impact) may not be problematic for a project-level cumulative effects analysis, doing so where multiple developers propose projects in the same licencing area may result in overly negative predictions of the combined impacts of all the proposed projects. In turn, this could affect overall growth of the sector by overestimating cumulative negative effects (Caine, 2022).

[142] The proposed CORER states: The technical details required in the application for authorization at the construction and operations phase are intended to reflect the range of design parameters within which the project would be designed, while the final design details would be submitted to the Regulator as part of the conditions of authorization. This approach, known as a “project envelope approach,” has been used successfully in the United States and Europe and provides flexibility for an operator to use the latest technologies and methodologies by not having to lock in the design too early in the project approval process, thereby minimizing the need for additional technical reviews, design, or technologies change during the approval process.

8.3 Federal Authority Input and Initiatives

Federal authorities provided input on cumulative effects primarily through written responses to Committee requests.[143] Additionally, at the request of the Committee, the IAAC facilitated a meeting in June 2024 between federal and provincial authorities and the Committee to discuss cumulative effects. Federal and provincial departments were invited to provide an overview of existing programs and initiatives related to cumulative effects in the Newfoundland and Labrador region, and to participate in a discussion on how this Regional Assessment could support effective cumulative effects management.[144] Staff from numerous federal and provincial departments attended, and DFO, ECCC, NRCan, and TC gave presentations.[145] Written responses and presentations are posted on the Registry and are referenced throughout this section. Table 8.3.1 summarizes federal authority input on cumulative effects.

[143] The Committee's Public, Fisheries, and Stakeholder Engagement – What We Heard Report contains a list of requests and responses.
[144] Then Letter to Impact Assessment Agency of Canada RE: Consulting Expert Authorities on Cumulative Effects can be found on the Registry under document reference number 243.
[145] The Committee's Public, Fisheries, and Stakeholder Engagement – What We Heard Report (Appendix B) contains a list of all meetings and meeting participants.

Table 8.3.1. Cumulative Effects of Offshore Wind Development – Federal Authority Input

Indigenous Communities, Activities, Interests, and Rights
• The following sections in this table provide federal input on topics/components that have been raised as concerns by Indigenous peoples to date: Marine Fish and Fish Habitat (particularly Atlantic Salmon and Atlantic Eel), Aerofauna, Marine Mammals and Sea Turtles (particularly cetaceans), Fisheries and Other Ocean Uses (commercial fisheries), and Protected and Special Areas (particularly as it relates to migratory pathways of birds, Atlantic Salmon, Atlantic Eel, and whale species in EBSAs).
Air Quality and GHGs (ECCC, 2024)
• Overall, the carbon footprint of wind power is significantly lower than that of fossil-based power.
Marine Fish and Fish Habitat (DFO, 2023p)

Species at Risk
• Northern Wolffish (SARA - Threatened), Spotted Wolffish (SARA - Threatened), Atlantic Wolffish (SARA - Special Concern) in NAFO Subareas 0, 2, 3, 4, 5
  ○ The trends in indices of stock size during the last two decades coincided with a period when wolffish species became protected by SARA (2002), along with concurrent shifts in oceanographic conditions and functional groups within the bioregions inhabited by wolffish.
  ○ It is unclear if the recent trends in abundance indices of wolffish stocks are driven mainly by a reduction in fishing mortality, changes in environmental conditions and community structure, or the result of cumulative effects.

Corals and Sponges • There has been very little work completed on cumulative impacts on cold-water corals or sponges and measuring these impacts can be extremely challenging, as little is known on the impacts from individual stressors and even less on their interactions (e.g., Ragnarsson et al., 2017). • The impact from activities such as bottom fishing, deep-sea mining, and oil and gas on cold-water coral physiology can be exacerbated by climate change (Smith et al., 2008).
Primary production • Increased turbulence and creation of wind wakes due to turbine presence can change stratification (Carpenter et al., 2016; Christiansen & Hasager, 2005; Schultze et al., 2020). • Changes in stratification may largely impact the ocean by   ○ vertically redistributing temperature, salinity, oxygen, nutrients, etc.,

- affecting timing of the phytoplankton spring bloom with potential impact on the whole ecosystem (e.g., a match/mismatch between primary production and other trophic levels) (Cyr et al., 2023).

- Increased turbulence within the water column due to the physical disturbance of the wind turbines on tidal currents can lead to the resuspension of detritus throughout the water column, thereby providing additional food sources for zooplankton. This resuspension can also mix nutrients from the sediments back into the water column, potentially extending phytoplankton primary production (Daewel et al., 2022; Wang et al., 2019). It is unclear how these mechanisms would manifest in the Focus Area, but any impacts to primary production can affect the ecosystem.

American Eel and Atlantic Salmon

- American Eel has similar potential concerns as for Atlantic Salmon.
- Knowledge on the potential impacts of offshore wind development on fishes (e.g. Atlantic Salmon), remains scattered (Svendsen et al., 2022).
- Potential stressors from offshore wind development include EMF, underwater noise, particle motion and vibration. Atlantic Salmon and American Eel can be sensitive to EMF (e.g., Gill & Bartlett, 2021). Studies, however, have not attempted to ascertain the exact relationship between electric or magnetic fields and observed behavioural modifications (DFO, 2023p).
- In general, the significance of EMF as a stressor on fish populations remains unknown and there has yet to be any evidence that existing underwater cables have caused significant disruptions to survival and reproductive success in any species. But EMFs may cause temporary and significant navigational disruptions (disorientation) to migrating species (Gill & Bartlett, 2021; DFO, 2014a).
- In addition, offshore wind development structures may have several ecosystem effects in marine environments, by attracting and enabling various species (including Atlantic salmon and those that prey upon Atlantic Salmon) to occur in novel areas due to the addition of habitat in a relatively featureless environment. A similar phenomenon seen for other artificial reef structures or fish aggregation devices (Schneider et al., 2023).

Aerofauna (ECCC, 2024)

- As a diverse group which includes migratory birds, migratory bats and Species At Risk (e.g., Monarch butterflies), a diversity of stressors can affect the population structure and size of aerofauna species.
- Stressors may include historical persecution, pollution (i.e., DDT), overfishing impacts on predatory prey dynamics, mortality from bycatch, contemporary pollution (e.g., oil spills, mercury, plastic), disease (e.g., white nose syndrome, Highly Pathogenic Avian Influenza), reduced recruitment from colony abandonment, disproportionate avoidance of areas with multiple industries, habitat destruction, and impacts associated with climate change.

- How these stressors accumulate over time and will interact with the impacts associated with various stages of offshore wind energy development (i.e., construction, electricity generation, maintenance, accidents, and decommissioning) are not known.
- Cumulatively, impacts from offshore wind development and other pressures (both anthropogenic and natural) may be additive, synergistic or compensatory, resulting in significant impacts on some aerofauna species during their use of the marine environment or transit through marine airspace along migratory routes.
- Certain species (i.e., marine birds) are exposed primarily to marine and coastal stressors. However, coastal and offshore migrants may be exposed to terrestrial, coastal, and marine stressors, depending on their life histories.
- Cumulative effects research and approach development for aerofauna are under way (see Table 8.3.2)

Marine Mammals, Sea Turtles, and Sharks (DFO, 2023p)

- Cumulative impacts associated with marine species at risk, particularly those that are endangered or threatened, are often associated with the combination of historical overfishing and bycatch, habitat degradation, and a changing marine climate that impacts water column structure, nutrients, primary productivity, and changing predator-prey relationships, and food supply.
- Knowledge on the potential impacts of offshore wind development on marine mammals, sea turtles, and shark is limited by the data gaps with respect to the spatial and temporal distribution and movements of species.
- Impacts associated with offshore wind development, such as habitat alteration, disruption, destruction, noise associated with installation or servicing, and/or vessels that may strike at-risk marine species, particularly slow moving and surface feeding animals, could have significant impact on the species status.
- Importantly, these potential impacts may be additive, or worse synergistically, with other ongoing stressors.

Marine mammals - cetaceans

- Efforts to model multiple stressors to assess impacts on marine mammals, sea turtles, and shark have been far more problematic than models using single stressors. This is mainly due to the relatively poor understanding of the impacts of single stressors on individual and population-level biological processes, let alone how multiple stressors might combine to yield an effect.
- Studies have tried modelling with limited numbers of stressors (e.g., Pirotta et al., 2019), but real-world assessments are needed to ground-truth these models.

Marine mammals – Pinnipeds

- As species that are strongly associated with coastal ecosystems, both harbour and grey seals face common threats from a wide variety of anthropogenic sources including disturbance, pollution from coastal run-off, coastal development, and interactions with fisheries and aquaculture.
- Climate change is projected to have significant impacts on their environment with significant potential changes in prey distribution and abundance.
- Little is known about the potential cumulative effects of these multiple stressors on these species

Sea turtles

- Sea turtles face common threats from many different sources (e.g., fishing, maritime transport, offshore petroleum, etc.) which may contribute to habitat degradation, vessel strikes, marine debris, and ocean noise.

Sharks

- Sharks have the ability to sense electromagnetic signals in the water through specialized cells in their snouts.
- Numerous species are attracted to or affected by electromagnetic signals. Instances where sharks have been attracted to the electromagnetic field given off by lithium batteries include attacks on ocean gliders deployed by the Ocean Tracking network in Canadian waters and preferential interaction with GoPro cameras during fieldwork even in the presence of bait. As such, sharks may be affected by the offshore wind developments.

Protected and Special Areas (DFO, 2023p)

- There have not been any studies or reviews conducted regarding cumulative impacts on EBSAs, SBAs, or other important areas in the Newfoundland region.

Fisheries and Other Ocean Uses (DFO, 2023p)

Commercial fisheries

- The impacts of offshore wind development on regional fish stocks are not known.
- Cumulative impacts associated with fish stocks, particularly those in the cautious, critical, or unknown zones, are often associated with historical over-fishing, habitat degradation, and a changing marine climate that impacts water column structure, nutrients, primary productivity, and changing predator-prey relationships.
- Impacts associated with offshore wind development, such as habitat alteration, disruption, destruction, noise associated with installation or servicing, and/or vessels that may be vectors for IS may impact the status of some fish stock, particularly benthic and/or vulnerable fish stocks.

Visual Aesthetics/ Viewscapes (Parks Canada, 2023a)
• Consideration should be made regarding the cumulative impact of already implemented or already known potential future projects, including other wind energy or other renewable energy projects (UNESCO World Heritage Centre, 2023).
Acoustic Environment
• Input provided on the cumulative effects of noise on Marine Fish, Aerofauna, Marine Mammals and Sea Turtles, Fisheries and Other Ocean Users (Commercial Fisheries), as noted throughout this table.
Physical and Cultural Heritage
• No specific input or advice provided to date regarding cumulative effects.
Health
• No specific input or advice provided to date regarding cumulative effects.
Communities and Economy
• No specific input or advice provided to date regarding cumulative effects.
Climate Change (ECCC, 2023n)

• The level of scientific confidence in climate projections is not the same for all climate variables as they involve processes of different complexities and with differing levels of uncertainty.
• Several key factors contribute to the uncertainty in projected future climates:
  ○ differences in how climate models numerically represent complex physical and biogeochemical processes
  ○ different possible scenarios (or pathways) of future emissions; and
  ○ the irreducible uncertainty in the climate system which shows up as natural climate variability.
• Best-practice for considering climate change is to use the range of information from an ensemble of climate models for a range of future emission scenarios.

Table Description: This table describes the input received from federal authorities on cumulative effects for various components with topics divided under components for specific issues where applicable.

Federal experts and the Committee agree that the variability in potential project factors (e.g., the unavailability of Canadian, regional, and species-specific data, and the varying methodologies), presents a challenge to providing specific cumulative effects information and advice at this time. However, federal authorities are actively working on cumulative effects and other

related initiatives in support of the government decision-making regarding cumulative effects of offshore wind development in Atlantic Canada, and cumulative effects management of various activities nation wide (Table 8.3.2).

Table 8.3.2. Existing and Planned Federal Government Initiatives Relevant to Cumulative Effects

Federal authority - Initiative	Description	Status
DFO MSP Program	Marine spatial plans are a framework to view the planning area through a holistic lens. These frameworks identify suitable and unsuitable areas for a range of marine activities. Some areas may require special protection measures. MSP participants work together on local, regional and national levels throughout the process. The more comprehensive the plan, the more benefits it can provide. For example, marine spatial planning frameworks can identify and address competing interests. Then, governments and industries can plan their activities equitable, efficiently and effectively. Regional marine spatial planning frameworks continue to evolve to reflect new information, ongoing engagement, and emerging priorities in the ocean environment. There are five MSP areas across Canada: Southern British Columbia, Pacific North Coast, NLS, Estuary and GSL, Scotian Shelf and Bay of Fundy (DFO, 2024l).	DFO leads MSP in partnership with other federal departments, the Government of Newfoundland and Labrador, Nunatsiavut Government, Innu Nation, NCC, MFN, and QFN. Key stakeholders include non-government organizations and industry groups, such as the fishing and oil and gas sectors. Several regional ocean management committees provide expertise, perspective, coordination and oversight. Coastal communities and other ocean users are being engaged in MSP to provide additional insight as the process unfolds. Engagement activities and sharing of data and information for the entire Newfoundland and Labrador Shelves planning area are ongoing to identify specific areas where MSP effort could be focused to help advance economic opportunities (DFO, 2023j).
DFO – Canada Marine Planning Atlas	Since MSP is about planning and management in marine spaces, decision-makers need a tool that helps them understand data and information in many dimensions. The Atlas is an interactive mapping tool that supports MSP and management by providing decision-makers with an overview of activities, and ecological processes and features, occurring in a given planning area. It will also serve as a place where all Canadians can go to find data on Canada's oceans and marine spaces.	The Atlantic Atlas includes data for the regions of Newfoundland and Labrador, the Maritimes, GSL, Quebec, and the Eastern Arctic. Development of the Atlas is ongoing and DFO continues to gather insights from partners and stakeholders into

Federal authority - Initiative	Description	Status
	While other marine atlases exist that cover Canadian marine data, this application distinguishes itself as an Atlas that adds value in several ways: • It was developed using an agile, user-focused design process, through extensive collaboration with partners and stakeholders, to cater to a range of user expertise. • The version 1 prototype provides an invitation for partners to evolve the final product, while making use of the current functionality. • The scope of the data is curated to focus on published data that meets a national level of data quality standards and enables decision makers to answer questions specific to MSP (DFO, 2023b)	how to evolve the fully functional prototype of the Atlas into an even better application that meets the needs of multiple partners and stakeholders (DFO, 2023b).
DFO National – Policy	Fish and Fish Habitat Protection Program (FFHPP) is developing a Position Statement for the Consideration of Cumulative Effects on Fish and Fish Habitat in Support of Decision-Making Under the *Fisheries Act* (1985). It will provide an overview on how FFHPP considers cumulative effects on fish and fish habitat prior to deciding to issue or refuse an authorization related to the death of fish and harmful alteration, disruption or destruction of fish habitat (DFO, 2024m).	DFO is finalizing the Position Statement to be published in the coming year (DFO, 2024m).
DFO Maritimes Region – Cumulative Human Impact Mapping	Calculating spatially explicit relative measure of cumulative impacts of 45 human activities in five sectors (land-based, coastal, marine, commercial fishing, climate change) on 21 habitats (benthic and pelagic from intertidal to deep sea) in the Scotian Shelf/Bay of Fundy Region. The assessment uses the Halpern cumulative impact mapping methodology (DFO, 2024l).	Does not include impacts from offshore wind development. Completion date of Fall 2025 (DFO, 2024m).
DFO Maritimes Region – Marxan with Zones Spatial Analysis	A decision-support tool developed by DFO Marine Planning and Conservation to find areas within the Nova Scotia Regional Assessment Study Area that meet the Government of Nova Scotia's 5 GW target for offshore wind development while minimizing spatial overlap with human uses and ecological features. DFO used Marxan with Zones decision-support software to achieve specific economic, social, and ecological targets based on a multi-sector analysis (e.g., commercial fishing, transportation, conservation, oil and gas, and aquaculture). The project includes 100+ individual data layers. Results could be compared to existing cumulative effects maps to examine cumulative impacts in the areas identified as potentially suitable for future development (DFO, 2024m).	DFO provided results to Nova Scotia Regional Assessment Committee in February 2024. DFO will publish results in a DFO Technical Report of Fisheries and Aquatic Sciences in 2024 (DFO, 2024m).

Federal authority - Initiative	Description	Status
DFO NL Region – Cumulative Impact Analysis	Due to the limited coverage and availability of habitat layers for the Newfoundland and Labrador region, the decision was made to take a species-based approach (i.e., Maxwell et al. 2013). This approach attempts to quantify the impacts of anthropogenic stressors on individual taxonomic or functional groups. Limited the scope of the work to look at the impacts of three anthropogenic activities (commercial fishing using fixed and mobile gear, substrate disturbance from oil and gas wells, and shipping of large commercial vessels) on eight fish functional groups (small benthivores, medium benthivores, large benthivores, planktivores, piscivores, plank-piscivores, shrimp, and snow crab) (DFO, 2024m).	DFO has no immediate plans to continue this work due to change in government priorities. DFO NL has identified the following for future exploration if this work becomes a priority again: • Refine resolution of analysis from functional groups to the species level. This is important when considering species distributions as well as their individual vulnerability to drivers of change. • Improve spatial coverage to include near-shore areas. • Look at impacts across different time periods versus aggregating data over multiple decades. • Incorporate climate change into analyses to inform proactive planning (DFO, 2024m).
ECCC-STB and ECCC-CWS-ATL (with BRI) - Conceptual Framework for assessing cumulative effects of offshore wind	To support decision-making during the initial offshore wind planning phase (i.e., site selection within regional boundaries), ECCC and BRI have developed guidance on a population- or species-centric approach for assessing the cumulative effects of offshore wind energy developments and other pressures on aerofauna (Ferguson et al., 2024). The framework distills the complex process of conducting a cumulative effects assessment into a coherent, detailed, and comprehensive framework. It not only synthesizes the fundamental steps but also provides a practical roadmap that	The framework has benefited from review by seven external subject matter experts. It was provided to the Regional Assessment Committee in September 2024. A manuscript describing the framework and analytical strategy is

Federal authority - Initiative	Description	Status
activities and other pressures on aerofauna	can be understood by practitioners, managers, and stakeholders, making it accessible and applicable across diverse contexts and regions. The approach and analytical strategy are applicable to various receptors, and adapts to available information on ecology, socioeconomics, and pressures. This framework creates a unified hierarchy of cumulative exposure and effects metrics that expand the range of species and pressures that can be explicitly evaluated in each cumulative affects assessment. The framework is a synthesis of best practices that has been informed by a comprehensive review of cumulative effects assessment approaches in regions with advanced offshore wind industries (ECCC, 2024b).	under peer review at a scientific journal. A preprint has been made publicly available (Ferguson et al., 2024).
ECCC-STB and ECCC-CWS-ATL (with BRI)- Regional cumulative effects case studies	To demonstrate the flexibility of the conceptual framework for assessing cumulative effects of offshore wind energy activities and other pressures on aerofauna, ECCC and BRI plan to apply it to case studies. These case studies are conducted in a research context and are not intended for immediate management decision-making, though the findings may inform future approaches	This work is underway and funded until March 31, 2027 (ECCC, 2024b). When completed, the case studies will be submitted to scientific journals for peer-review and publication.
ECCC-STB and ECCC-CWS-ATL (with BRI) - Mitigation: Available evidence and data gaps	ECCC and BRI have conducted an extensive review of the scientific and gray literature to identify approaches for mitigating (e.g., avoiding, minimizing, restoring, or offsetting) the effects of offshore wind energy development on birds and bats and to assess the evidence of the efficacy of these mitigations (ECCC, 2024b). There is limited evidence of effectiveness for most approaches, suggesting 1) a need for dedicated testing of commonly suggested and implemented mitigation measures such as curtailment for birds, and 2) that avoidance of effects via careful siting of offshore wind activity remains the best available option for mitigation. To fully mitigate the effects of offshore wind development on aerofauna, compensation and offset strategies should also be further explored (Gulka et al. 2024).	A manuscript describing this research has been submitted for publication in a peer-reviewed journal, posted as a preprint (Gulka et al., 2024).
NRCan-Office of the Chief Scientist – Open	NRCan developed OSDP to integrate fragmented data and science products dispersed across government systems to support better understanding cumulative and uphold public trust. The OSDP provides access to 170,000+ records from	NRCan is continually updating the OSDP with information.

Federal authority - Initiative	Description	Status
Science and Data Platform (OSDP)	sources from all levels of government sources. It includes datasets and scientific publications relevant to cumulative effects and to the Regional Assessment, and can be enhanced over time (NRCan, 2024c).	The Regional Assessment Study Area, Focus Area, and Preliminary Offshore Wind Licencing Areas (from Interim Report, March 2024) are available on the OSDP. The Initial Offshore Wind Energy Licensing Areas for Consideration from this Report will also be added to OSDP.
NRCan – Offshore Wind Predevelopment Program (OWDP)	The OWDP is designed to provide new investments in government-led marine data collection efforts to help capitalize on Canada's offshore wind energy potential, particularly off the coasts of Nova Scotia and Newfoundland and Labrador. It consists of: 1) Regional Marine Data Collection Campaign which aims to establish the necessary baseline data and fill data gaps to set the enabling conditions for responsible and efficient offshore wind development; 2) Offshore Wind Integration and Transmission Study, to inform decision-making and identify necessary investments in the bulk electricity system to enable the reliable and efficient integration of offshore wind-generated electricity in Atlantic Canada and include considerations related to the use of offshore wind energy production for the production of hydrogen in Atlantic Canada (NRCan, 2024c).	OWDP received funding through Budget 2023 and will be funded until March 31st, 2028. Regional Marine Data Collection Campaign is expected to begin next calendar year off the coasts of Nova Scotia and Newfoundland and Labrador and run until March 31st, 2028. Offshore Wind Integration and Transmission Study to be completed by March 2026.
TC - Cumulative Effects of Marine Shipping (CEMS)	Launched in 2017, TC seeks to improve the understanding of the cumulative effects of marine vessel related activities in seven assessment areas across Canada, including the Placentia Bay area of Newfoundland and Labrador. The results of the cumulative effects assessments will subsequently be used by TC and interested collaborators to develop recommendations, such as mitigation tools and strategies, that could be applied to current vessel movements and future projects with associated marine vessel activity to decrease the possible impacts of marine vessel activities in the assessment areas. The assessments also support the design of a common national framework for assessing the cumulative effects of marine vessel related activities (TC, 2024).	Does not include offshore wind industry. TC's Draft National Framework for Assessing the Cumulative Effects of Marine Shipping was published in spring 2022. Consultant delivered final report on Placentia Bay to TC December 2023. The assessment used the Halpern cumulative impact mapping methodology.

Federal authority - Initiative	Description	Status
DFO and Parks Canada – Protected Areas	Protected areas can provide mitigation for cumulative effects and demonstrate taking action to reduce cumulative effects beyond monitoring and assessing (Government of Canada, 2023). The various existing and proposed protected areas within the Focus Area are described in Sections 6 and 7 of this Report.	Ongoing Government of Canada effort.

Table Description: This table describes existing and planned federal government initiatives and their respective status.

A key takeaway for the Committee regarding federal authority cumulative effects initiatives is that there is no one, right way to assess cumulative effects. While this posed a challenge in the context of this Regional Assessment, the diversity of methodologies is an asset in the practice of cumulative effects assessment. Although there is currently no formal guidance from the IAAC on assessing cumulative effects under Regional Assessments, there are several relevant documents that can provide guidance and examples to support the assessment of cumulative effects at a regional scale (Curren et al. 2022, Griffiths et al. 2020, Judd et al. 2015, Murray et al. 2014, 2020). The diversity of approaches reflects the diversity of management objectives that may underpin any given CEA. For example, a sector-based CEA will address different management objectives than a species-based CEA (Murray et al., 2020). Where a species-based approach is desirable, Ferguson et al., (2024) have distilled the complex process of conducting a CEA into a coherent, detailed, and comprehensive framework that accommodates different types of information about species and pressures. Supported by a comprehensive review of CEA approaches in regions with advanced offshore wind industries, this document synthesizes the fundamental steps for implementing a CEA, providing a practical roadmap."

8.4 Engagement Outcomes

Throughout the Regional Assessment, participants shared three key areas of concern applicable to the consideration and analysis of cumulative effects: uncertainty regarding extent of offshore wind development; the implications of the Committee's Focus Area approach; and cumulative effects of offshore and onshore wind development. Some participants also provided feedback specifically on cumulative effects of offshore wind development on select components.

8.4.1 Uncertainty Regarding Extent of Development

There is no indication of the extent of possible offshore wind development in the province, either through publicly announced projects or a provincial policy statement on targets (i.e., a goal to develop a certain amount of GW within a specified timeframe). Some participants expressed concern regarding the possible pace and number of offshore wind projects that could be developed in the Offshore Area and spoke to the difficulties in providing meaningful feedback on any topic relevant to this Regional Assessment without having a better sense of how many projects may occur, where, and when. Participants understand that generally, several projects in proximity with overlapping construction phases have more of an impact than few projects dispersed over space and time.

8.4.2 Implications of the Focus Area Approach

The Committee's process for identifying the Focus Area is described in Section 5 of this Report. In providing feedback on the proposed Focus Area, some participants shared concerns that this approach diminished what the Regional Assessment is intended to address, including limiting the scope of consideration and analysis of cumulative effects. Some participants suggested that if a thorough analysis of cumulative effects cannot be completed during the Committee's mandate, then the Committee should recommend another mechanism through which a cumulative effects analysis could be done.

8.4.3 Cumulative Effects of Offshore and Onshore Wind Development

Some participants residing on the Port au Port Peninsula on the west coast of the Island of Newfoundland (the Peninsula) have shared concerns regarding cumulative effects of offshore and onshore wind development in their area. Some of the Committee's identified initial offshore wind energy licencing areas are within this region of the Island, which is also the site of a proposed onshore wind development.

World Energy GH2 Limited Partnership has been released from further assessment under the Newfoundland and Labrador *Environmental Protection Ac*t (2002) for the Port au Port-Stephenville Wind Power and Hydrogen Generation Project (also known as Project Nujio'qonik). This is a one GW onshore wind project consisting of 164 turbines and transmission and supporting infrastructure occupying 108,000 hectare (ha) on the peninsula. The project will power a 0.5 GW hydrogen/ammonia production facility in the Port of Stephenville.

Residents of the area have shared the following cumulative effects concerns with the Committee:

- The consideration of cumulative effects of offshore wind development must include Project Nujio'qonik.
- The cumulative effect of onshore and offshore wind development could be highly problematic for migratory birds and bats and pose extreme risks and stresses for migratory species.
- Residents of the area will be surrounded by turbines, adversely affecting their health and well-being.
    - Some residents support Project Nujio'qonik, but not offshore wind development.
    - Some residents do not support Project Nujio'qonik or offshore wind development.
- If construction phases of onshore and offshore wind projects overlap, there will be a significant demand on local housing, infrastructure, and services.
    - There is concern supply will not meet demand and will adversely impact citizens in the area.
    - There is a particular need to apply a gender and diversity lens to this aspect to better understand the effects on diverse populations.

At the same time, some participants recognize the potential cumulative economic benefits to be gained should the area become a wind energy hub. As described in Section 7.13 of this Report, QDC is putting educational and business plans in place to ensure local Indigenous and non-Indigenous residents participate in and benefit from the wind development in the region.

Some participants in the area also see the economic benefits of the concentration of wind energy in the region, including creation of local jobs, attracting a younger population, and associated community growth. Some participants are also optimistic about growth opportunities for the Stephenville airport and the Port of Stephenville (see Section 7.13).

8.4.4Cumulative Effects on Specific Components

In addition to the broader cumulative effects concerns and perspectives describe above, some participants shared concerns regarding cumulative effects on a specific component (Table 8.4.1).

Table 8.4.1. Participant comments on cumulative effects of offshore wind development on specific components

Component	Participant comments
Indigenous Communities, Activities, Rights, and Interests	• Comments reflected throughout this table.
Aerofauna	• Some Indigenous participants on the Island of Newfoundland and in Quebec are concerned about the offshore wind industry having a cumulative effect on migratory birds, particularly regarding effects on migratory routes.
Marine Fish and Fish Habitat Marine Mammals and Sea Turtles	• Some Indigenous participants on the Island of Newfoundland, throughout the Maritimes, and in Quebec have expressed concern regarding the additional effect a new offshore wind industry may have on American Eel and Atlantic Salmon, particularly on migratory routes. • Some Indigenous participants in Quebec have also shared the same concern regarding whale migratory routes. • One participant noted that analysis should include cumulative effects of all stages of offshore wind development on spawning and nursing grounds. • Another participant asked for analysis to consider the cumulative effects of increased shipping and the impacts it can have on marine life (e.g., increased underwater noise, increased risk of marine pollution, increased possibility of vessel strikes).
Fisheries and Other Ocean Uses	• Some Indigenous and non-Indigenous fish harvesters have been clear throughout this process that offshore wind development will be another contributor to their displacement, and another source of effects on fish stocks, with negative consequences to their livelihoods, communities, and economy. • One participant suggested that governments consider the economic loss of commercial fishing revenue versus the economic gain for offshore wind development. • Some fishers have shared that while they are not against offshore wind development, they are concerned about the pace at which governments are proceeding with plans for this new industry without adequate time to engage, collect data, and develop plans for mitigation and compensation.

Health Communities and Economy	• One participant noted that the Committee should consider the cumulative effect of offshore wind development not only on the community as a whole, but also on the individuals who will be working in the industry.

Table Description: Table summarizes comments from participants on cumulative effects as they relate to specific components. Participant comments are grouped where they apply to more than one component.

8.5 Committee Approach

The Committee understands that regional assessments under the IAA can offer an opportunity to more effectively address cumulative effects compared to cumulative effects assessments at the project level. The Committee also appreciates that because of this, participants had high expectations for cumulative effects in this Regional Assessment.

Unfortunately, there are too many unknowns and too many data gaps with not enough time in the Committee's mandate to fill these gaps and be able to undertake a thorough, reliable cumulative effects analysis in this Regional Assessment. There are no projects or development goals announced on which to base realistic scenarios. As already identified throughout this Report, the numerous information and data gaps identified must be addressed to better understand the effects of offshore wind development on each component, including cumulative effects, and the effectiveness of mitigation measures. While there are several federal initiatives that have made, and will make, valuable contributions to understanding, assessing, and managing cumulative effects in the region, some do not address offshore wind development, some use differing methods to account for data deficiencies, and those most relevant to offshore wind development in Newfoundland and Labrador will not be completed during the Committee's mandate. The Committee understands the challenges these teams face, recognizes the importance of this work, and hopes the recommendations in this Report result in continued support for these and other initiatives.

The Committee has, however, considered cumulative effects by:

- Identifying measures that can reduce or enhance contribution of offshore wind development to adverse and positive cumulative effects in the region (as provided on a component-by-component basis in Section 7 of this Report).
- Highlighting locations where current and potential accumulation of activities and/or effects may be of concern (as described in Section 6 of this Report).
- Recommending potential approaches and measures to address cumulative effects of offshore wind activities at a regional / non-project-specific scale (see below).
- Recommending ways to address information and data gaps to support further understanding and assessment of cumulative effects of offshore wind development activities in the region (see below).

8.5.1 Mitigating Cumulative Effects Through Licencing Area Selection

One of the objectives of this Regional Assessment is to provide information and analysis to inform future planning and licencing for offshore wind development. In fulfilling that objective, the Committee conducted a constraints analysis to identify initial offshore wind energy licencing areas for consideration. The constraints are distinct areas where offshore wind licences should not be considered at this time because of potential impacts to environmental, health, social, and economic components. As such, these are locations where current and potential accumulation of activities and/or effects may be of concern. The Committee's identification of these areas is limited by the data that were available at the time the constraints analysis was performed. The Committee's constraints analysis is

a starting point for considering cumulative effects at a regional scale in the context of offshore wind development.

The initial licencing areas avoid marine critical habitat, MPAs, marine traffic routes, a proposed NMCA, significant viewscapes from a National Park and WHS, high-density fishing areas and other near-shore ocean uses. By applying a coastal buffer, the Committee sought to avoid or minimize impacts to IBAs, KBAs, marine refuges, fisheries closures, coastal fisheries (including lobster fisheries), aquaculture sites and licences, airports and marine aerodromes, provincially protected areas, and community and cottage viewscapes. As described in Section 7 of this Report, these constraints link to the various environmental, health, social, and economic components.

8.5.2 Approaches for Addressing Cumulative Effects at a Regional Scale

The Committee acknowledges that cumulative effects assessment at the project level will be a means to identify measures that further minimize effects, as well as provide offsetting and compensation measures. Project level assessments will also be critical in helping to address the various knowledge and data gaps identified throughout this Report. However, relying on only project level cumulative effects analysis is ineffective in understanding and mitigating cumulative effects on a regional scale. There needs to be proactive consideration of avoidance and minimization of cumulative effects through early planning processes. This is what the Committee has attempted to do with their approach to identifying the initial licencing areas.

As described in Section 5 of this Report, other jurisdictions with offshore wind industries employ MSP which can provide an even earlier mechanism to starting to address cumulative effects at a regional scale. MSP is a multi-sectoral, participatory planning process that strives to balance environmental and economic goals, and proactively address spatial and temporal conflicts between various marine users. Areas are allocated for offshore wind development, and licensing areas are subsequently identified therein. Locally, DFO is working with other federal agencies, provincial and Indigenous governments, and engaging with stakeholders on MSP for the NLS MSP Area (as described in Table 6.1).

Within the context of offshore wind development in the Offshore Area, regional and strategic assessments offer yet another mechanism. In addition to providing regional assessments, the IAA (s. 95(1)) also provides for strategic assessments of

- any Government of Canada policy, plan or program — proposed or existing — that is relevant to conducting impact assessments; or
- any issue that is relevant to conducting impact assessments of designated projects or of a class of designated projects.

Bill C-49 (138.017-.018) proposes the CNLOER:

- may conduct a regional assessment of the effects of any existing or future work or activity
- may conduct a strategic assessment of any proposed or existing policy, plan, or program respecting the offshore or of any issue that is relevant to any existing or future work or activity

Strategic assessments allow for consideration of a proposed plan and governments are currently identifying licencing areas. Conducting a strategic assessment of areas to be issued for bids will offer an early opportunity to address cumulative effects at a regional scale.

8.5.3 Importance of Regional Cumulative Effects Assessment in Offshore Wind Development

While the Committee could not undertake cumulative effects assessment within this Regional Assessment, it is critical that a regional scale cumulative effects assessment occur on offshore wind development in Newfoundland and Labrador.

Without assessing the cumulative effects of offshore wind projects alongside existing human activities and natural processes, there is a risk of overlooking potential adverse outcomes on marine habitats and wildlife. This lack of foresight could result in complications during the development phase, necessitating further assessments and modifications to projects that could have been proactively addressed.

Conversely, implementing a comprehensive cumulative effects assessment at the regional scale can enhance decision-making by providing a clearer understanding of how offshore wind projects interact with existing ecological and socioeconomic conditions, including onshore wind projects. By identifying potential cumulative impacts early on, stakeholders can better inform site selection within the initial licensing areas, ensuring that developments are strategically planned to minimize cumulative effects on valued components through avoidance. Furthermore, a thorough assessment can promote collaborative approaches among various stakeholders, facilitating informed discussions about resource management and enabling the development of more effective mitigation strategies.

8.6 Committee Conclusions and Recommendations

The Committee makes the following recommendations in support of planning, licencing, and impact assessment processes that collectively improve cumulative effects knowledge and management. Some are repeated from elsewhere in this Report, as they are applicable to cumulative effects. Additionally, the Committee's use of the support throughout these recommendations refers to dedicated, multi-year budgets for each named department to secure necessary resources and expertise, and to provision of adequate time for research, analyses, and engagement.

- The Government of Canada continue to support ECCC in their offshore wind cumulative effects research and analysis on aerofauna in the Atlantic Region.

- The Government of Canada renew support for DFO NL Region's Cumulative Impact Analysis, and support additional studies to be comparative to what DFO Maritimes has been doing in support of offshore wind development.
- The Government of Canada continue to support DFO's MSP initiative for the NLS Planning Area.
    - The Government of Canada continue to support DFO's continued development and maintenance of the Atlas to assist in MSP.
- The Government of Canada continue to support NRCan's continued development and maintenance of the OSDP.
- The Government of Canada provide support for other federal authorities who hold expertise in the specific valued components that are most likely to be adversely affected by offshore wind development.
- The Government of Canada conduct a strategic assessment of offshore wind licencing areas (once those areas are determined) with the key objective of supporting a more thorough assessment of cumulative effects.
    - The strategic assessment should be designed in collaboration with federal authorities who hold expertise in cumulative effects assessment, and in the specific valued components (e.g., ECCC for aerofauna; DFO for marine fish and fish habitat, and commercial fisheries; TC for marine traffic) that are most likely to be adversely affected by offshore wind development.
    - At this early stage of the industry, there may not be enough information to scope all issues effectively. The approach will have to be iterative.
    - The strategic assessment design and conduct should include engagement with Indigenous peoples, fish harvesters, residents of coastal communities with port infrastructure suitable for offshore wind development, and other segments of the population that are most likely to be adversely affected by offshore wind development.
    - The strategic assessment design and conduct should also be inclusive of experts in socio-economic benefits side to ensure there is also understanding and consideration of cumulative benefits
- The CNLOER require EA of any project that does not fall under the IAA.
- The federal Minister of Environment and Climate Change does not exclude proposed offshore wind projects within the Study Area from future project-level impact assessments, including at sites within the identified initial offshore wind energy licencing areas.
- The provincial Minister of Environment and Climate Change require all offshore wind projects within the Study Area to undergo provincial environmental assessment (should portions of the Offshore Area become exclusively provincial jurisdiction)
- The IAAC and CNLOER develop specific guidelines that define parameters for Project Design Envelopes, that consider the implications of a "worst case scenario" in cumulative effects assessments.
- The CNLOER establish a collaborative data-sharing platform that ensure continuous access to the best available information on baselines, existing conditions, and the effectiveness of mitigation measures. Sharing information in this manner will help address data gaps and will facilitate contributions from offshore wind energy proponents, relevant stakeholders, and Indigenous communities to allow for more effective cumulative effects management.

9. Accidental Effects and Effects of the Environment on Offshore Wind Development

The following section examines both the environmental effects caused by accidents associated with offshore wind project development and the effects of the environment on these developments. By exploring these effects, including but not limited to, structural integrity challenges, safety hazards, operational issues and broader implications, a comprehensive understanding of the complex interplay between offshore wind projects and the surrounding environment is provided.

9.1 Physical Environment

The physical environment plays a crucial role in the planning, assessment and execution of offshore wind development activities. Understanding and carefully considering environmental factors such as wind patterns, wave behaviour, ice presence, precipitation and other variables are essential for the design, construction, installation, operation, maintenance, and decommissioning of these projects effectively. Understanding and respecting these parameters are also crucial to safeguarding human health, protecting the environment, and ensuring the integrity of equipment and infrastructure. This involves minimizing the risk of incidents and accidents resulting from unforeseen interactions between offshore operations and the marine environment.

9.1.1 Wind

The basic prerequisite for the establishment of a wind farm in any area is the supply of a steady and strong wind source. The typical wind speed threshold used to determine technical viability, based on current technology, is an annual average of at least 7 m/s (25.2 km/hour or 15.7 miles/hour) at a height of 100 m asl (Musial et al., 2016). While 7 m/s is considered a minimum, many of the operating projects in Europe are in areas with average wind speed of 8 m/s (28.8 km/hour or 17.9 miles/hour) to 9 m/s (32.4 km/hour or 20.1 miles/hour) (Energy Sector Management Assistance Program, 2019). Throughout the Focus Area, an average annual wind speed can be seen exceeding the 7 m/s mark at a height of 100 m (ECCC, 2023j). Figure 9.1 below shows the high wind speeds found throughout the Focus Area.

Figure 9.1. Average Annual Wind Speed at 100m in the Atlantic Shelf

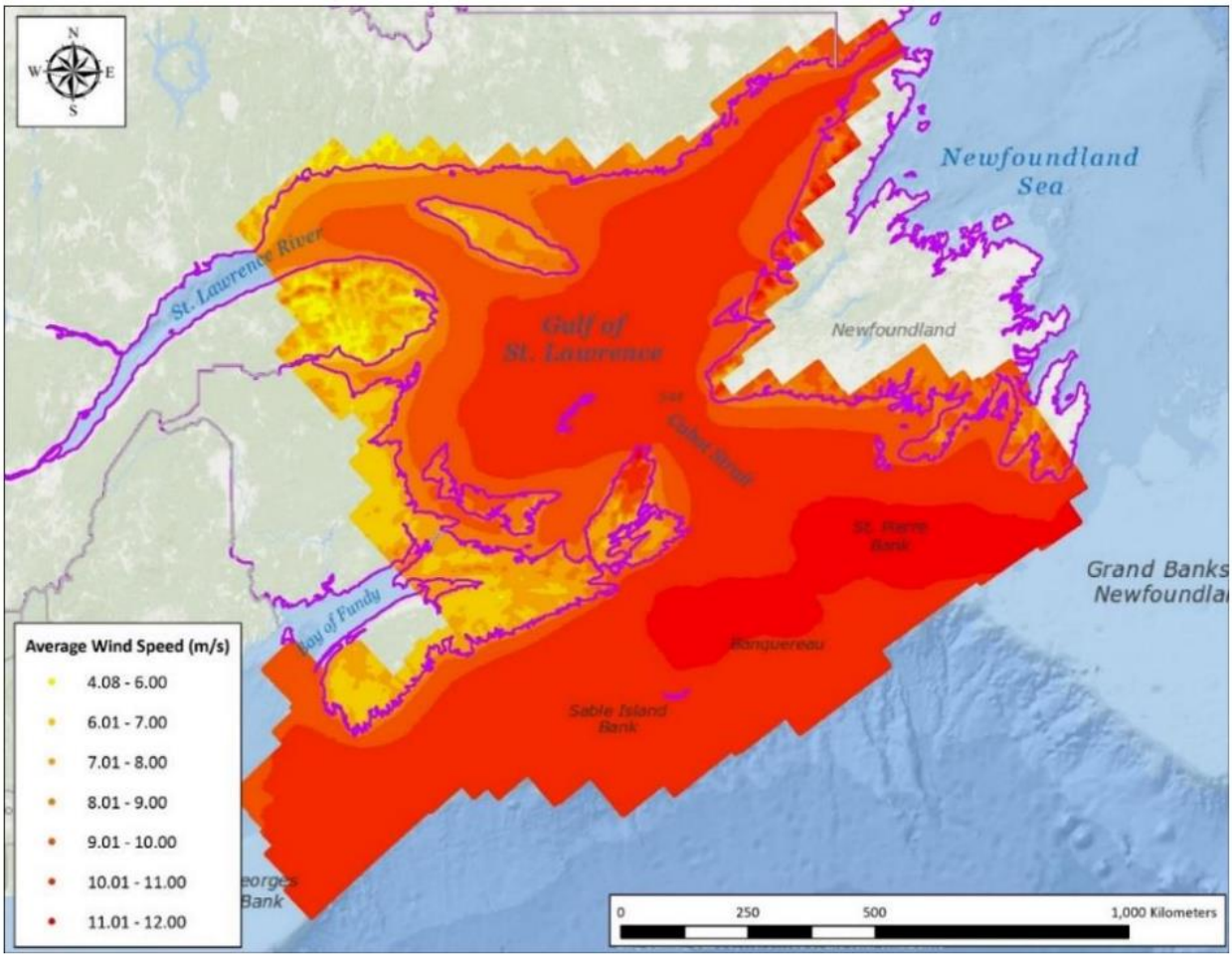


Figure Description: Map depicting average annual wind speed at 100m on the Atlantic Shelf, from modelled data from 2008 (ECCC).
Source: Adopted from Tang & Kilpatrick, 2021.

Turbine blade rotation will start at cut-in wind speeds of approximately 3.7 m/s (13.3 km/hour or 8.3 miles/hour) and will stop at cut-out wind speeds of approximately 25.6 m/s (92.2 km/hour or 57.3 miles/hour). As the wind speed increases to 14.4 m/s (51.8 km/hour or 32.2 miles/hour), electricity generation also increases until it reaches its maximum or rated power. These speeds can vary with the type of turbine. At the rated wind speed and higher (up to its cut-out speed), the turbine produces at its rated power, as seen in Figure 9.1 (Office of Energy Efficiency & Renewable Energy, 2017). When the turbines experience Category 2 hurricanes (or high winds in excess of 45 m/s (162 km/hour or 100.7 miles/hour), it has been shown in a study that 6% of turbines towers in a wind farm will buckle. As the winds and hurricane Categories increase, the percentage of turbine buckling increases exponentially (Rose et al., 2012). These high winds can also lead to damage to the blades, due to bending or breaking. This damage to the turbine's structure or blades can lead to a complete shutdown (Santie Oil Company, 2023).

Figure 9.1. Power Output of Turbines against Steady Wind Speeds

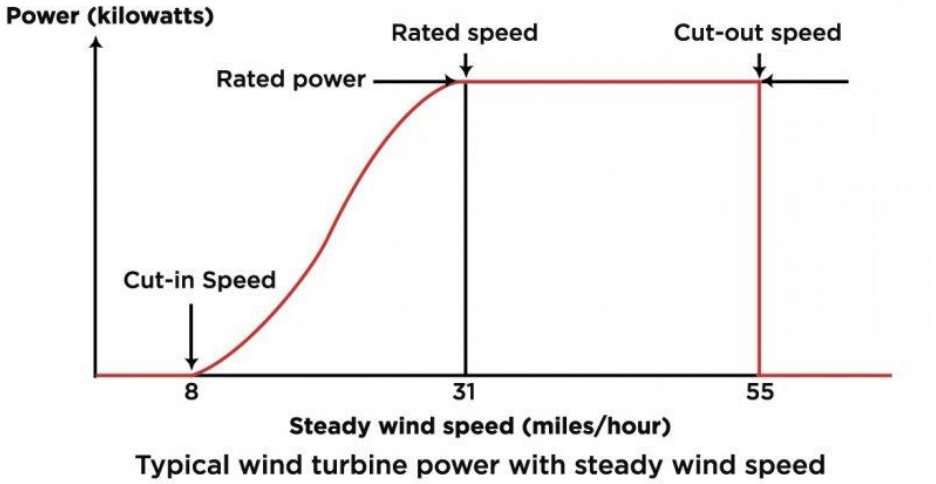


Figure Description: Graph depicting power of a turbine with steady wind speeds, showing the typical cut-in and cut-out speeds (Office of Energy Efficiency & Renewable Energy, 2017). The following speeds are metric conversions from miles/hour in the graphic to aid in understanding:
Cut-in speed at 8 miles/hour = 12.87 km/hour or 3.58 m/s
Rated speed at 31 miles/hour = 49.89 km/hour or 13.86 m/s
Cut-out speed at 55 miles/hour = 88.51 km/hour or 24.59 m/s
Source: Adopted from Office of Energy Efficiency & Renewable Energy, 2017.

Offshore wind turbines face intensified challenges from storms, including strong winds and powerful waves. Due to its colder waters, Atlantic Canada yields a higher potential for extractable wind resources (Eamer et al., 2021), but these colder water temperatures will typically weaken most tropical cyclones or hurricanes passing through, unless these storms move quickly through the region or if they interact with other weather systems (ECCC, 2023). Between 1985 - 2022, the Focus Area experienced 34 severe tropical or post tropical storms (ranging from less than hurricane force to Category 2 hurricanes), where some caused severe damage to the Island of Newfoundland's coastal areas, and all had winds in excess of 25.6 m/s (cut-out speed).

Figure 9.2. Severe Storm Tracks through the Focus Area

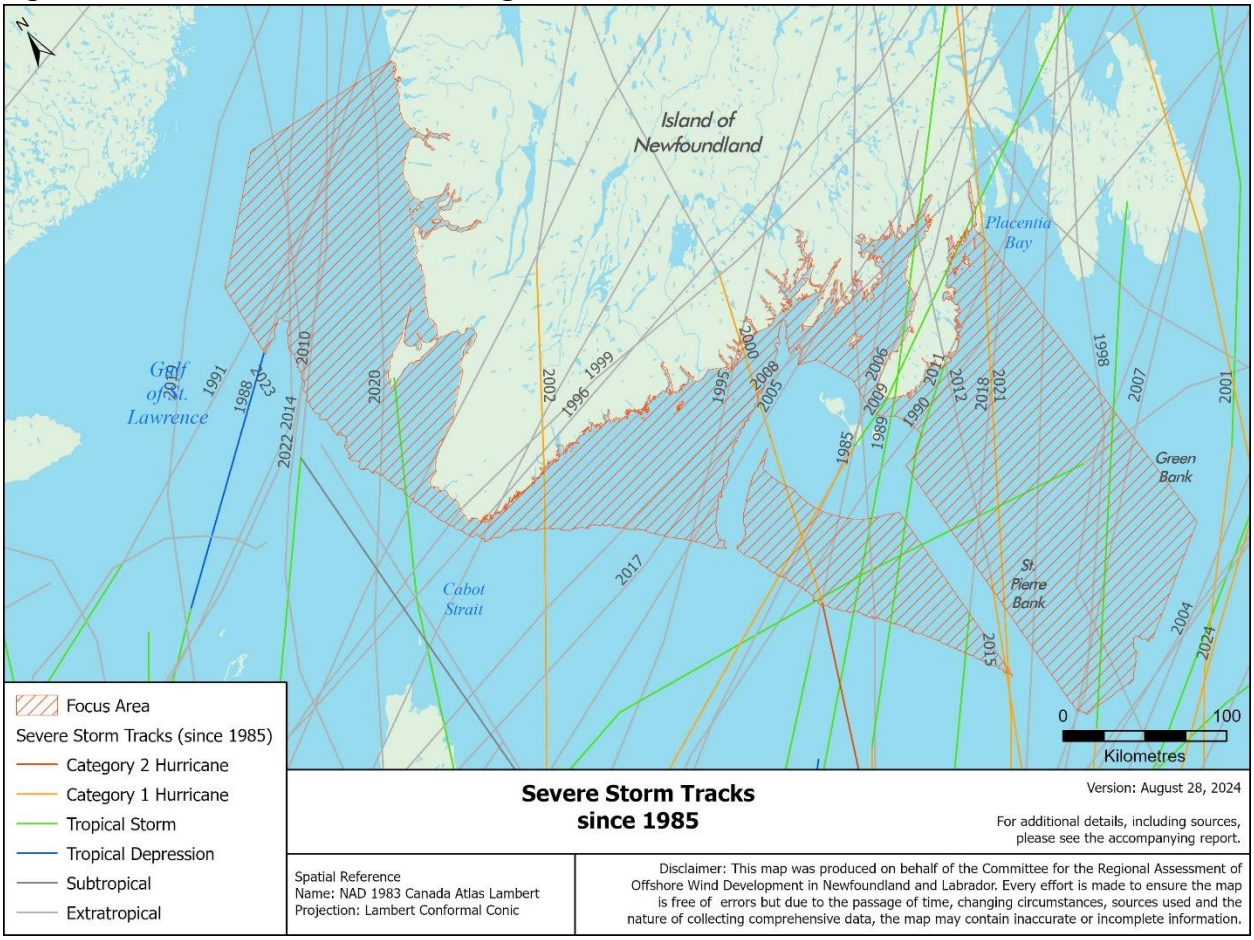


Figure Description: Map depicting severe storm tracks since 1985 that have passed through the Focus Area.
Source: National Centers for Environmental Information, n.d..

9.1.2Waves

As storms intensify, the wave action in the surrounding waters will increase. In situations of a Category 1 hurricane, or a strong tropical storm with winds of 100 km/hour or stronger, “resonant waves”, which are waves that follow the track of a storm and build in intensity alongside the storm, can be generated. The waves can be as high as 30 m in offshore waters, and once they reach the coastline, they can be very destructive to infrastructure (ECCC, 2023i). As waves increase in height and intensity, the breaking waves on the turbines may cause potential significant dynamic implications on the structural response of these structures; hence, increasing the probability of fatigue failure (Chella et al., 2012). Access to the wind farms for maintenance activities is also impacted by waves as wave heights in excess of 2 m can become difficult depending on the type of vessel used.

9.1.3Icebergs, Sea Ice, and Atmospheric Icing

Within the colder waters that surround Newfoundland and Labrador, icebergs, sea ice and atmospheric icing (including freezing spray) are to be considered when developing offshore

wind projects. Sea ice (including icebergs) collisions with offshore structures can cause significant damage, varying from ice-induced vibration that can lead to structural fatigue, all the way to complete structure collapse (Ramadhani et al., 2022). The severity of impact is proportional to the duration and force exchanged between the ice and turbine tower and is also dependent on the kinetic energy and other features of the ice. Wind farms where the ambient temperature is below 0°C and within a generally humid environment will also experience icing to the turbine structure. This can cause additional loading, impacting overall safety around the structure, as it can cause ice throw and balance issues with the turbine, impacting the cost-effectiveness of the system. Overall, different variations of ice can cause a variety of issues to turbines, including (Battisti et al., 2006):

- Prone to error or non-functioning measurement devices (during wind evaluation and turbine operations phases).
- Decline in overall performance of the turbine.
- Elevated noise levels.
- Heightened fatigue on turbine structures.
- Downtime is caused by excessive vibrations.
- Risk of ice-throw (impeding safety of maintenance crews and nearby structures).
- Site accessibility challenges (sometimes due to weather windows).
- Potential for more convoluted building permit granting processes.

9.1.4Visibility

In discussions with offshore wind developers with international experience during the advisory group consultations, developers shared that they are not aware of situations when minimal visibility was an issue, specifically during maintenance operations. While visibility may impede transportation safety out to offshore wind sites, it was noted that is not a concern when it comes to executing maintenance operations. Developers also stated that lack of visibility (i.e., fog) is not a deterrent when selecting offshore wind sites.

9.1.5Tidal Range

The efficiency of operation of offshore wind farms can be affected by tidal ranges. The wind shear increases with the height of the blades above sea level and the rise and fall of the sea surface due to the tide moves an offshore wind turbine hub through the wind shear profile. One study (Watson et al., 2003) was conducted offshore near Skegness in the eastern U.K. where the maximum tidal range is 7 m. The study showed a maximum effect on the wind shear of less than 4% with a maximum tidal range of 7 m and concluded that the effect of tidal height on wind power resource assessment is likely to be small at such tidal ranges. Within the Focus Area, the tidal ranges predicted for 2024 are in Table 9.1:

Table 9.1. 2024 Tidal Ranges Predicted within the Focus Area

Port	Tidal Range (m)	
	Mean Tide	Large Tide
Bay of Islands		
Corner Brook	1.3	2.0
Lark Harbour	1.3	2.1
Port au Port Bay		
Fox Island	1.3	2.1
St. George's Bay		
Port Harmon	1.0	1.6
St. George's	1.0	1.5
South Coast		
Grand Bay	1.1	1.6
Isle aux Morts	1.1	1.6
Connoire Bay	1.2	1.7
Rencontre West	1.3	1.8
Pushthrough	1.3	1.9
St. Alban's	1.4	2.1
Hermitage	1.4	2.0
Harbour Breton	1.4	2.1
Terrenceville	1.5	2.1
Grand Bank	1.5	2.0
Placentia Bay		
Burin	1.5	2.3
South East Bight	1.3	2.1

Table Description: Table depicting 2024 predicted tidal ranges for listed secondary ports that are within the Focus Area.
Source: DFO 2024d; e.

9.1.6Seismic Activity

If an earthquake occurs within the radius of an offshore wind farm, there are multiple hazards that can arise. Large fault movements occur during an earthquake, which can cause submarine landslides and tsunamis, resulting in extreme wave loads, leading to structural fatigue and decrease durability of the turbine structure. Extreme events of ground shaking and liquefaction (when soil temporarily loses its strength and stiffness during an earthquake) can also occur. These events can result in structural damage to the turbines or to the submarine cables. These situations can affect turbine types differently, which can be seen in Table 9.2 below.

Table 9.2. Effects of Seismic Activity to Turbine Types

Turbine Type	Seismic Effects
Monopile	• Increase of forces on the foundation • Movement of layered soils in which the turbine is installed • Weakening in lateral load/moment carrying capacity due to seabed movements
Jacket foundation	• Buckling of braces • Rigid structure can lead to high Rotor Nacelle Assembly (RNA) acceleration • Smaller diameter piles are prone to buckling
Caissons	Overturning due to tsunami wave action.
Floating	Less affected by seismic activity, but if a surface fault rupture occurs, it can cause high tensile forces on the cables.

Table Description: Table describing potential effects on turbine types caused by seismic activity.
Source: Bhattacharya et al., 2021.

Within the Focus Area, the St. Pierre Bank region has a moderate to high seismic risk, as seen below in Figure 9.3.

Figure 9.3. Canada Seismic Hazard Map

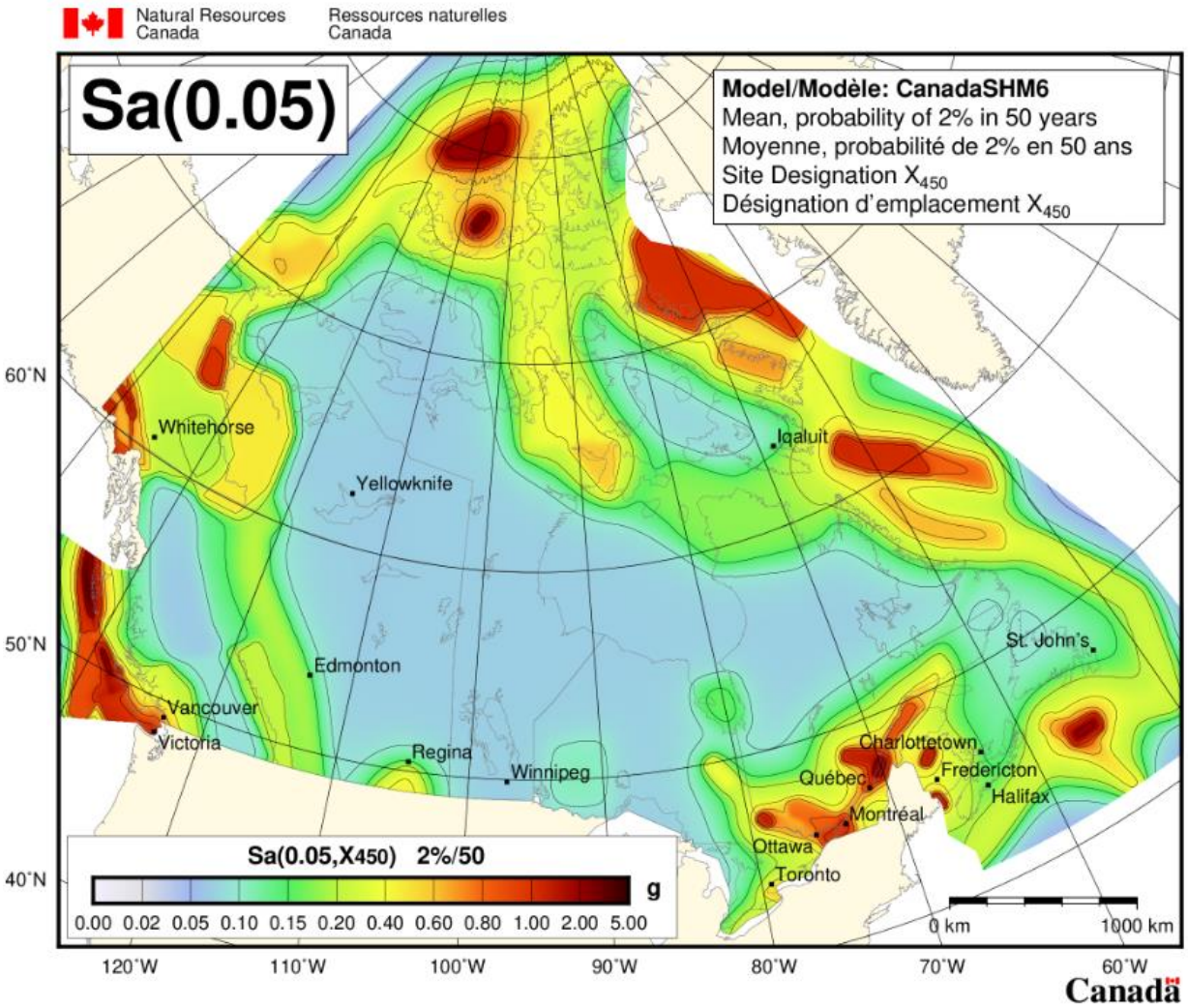


Figure Description: Seismic hazard map of Canada (2020) that shows the level of seismic hazard. This is specifically a spectral acceleration map for a period of 0.05 seconds for Canada (mean values of 5% damped spectral acceleration for Site Designation X_{450} and a probability of 2%/50 years. Spectral acceleration is contoured in g (9.81 m/s^2).
Source: Adopted from NRCan, 2021.

9.1.7 Seabed Scour

Scour is a phenomenon that occurs when an offshore structure causes a localized increase of current and wave motions, causing seabed particles to get stirred up and transported away from the structure. This movement creates a depression around the foundation of the structure. There are multiple types of scour that can occur around marine structures including local scour, global or dishpan scour and sand waves. Local scour results in steep-sided scour pits occurring around a single leg or pile. Global or dishpan scour results in the lowering of a large area around the entire structure. Sand waves are the result of large-scale morphological effects, spanning over several years, resulting in the overall movement of the seabed. The type of scour that occurs depends on

the type and complexity of turbine structure used (van der Tempel et al., 2004), with floating turbines not being as extensively studied and the types of scour understood as well as fixed turbines (Chambel et al., 2024). The table below outlines the types of scours expected for each type of fixed turbine.

Table 9.3. Scour Expected for Fixed Turbines

Turbine Type	Scour Expected
Monopile (fixed)	• Local • Sand waves
4-legged Jacket (fixed)	• Local • Global or dishpan • Sand waves

Table Description: Table outlining different types of scour that could occur with various fixed turbine structures.

Source: van der Tempel et al., 2004.

The scour that can occur around the infrastructure of the turbines affects the foundation length of the turbine, the natural frequency of the structure and the J-tube (used to support the power cable from the turbine to the seabed). Since the main transfer of loads on the turbine is through lateral loading, removal of the top part of the seabed surrounding the foundation pile due to scour can reduce the structural integrity of the foundation. Therefore, scour prevention or control is critical to ensuring adequate lateral bearing. Turbine structures must be dynamic in nature to withstand the impacts of waves, wind and turbine rotation. Scour occurrence would remove material from the base of the structure and the lengthened unsupported section of the pile would become more flexible. This increased flexibility would change the natural frequency of the turbine which would inherently enhance structural fatigue and shorten the lifespan of the turbine. Scour can also cause the J-tube to become free spanning over the scour hole, making it more prone to damage. Since the J-tube protects the power cable, a vital component of the turbine, all damage should be prevented at all costs (van der Tempel et al., 2004).

Within the Focus Area, the sediment mobility index (which helps quantify the seabed exposure to sediment mobilization) is fairly low, except in areas surrounding the St. Pierre Bank and a few smaller areas just to the west of the Burin Peninsula (Li et al., 2024), as seen in Figure 9.4 below. Areas with higher sediment mobility index may be more prone to scour.

Figure 9.4. Spatial Distribution of Sediment Mobility Index on the Canadian Atlantic Shelf

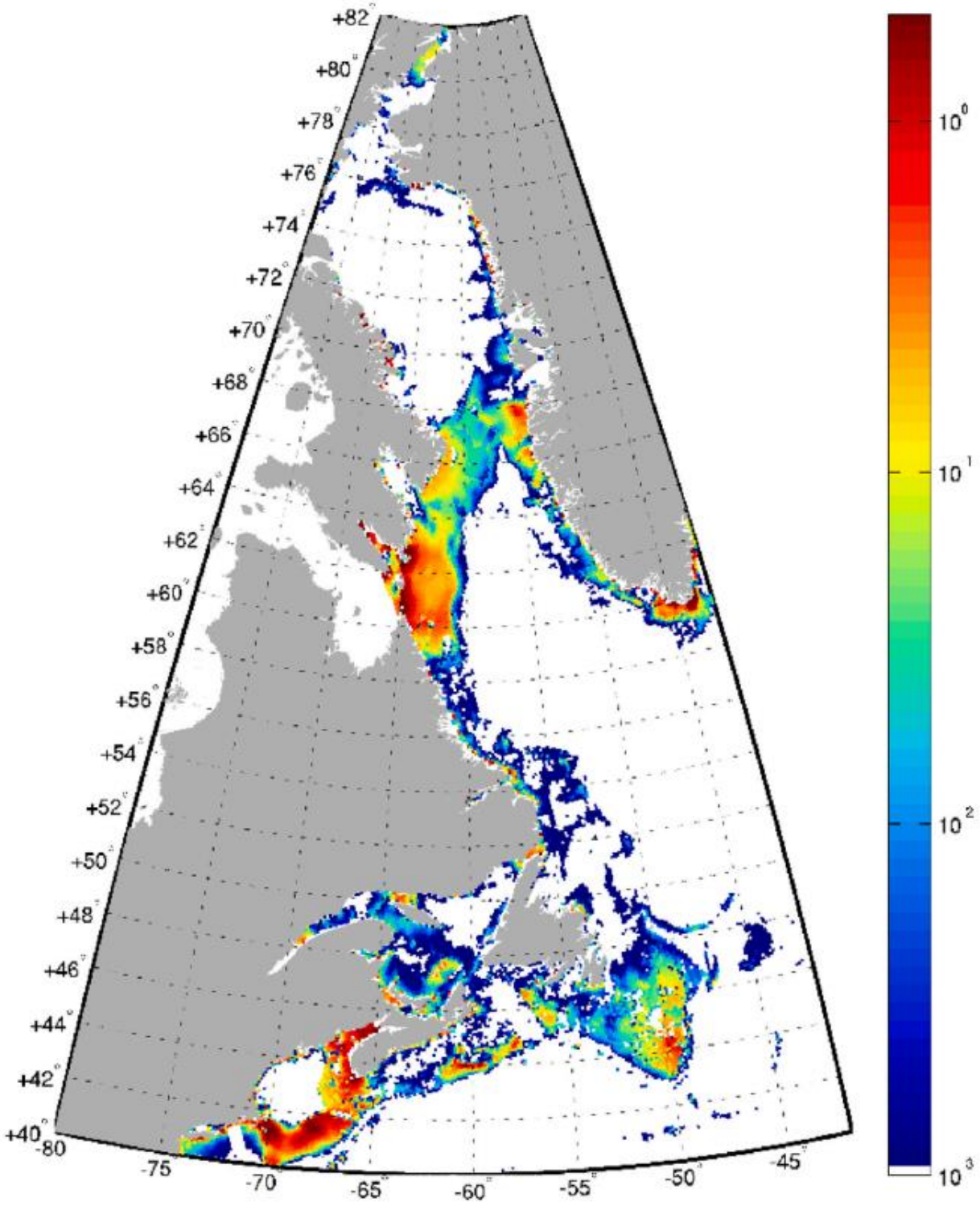


Figure Description: Map depicting the spatial distribution of sediment mobility index on the Canadian Atlantic Shelf. Red indicates high sediment mobility, and gradually goes to blue, indicating low sediment mobility.
Source: Adopted from Li et al., 2024.

9.1.8 Biofouling

Most offshore structures, such as turbines, are usually situated in softer seafloor environments, which provide a hard substrate habitat where they would not normally exist. These structures then act as artificial reefs for species that may not usually be found in the surrounding areas (Simons et al., 2016). Since both fixed structures and mooring lines on floating structures are attractive to biofouling species, anti-fouling techniques (such as coated steel) are usually recommended, due to the effects that bio-fouling causes to these structures. If anti-fouling coatings are not utilized, it could result in extensive inspection and maintenance to the structures, due to the creation of these micro-environments, causing corrosion and extra hydrodynamic and weight loading to the structures (Klijnstra et al., 2017).

9.2 Accidental Effects

The available information on accidental events associated with offshore wind development and the potential impacts are limited; however, other offshore industries provide examples of potential impacts in some cases (Arisian et al., 2017). Components affected by these accidental effects can be seen in Table 9.4 below.

Table 9.4. Relevant Components Affected by Accidental Effects

Accidental Effect	Component/Report Section												
	7.1 Indigenous Communities, Activities, Interests, and Rights	7.2 Air Quality and GHGs	7.3 Aerofauna	7.4 Marine Fish and Fish Habitat	7.5 Marine Mammals and Sea Turtles	7.6 Protected and Special Areas	7.7 Fisheries	7.8 Other Ocean Uses	7.9 Visual Aesthetics and Viewscapes	7.10 Acoustic Environment	7.11 Physical and Cultural Heritage	7.12 Human Health	7.13 Communities and Economy
Structural Failure/Loss of Turbines	●		●	●	●		●	●		●	●	●	●
Accidental Spills or Leaks	●		●	●	●	●	●	●			●	●	●
Fire/Mechanical Fire	●	●	●	●	●	●	●	●	●		●	●	●

Table Description: Table outlining components affected by specific accidental effects mentioned in Section 9.2 of this Report.

9.2.1 Structural Failure/Loss of Turbines

Structural failure or the loss of turbine or a blade is an infrequent event that affects the immediate area of the event (Mishnaevsky, 2022; Sun et al., 2023). The greatest risks of structural failure are the impact of debris on the surface of the ocean, sinking of debris, introduction of chemicals or contaminants to the ecosystem, or disruption to the artificial reef effect. The impacts of chemical and oil contamination are described below under Section 9.2.2 of this Report.

The likelihood of an animal or person being present at or near the surface at the time of an accidental structural failure and being hit by falling debris is unlikely due to the timing and small area in which they occur (Mishnaevsky, 2022; Sun et al., 2023).

The length and capacity of cables, as well as current strengths used for offshore wind farms increases with distance from shore to ensure efficient energy transport (CMACS, 2003; OSPAR Commission, 2012; U.K. BIS, 2008). When combined with the wear in power cables caused by biofouling and/or hydrodynamic forces in the water column, floating offshore wind turbines may be at greater risk for EMF emissions (Svendsen et al., 2022).

9.2.2 Accidental Spills, Leaks, and Other Debris

Due to damage or other events occurring to the turbines, there is the chance of accidental spills and leaks occurring. Events that can cause damage to turbines to the extent that accidental oil spills and leaks could occur include:

- Natural events.
  - Extreme weather events (hurricanes, tropical storms, blizzards, and other storms).
  - Extreme seismological events (earthquakes, tremors, or tsunamis).
  - Impacts with sea ice.
- Accidents involving transportation.
  - Vessel-turbine or vessel-vessel collisions
    - Vessels, airplanes or helicopters that accidentally collide, ram or ground upon structures (oil leaks can ensue from the turbine or the vehicle).
- Fires or explosions.
- Intentional damage.
  - Vandalism (breaking components, or damaging the controls or mechanics of the turbine).
  - Terrorist attacks or acts of war (either vehicles crashing into the structure, or bombs from airplanes or vessels).
- Unintentional damage caused during maintenance operations or repairs.

All these events could result in structural failures, mechanical or equipment failures or operations errors, which could lead into situations of oil or hydraulic fluid loss, leading to potential environmental issues (Environmental Research Consulting, 2006). This includes debris and cargo (e.g., oil and chemicals) that may be leaked into the ocean, fire could

break out, or the vessel could sink in the case of a collision (Biehl & Lehmann, 2006). During the installation and operation of turbines, harmful chemicals and hydrocarbons may be accidentally released which can be toxic to marine species (Bat et al., 2013; Bejarano et al., 2013; Farr et al., 2021). Accidental releases may also occur via routine discharges, though the discharge of fluids in the case of offshore wind farms are often authorized operational effluents and controlled through treatment and monitoring systems as well as permit limitations (BOEM, 2019). There is also the chance of paint and corrosion to flake off of the turbines and land in the surrounding waters.

9.2.3 Fire / Mechanical Fire

The number of reported fires at offshore wind farms to date is limited, incomplete, or not publicly available (Mou et al., 2021; Uadiale et al., 2014). Potential effects are likely to be similar to those caused by accidental fires in other offshore industries such as pollution of the air and surrounding marine environment, exposure to chemicals and oils, inhalation of smoke or other chemicals, or changes in behaviour (Mou et al., 2021; Uadiale et al., 2014). The effects of oil and chemicals are described above under Section 9.2.2 of this Report.

9.3 Mitigation and Other Measures

As always, the main method of mitigation to avoid as many effects as possible on wind turbines is avoidance, which would come from proper site-specific assessments before construction. This will ensure that developers are aware of as much of the environment factors as possible in specific areas (while understanding some weather or seismic events can occur as outliers from typical behaviour), to prepare appropriately and design turbines to suit the environment as best as possible. In addition, within the “Offshore Renewable Energy Regulations: Proposed Technical Requirements”, it states that developers will have to have processes in place for inspection, monitoring and maintaining the integrity of their facilities, equipment and systems (NRCan, 2024b), which will aid in identifying any issues from the effects discussed above and allow the proper mitigations to be implemented. Mitigation measures for each component discussed earlier, that can be utilized are outlined in Table 9.5 below:

Table 9.5. Effects Mitigation Measures & Examples in Other Jurisdictions

Effect	Mitigation/Enhancement Measure	Mitigation Description & Examples in Other Jurisdictions
Wind	Rotor & Blade Damage Prevention	• At the cut-out speed the turbine will shut down to prevent unnecessary strain on its rotor. The cut-out speed can vary with the type of turbine (Office of Energy Efficiency & Renewable Energy, 2017). • Engineers employ models to predict loading, aiming to refine rotors for extreme conditions. In the U.S., a new offshore wind R&D consortium funded by their Department of Energy prioritizes understanding extreme metocean conditions, crucial for designing more robust turbines (Hartman, 2017). • Limited data exists, but a twisted jacket foundation shows promise for hurricane-prone areas, proven by its resilience during Hurricane Katrina. Notably, Wetzel Engineering's downwind rotor design diverges from conventional upwind designs, enhancing hurricane resilience by allowing blades to flex away from the tower, reducing structural damage risks (Hartman, 2017). • In other jurisdictions, the shutdown process has been demonstrated when wind farms experience high winds. The Block Island wind farm, located offshore Rhode Island, experienced a sub-hurricane storm, where all five turbines had shut down for several hours once wind speeds reached 92 km/hr and up to 117 km/hr, exceeding the cut-out speed. This triggered automatic shutdown during this period, and the turbines powered back up once the winds diminished (Office of Energy Efficiency & Renewable Energy, 2017).
Waves	Resisting Infrastructure Damage	• In areas where the risk of intense waves is likely, this could result in design requirements for more expensive structures to withstand the impacts from these waves (Chella et al., 2012)
	Ensuring Worker Safety	• To ensure the safety of workers, the wave heights must be within an acceptable window (the mobilization window) for the duration that a service vessel is at sea (Taylor & Jeon, 2018). This mobilization window may differ depending on the service vessel used, so wave heights should be monitored accordingly to ensure the safety of the workers.

Effect	Mitigation/Enhancement Measure	Mitigation Description & Examples in Other Jurisdictions
		• The Committee has heard from developers that "Walk to Work" vessels help reduce safety and operational risks in larger waves. It has been found that some "Walk to Work" vessels can be safely operated in waves up to 3 m in height (Royal Wagenborg, n.d.).
Icebergs, Sea Ice & Atmospheric Icing	Resisting Impact from Ice	• The impact of ice collisions can be mitigated through designing structures to resist these forces through barriers or ice collars or using cooperating foundations to act together to prevent the movement of the ice. • Manufacturers will usually consider the turbines standstill temperature (turbines lowest operating temperature) to ensure the selected turbine can operate in the largest range of operating temperature. If a collision occurs below standstill temperature, it could be catastrophic due to the brittle behaviour of low carbon steels (Battisti et al., 2006). • Safety and Ice Management Plans would also be required and is a valuable mitigation method, as when the risk of ice is present. It would include a description of safety measures to protect the multiple turbines comprising a wind farm and its operations, systems for ice detection, surveillance, data collection, reporting, forecasting and if applicable, ice deflection and avoidance measures (NRCan, 2024b).
	De-icing	For atmospheric icing, de-icing methods (i.e., blade heating systems, coated blades or thermal de-icing systems) are recommended to mitigate this issue (Battisti et al., 2006). • Cold weather packages are usually applied for sites installed in colder climates (Battisti et al., 2006).
Visibility		*No literature has been found to date.*
Tidal Range		*No literature has been found to date.*
Seismic Activity	Planning and Risk Assessment	It is recommended that seismic related hazards should be assessed when planning and designing wind developments in offshore waters (Bhattacharya, S. et al., 2021).

Effect	Mitigation/Enhancement Measure	Mitigation Description & Examples in Other Jurisdictions
Seabed Scour	Scour Protection, Monitoring and Response Planning	To protect the soil around the turbine pile, the most cost-effective method is dumping crushed rock in a way that the current will not wash it away from the structure. In some cases, multiple layers are needed to prevent any wash out (Tempel et al., 2004). Inspection programs would determine the need for maintenance of the scour protection.
Biofouling	Anti-fouling	Since both fixed structures and mooring lines on floating structures are attractive to biofouling species, anti-fouling techniques (such as coated steel) are usually recommended, due to the effects that bio-fouling causes to these structures. • If anti-fouling coatings are not utilized, it could result in extensive inspection and maintenance to the structures, due to the creation of these micro-environments, causing corrosion and extra hydrodynamic and weight loading to the structures (Klijnstra et al., 2017).
Accidental Spills & Leaks	Pollution Control and Spill Response Plans	Plans should include a pollution risk assessment and additional mitigations measures and procedures that are implemented before construction and are to be followed if an event occurs where an accidental spill or leak occurs. This will include a response plan and communication procedure (Mainstream Renewable Power, n.d.).
	Navigational Risk Assessment and Collision Risk Management Plan	A Navigational Risk Assessment should be completed, with safety management procedures outlined. Where and when applicable, there should be safety zones applied around the development and guard vessels to aid navigation around or through the development area (Mainstream Renewable Power, n.d.).

Table Description: Table outlining mitigations to effects noted in Section 9 of this Report, and examples from other jurisdictions where applicable.

9.4 Committee Conclusions and Recommendations

The Committee makes the following conclusions and associated recommendations:

- C-NLOER and NRCan should review previous safety incidents or accidental effects on other offshore vessels and installations to inform design, regulation and procedures for offshore wind development.
- Proponents should consider hurricane force winds, and associated winds and atmospheric icing, in project design given the potential for these forces throughout the Focus Area.
- Proponents should utilize the precautionary approach when siting a project, especially when considering areas prone to sea ice or icebergs.
- Proponents should research and understand the lessons learned in the design and operation of offshore oil & gas facilities and should apply these findings to offshore wind development, for example, ice management planning. Ideally this research should be made public through the regulator.
- Due to the change in oceanographic parameters, i.e. sea temperature, risk assessments regarding ice and iceberg incursion in all areas of the Study Area should be undertaken.

10. Sustainability, Climate Commitments, and Environmental Obligations

10.1 Sustainability

The Agreement requires the Committee to identify and consider the extent to which offshore wind development activities and their potential effects would contribute to sustainability, as per the definition of sustainability in the IAA:

> "the ability to protect the environment, contribute to the social and economic well-being of the people of Canada and preserve their health in a manner that benefits present and future generations" (*Impact Assessment Act*, 2019a).

Sustainability is contextual and may be defined in different ways by communities or groups within communities. The IAAC's 2022 - 2026 Federal Sustainable Development Strategy (FSDS) collates sustainable development goals, targets, short-term milestones, and implementation strategies from across the Government of Canada (ECCC, 2024d). The FSDS provides a balanced view of the environmental, social, and economic dimensions of sustainable development. It also reflects the Government of Canada's sustainable development priorities, including achieving net-zero GHG emissions; conserving nature and biodiversity for future generations; advancing reconciliation with First Nations, Inuit, and Métis communities; promoting gender equality; and supporting innovation and economic growth.

Protecting the environment in a sustainable manner requires maximizing the overall benefits and minimizing adverse effects of development. The mitigation and other measures to address potential effects of offshore wind development on environmental components are described in Section 7 of this Report. These measures will help offshore wind energy develop while conserving the existing nature and biodiversity for present and future generations by maximizing the overall benefits and minimizing adverse effects. Offshore wind development can also contribute to sustainability by adhering and contributing to the provincial, federal, and international environmental obligations and climate change commitments described below in Section 10.2 of this Report.

The extent to which offshore wind development can provide benefits to social and economic well-being is described in Section 7.13 of this Report.

Ensuring sustainable development also includes protecting the health of present and future generations. Offshore wind development can contribute to the present and future health of communities through improving air quality, reducing GHG emissions, creating a new source of renewable energy and providing economic opportunities.

The offshore oil and gas industry was a 'new industry' in Newfoundland and Labrador's offshore in the late 1970s and early 1980s. It was greeted with interest, excitement,

suspicion, and concern. It has been an important part of the province's socioeconomic environment ever since, for more than 40 years. Can a 'new offshore wind energy industry' have a similar socioeconomic effect? During the Committee's public engagement sessions, all these same emotions were voiced.

The biggest difference between the two industries is that the offshore wind energy is based on arrays of stand-alone turbines, each mounted on an unmanned foundation – not a crewed 24/7 facility, whether floating or fixed. Nonetheless, there is the potential for considerable economic benefits. Offshore wind energy is, by definition, a marine industry requiring mariners' skills and vessels but also the design, materials, structures, and operational capabilities of turbines and foundations that match offshore conditions and requirements, along with ongoing support and servicing. A recent review (2019) of the socioeconomic benefits from the offshore petroleum industry in this province, shows that direct employment is only one of many benefits. The reports states "The socioeconomic effects of the Newfoundland and Labrador offshore petroleum industry have been 'large, widely distributed, and long term'." (Stantec Consulting Limited, 2019). A brief description of some of the direct and indirect socioeconomic benefits follows an example of what one industry has provided. Direct economic impacts are capital costs expended in the province, employment and wage/benefits, operating costs and royalties. Indirect local impacts are mainly seen by the companies' providing goods and services to the oil companies. The main types of businesses providing services to the offshore petroleum industry include business services; air transport; water transport; wholesaling; storage; and architectural, scientific, and engineering services (Stantec Consulting Limited, 2019). Many of these services would also be needed by offshore wind energy companies. The offshore oil and gas industry has made a substantial contribution to infrastructure development in Newfoundland and Labrador, with some of this infrastructure contributing to the diversification of the provincial economy. For example, many Newfoundland and Labrador companies have successfully leveraged harsh environment engineering expertise, developed in provincial facilities, for opportunities in other sectors and countries (Stantec Consulting Limited, 2019).

The petroleum industry has also invested in the provincial education infrastructure to enhance the training abilities of education institutions to address skill gaps and plan for future needs in the oil and other industries. In addition to infrastructure, the petroleum industry has, over the years, supported students through awards and work experience in a range of occupations such as business and STEM (Science, Technology, Engineering, and Math), both within and outside the province (Stantec Consulting Limited, 2019). The industry has also funded a number of new research chairs at Memorial University and new equipment and curricula at Memorial's Marine Institute and College of the North Atlantic. The needs and opportunities, both financial and in-kind support, arising directly from the industry has stimulated tremendous growth in the R&D community in the province. Many of the resulting products have found opportunities and other applications both nationally and internationally (Stantec Consulting Limited, 2019). Oil companies working in Newfoundland and Labrador also make substantial contributions to local charities and

community groups, providing key support for a wide range of endeavours in arts and culture, STEM, and community needs through the Community Sector Council and United Way.

Recycling and waste management is a sustainability challenge identified by the wind industry, the U.S. Department of Energy, and other national governments. Improving the development and use of a circular economy is necessary for longevity and sustainability for the industry. A circular economy keeps materials, products, and services in circulation for as long as possible. This includes engineering technology from the start to require fewer materials, resources, and energy, while lasting longer and having components that can easily be broken down for use in future applications (U.S. Department of Energy, 2023; n.d.). These approaches help minimize waste, conserve resources, and reduce GHG emissions associated with the production and disposal of wind turbine components (U.S. Department of Energy, 2023; n.d.). This is consistent with the update to Canada's Sustainable Development Strategy which outlines steps towards developing a more sustainable waste management system including the goal to divert 50% of all waste from landfills by 2030 (ECCC, 2023p; 2024d).

The management of waste associated with both onshore and offshore wind development has many of the same issues, successes, and challenges. By 2050, the quantity of turbine blades that will have completed their useful life throughout the world, for both offshore and land-based wind projects, is estimated to be around 43 million tonnes (Liu & Barlow, 2017). The technology exists for sustainable waste management of offshore wind development materials with about 85 - 90% of the components used to construct wind turbines and associated infrastructure are recyclable materials (U.S. Department of Energy, 2023; n.d.). Recycling or reusing turbine blades, as well as hub and nacelle covers, poses a considerable challenges due to the strength of some materials of construction (e.g., epoxy resin, carbon fiber, and fiberglass) and the waste handling to date, has been through landfill disposal or incineration (Liu & Barlow, 2017). However, potential recycling techniques for these components are in the early stages of development (Calma, 2023; Jacoby, 2022; Liu & Barlow, 2017; Marsh, 2017). Recycling techniques or material reuse currently practiced for offshore wind projects include mechanical recycling, thermal decomposition recycling, and repurposing (U.S. Department of Energy, 2023; n.d.). R&D and efforts to meet these sustainability challenges and achieve circular economy goals are being funded and conducted by industry, governments, and academic institutions throughout the world (Jacoby, 2022; Marsh, 2017; U.S. Department of Energy, n.d.). Three areas in which R&D is being focused and examples of R&D activities include (U.S. Department of Energy, n.d.; Siemens Gamesea Renewable Energy, 2021; Calma, 2023):

- Increasing durability and extending the life of turbine blades (e.g., development of innovative materials such as novel carbon fibers for lighter and more durable blades and development of advanced blade inspection techniques and improving repair capabilities.
- Developing new resins for blade production which can be more easily recycled into materials for new products, including new turbine blades (e.g., Siemens Gamesea and partners' development of a new resin type and production of turbine blades which are being tested at the Kaskasi

offshore wind power plant in Germany. The resin is reported to be efficiently separated from the other blade components at end-of-life and reusable.

- Developing/improving techniques to separate and recycle components in existing turbine blades (e.g., Vesta and partners' development of a liquid chemical solution to break down spent blades into epoxy/resin fragments and fibers. The epoxy can be processed into "virgin grade" epoxy. The liquid chemical solution is reported to be inexpensive, non-toxic and readily available in large quantities. Further details are currently confidential while patents are being filed.

These evolving state-of-the-art technologies should enhance sustainability and should be considered for future, world-wide offshore wind projects, including those in the Newfoundland and Labrador waters (Jacoby, 2022; Marsh, 2017).

10.2 Environmental Obligations and Climate Change Commitments

The Agreement requires the Committee to identify and consider the extent to which offshore wind development activities and their potential effects hinder or contribute to the federal and provincial governments' abilities to meet their environmental obligations and/or commitments with respect to climate change.

Identification of environmental obligations and climate commitments relevant to the Regional Assessment was based on IAAC guidance for project-level impact assessments, the *Policy Context: Considering Environmental Obligations and Commitments in Respect of Climate Change under the Impact Assessment Act* (IAAC, 2020a). Environmental obligations are those applicable to the Government of Canada in domestic and international law in relation to the protection of the natural environment. These are set out in federal legislation and regulations and are legally binding international instruments (e.g., conventions) to which Canada is a party. Commitments with respect to climate change are considered to be both legally binding and non-binding (e.g., targets) domestic and international instruments.

This section only identifies environmental obligations and commitments with the potential to substantively inform recommendations related to future licencing decisions and/or impact assessments. Considering domestic instruments developed in response to Canada's international obligations and commitments (e.g., legislation, regulation, policy, target, plan, framework), it indicates which are most relevant and will substantively inform the Committee's recommendations. The scope of obligations and commitments considered in this section have been narrowed to take the Regional Assessment context into account (e.g., the Focus Area, activities related to offshore wind development and their potential effects, environmental components that may be affected by offshore projects, etc.).

10.2.1 Canada's Environmental Obligations

Canada has numerous obligations related to the protection of the environment, which stem from a variety of agreements and protocols, as seen in Table 10.1, which are implemented through federal, international, and/or provincial control mechanisms (e.g.,

legislation, regulation, policy, targets, plans or frameworks). Table 10.1 also identifies the potential effects of offshore wind development and associated activities in the Focus Area on the applicable obligations and commitments.

Table 10.1. International, Federal, and Provincial Environmental Obligations

Obligation	Federal and International Control Mechanisms	Provincial Control Mechanisms	Relevant Potential Effect	Implications for Meeting Obligation
International Convention for the Prevention of Pollution from Ships (1973)	Canadian Ambient Air Quality Standards (2012) and *Canada Shipping Act* (2001) and its associated regulations: • Vessel Pollution and Dangerous Chemicals Regulations (2012); • Environmental Response Regulations (2019).	*Environmental Protection Act* (2002), and associated Air Pollution Control Regulations (2022).	Vessel discharges may affect air and water quality and contribute to emissions of GHGs.	Neutral, provided construction and operations vessels comply with applicable regulations.
Convention for the Protection of Migratory Birds in the U. S. and Canada (1916)	All offshore wind project operators must comply with the *Migratory Birds Convention Act* (1994).	*Endangered Species Act* (2001).	Birds are attracted to platform/ship lighting at night, and may encounter wind turbine blades, leading to possible adverse effects, including injury or death.	Potentially neutral, provided operators implement associated mitigation and monitoring measures (see Section 7.3.4). Potential effects of increased stress and energy for seabirds to reach colonies or foraging areas needs more research.
The UNCBD (2022)	Canada has various legislation, to protect biological diversity in the marine environment, including: • *SARA* (2002); • *Oceans Act* (1996); • *Migratory Birds Convention Act* (1994); • *Fisheries Act* (1985) and associated Marine Mammals Regulations (1993).	*Endangered Species Act* (2001), and the *Environmental Protection Act* (2002).	Normal operations have not been shown to negatively affect biodiversity. There may be some evidence that monopile and lattice structures may provide habitat for corals and increase benthic biodiversity (Bray et al., 2016).	Neutral, provided operators comply with the legislation (see Sections 7.3.1, 7.4.1, 7.5.1, and 7.7.1). Small risk of hindering Canada's biodiversity obligations (e.g., displacing or injuring migratory aerofauna species, marine mammals, fish, and other marine life during construction and operations of offshore wind projects).

Obligation	Federal and International Control Mechanisms	Provincial Control Mechanisms	Relevant Potential Effect	Implications for Meeting Obligation
Montreal Protocol on Substances that Deplete the Ozone Layer (1987)	• *Canadian Environmental Protection Act* (1999) and associated • Federal Halocarbon Regulations (2022); • Ozone-depleting Substances and Halocarbon Alternatives Regulations (2022).	*Environmental Protection Act* (2002), and associated Air Pollution Control Regulations (2022).	None. Halon, which has been used in ship-board firefighting systems, is being phased out of use and is no longer used in the Newfoundland and Labrador offshore industry.	Neutral. O_3 depletion is associated with halocarbons (e.g., HFCs, CFCs), the use of which has been phased out in Canada.
IUCN (1948)	• *SARA* (2002); • *Fisheries Act* (1985); • Healthy Environment and Healthy Economy Plan (2021).	'The Way Forward on Climate Change – Newfoundland and Labrador Action Plan, (2019).	Assessment of potential environmental harm to at-risk marine species during offshore wind development (e.g., Northern Bottlenose Whale, North Atlantic Right Whale, Loggerhead Sea Turtle, etc.)	Neutral. Protection of marine life within the Focus Area is dependent on identification of species at risk and their critical habitats, designation of MPAs and Marine Refuges, and construction and operations vessels complying with applicable regulations.
The International Commission for the Conservation of Atlantic Tunas (2022)	Proponents manage discharges and emissions in accordance with: • *Canada Shipping Act* (2001); • *Canadian Environmental Protection Act* (1999); • *Coastal Fisheries Protections Act* (1985) and associated Coastal Fisheries Protection Regulations (2019).		Tuna occurs in some of the Newfoundland and Labrador Focus Area.	Neutral. There have been limited targeted studies, but Environmental Effects Monitoring studies near production projects have not revealed any adverse effects on fish health but any potential negative effects that may arise can be mitigated (see Sections 7.3.3, 7.4.3, and 7.7.3). There are no known specific, adverse effects of pile driving from offshore wind project construction on tuna.

Obligation	Federal and International Control Mechanisms	Provincial Control Mechanisms	Relevant Potential Effect	Implications for Meeting Obligation
London Protocol (1996)	*Canadian Environmental Protection Act* (1999) and associated Disposal at Sea Regulations (2001).		Pre-construction or operational discharges to the marine environment from drilling platform (in the case of monopiles/non-floating structures).	Neutral, provided offshore wind developers and operators comply with permit conditions and the regulations for disposal of materials at sea.
International Convention for the Control and Management of Ships' Ballast Water and Sediments (2017)	*Canada Shipping Act* (2001) and associated Ballast Water Control and Management Regulations (2011).		Vessels arriving from overseas destinations may introduce invasive species into the Northwest Atlantic.	Neutral, provided vessels comply with ballast water control and management regulations while in Canadian waters.
United Nations Convention on the Law of the Sea (UNCLOS) (1982)	Canada participates in the work of various bodies created under UNCLOS, including the International Seabed Authority, an organization created to administer the mineral resources of the Area (the seabed beyond national jurisdiction).		Potential effects to the marine environment and associated human uses. GHG emissions from equipment.	Neutral, provided proponents adhere to the laws and agreements of the multi-national treaties and governing bodies (i.e., marine observers).

Obligation	Federal and International Control Mechanisms	Provincial Control Mechanisms	Relevant Potential Effect	Implications for Meeting Obligation
NAFO Convention on Cooperation in the Northwest Atlantic Fisheries (2017)	Canada supports and implements the NAFO convention and its goals through compliance with its various environmental protection legislation and policies, key ones include: • *SARA* (2002); • *Migratory Birds Convention Act* (1994); • *Fisheries Act* (1985) and associated Marine Mammals Regulations (1993).	*Environmental Protection Act* (2002); *Wild Life Act* (1990); *Endangered Species Act* (2001).	Reduced fishing opportunity caused by all stages of offshore wind development.	Neutral, provided proponents adhere to the goals of the multi-national organisation and federal/provincial legislation.
Rio Declaration on Environment and Development (1992)	• *Canadian Environmental Protection Act* (1999); • *IAA* (2019) under the Strategic Assessment of Climate Change (2020).	*Environmental Protection Act* (2002).	Potential effects to the marine environment, pollution, and GHG emissions.	Neutral, provided proponents adhere to the principles of the declaration through implementing federal/provincial legislation.

Table Description: Environmental obligations and commitments in respect of climate change typically stem from agreements and protocols, and are implemented through federal, international, and/or provincial control mechanisms. Table columns correspond with this regime. The table also identifies potential effects of offshore wind development in the Focus Area on the identified environmental obligations and climate commitments.

Sources: Air Pollution Control Regulations, 2022; Ballast Water Control and Management Regulations, 2011; Canadian Council of Ministers of the Environment, 2020; *Canada Shipping Act,* **2011**; *Canadian Environmental Protection Act*, 1999; *Coastal Fisheries Protections Act*, 1985; Coastal Fisheries Protection Regulations, 2019; Convention for the Protection of Migratory Birds in the U.S. and Canada, 1916; Disposal at Sea Regulations, 2001; ECCC, 2020a; c; Newfoundland and Labrador *Endangered Species Act,* 2001; Newfoundland and Labrador *Environmental Protection Act*, 2002; Environmental Response Regulations, 2019; Fayram & de Risi, 2007; Federal Halocarbon Regulations, 2022; *Fisheries Act,* 1985; Government of Canada, 2016b; Government of Newfoundland and Labrador, 2019a; b; IAAC, 2020a; ICCAT, 2022; *Impact Assessment Act*, 2019a; IUCN, 1948; London Protocol on Prevention of Marine Pollution, 2006; Marine Mammals Regulations, 1993; IMO, 1973; 2017; *Migratory Birds Convention Act*, 1994; NAFO, 2017; *Oceans Act,* 1996;

Ozone-depleting Substances and Halocarbon Alternatives Regulations, 2022; Pérez-Arjona et al., 2014; *SARA,* 2002; UNCBD, 2022; UNCED, 1992; UNCLOS, 1982; Vessel Pollution and Dangerous Chemicals Regulations, 2012; *Wild Life Act,* 1990.

10.2.2 Climate Change Commitments

Canada has numerous commitments related to mitigating the effects on climate change which stem from a variety of agreements and protocols, seen in Table 10.2, which are implemented through federal, international, and/or provincial control mechanisms (e.g., legislation, regulation, policy, targets, plans or frameworks). Table 10.2 also identifies the potential effects of offshore wind development and associated activities in the Focus Area on the applicable obligations and commitments.

Table 10.2. International, Federal, and Provincial Climate Change Commitments

Obligation	Federal and International Control Mechanisms	Provincial Control Mechanisms	Relevant Potential Effect	Implications for Meeting Obligation
Paris Agreement (2015)	Canada submitted its long-term low GHG development strategy to the United Nations Framework Convention on Climate Change in November 2016. Other control mechanisms exist such as: • *Canadian Net-Zero Emissions Accountability Act* (2021); • Strategic Assessment of Climate Change (2020).	*Environmental Protection Act* (2002).	GHG emissions from equipment and vessels.	Any project that emits GHGs contributes to Canada's overall emissions and may therefore potentially hinder the ability to meet targets (see Section 7.2, Air Quality and GHG's). Positive, establishing offshore wind energy in Newfoundland and Labrador will support the long-term goal of transitioning away from fossil fuels and GHG emissions from energy production both onshore and offshore.
Canada's 2030 Emissions Reduction Plan (2022)	• *Canadian Net-Zero Emissions Accountability Act* (2021); • IAA (2019) under the Strategic Assessment of Climate Change (2020).		GHG emissions from equipment and vessels.	Positive, establishing offshore wind energy in Newfoundland and Labrador will support the long-term goal of transitioning away from fossil fuels and GHG emissions from vehicles and vessels.
Pan-Canadian Framework on Clean Growth and Climate Change (2018)	• *Canadian Net-Zero Emissions Accountability Act* (2021); • IAA (2019) under the Strategic Assessment of Climate Change (2020); • *Canadian Energy Regulator Act* (2019).		Development of offshore wind will contribute to expanding the non-GHG emitting energy sector.	Positive, establishing offshore wind energy in Newfoundland and Labrador will increase Canada's renewable and non-emitting energy sources.

Obligation	Federal and International Control Mechanisms	Provincial Control Mechanisms	Relevant Potential Effect	Implications for Meeting Obligation
39th Conference of New England Governors and Eastern Canadian Premiers (2015)	Canada's Eastern Premiers agreed to achieve 35-45% reduction of GHG's by 2030 from 1990 levels, Canada will fulfill these obligations through: • *Canadian Net-Zero Emissions Accountability Act* (2021); • Canada's 2030 Emissions Reduction Plan (2022).		GHG emissions from equipment and vessels.	Positive, establishing offshore wind energy in Newfoundland and Labrador will reduce Canada's GHG emissions by generating clean renewable energy and decreasing dependence on GHG emitting energy sources.
Vancouver Declaration on Clean Growth and Climate Change (2016)	• *Canadian Net-Zero Emissions Accountability Act* (2021); • Canada's 2030 Emissions Reduction Plan (2022); • *IAA* (2019) under the Strategic Assessment of Climate Change (2020).		Potential effects to the marine environment, and GHG emissions from equipment and vessels.	Positive, establishing offshore wind energy in Newfoundland and Labrador will reduce Canada's energy related GHG emissions and encourage investment in clean technology solutions.
International Marine Organization Strategy on Reduction of GHG Emissions from Ships (2023)	• *Canada Shipping Act* (2001); • *Canadian Net-Zero Emissions Accountability Act* (2021); • Canada's 2030 Emissions Reduction Plan (2022);		GHG emissions from international shipping vessels.	Neutral, provided proponents adhere to the principles of the strategy through implementing federal/provincial legislation.

Table Description: Climate change commitments typically stem from agreements and protocols, and are implemented through federal, international, and/or provincial control mechanisms. Table columns correspond with this regime. The table also identifies potential effects of offshore wind development in the Focus Area on the identified environmental obligations and climate commitments.

Sources: Arvesen & Hertwich, 2012; Brussa et al., 2023; *Canadian Energy Regulator Act*, 2019; *Canadian Net-Zero Emissions Accountability Act*, 2021; Canadian Intergovernmental Conference Secretariat, 2015; 2016; *Canada Shipping Act*, 2001; ECCC, 2016b, 2019, 2020c, 2022; Newfoundland and Labrador *Environmental Protection Act*, 2002; Government of Canada, 2016a; b; IAAC, 2020a; *Impact Assessment Act*, 2019a; International Energy Agency, 2020; Marine Environment Protection Committee, 2023; UNFCCC, 1992; Wang & Jinxiang, 2019.

Canada is a part of an overall effort to limit the global average temperature rise to below 2°C and pursue efforts to limit the increase to 1.5°C. Generating electricity from fossil fuels emits GHG's as well as pollutants that harm human health and contribute to this temperature rise.

Offshore wind farms produce atmospheric emissions from several sources, primarily:

- Fuel combustion from engines and other mechanical equipment aboard construction vessels, support vessels, and helicopters; and
- Fuel combustion and discharge from the fabrication of materials required for construction and maintenance (steel, concrete etc.).

Emissions from these activities are likely to include CO_2, CO, SO_2, NO_X, and PM. While the Agreement requires the Committee to consider the extent to which the effects of offshore wind development hinder or contribute to the Government of Canada's ability to meet its commitments with respect to climate change, it is also useful to consider the avoided GHG emissions through non-renewable energy displacement. These comparisons have generally found that predicted GHG emissions from an individual offshore wind project are low, primarily occurring during the construction phase, and below GHG targets (Nordman & VanderMolen, 2014). Offshore wind energy is expected to offset 3.5 Mt CO_2/GW of unabated coal energy and 1.6 Mt CO_2/GW of natural gas annually (International Energy Agency, 2020).

The scale of the reduction in pollutants depends on the energy source being replaced and the size or type of wind farm being implemented. In an article on the effects of wind power on CO_2 emissions in Belgium, reductions in CO_2 emissions amount to 1.24 kton/MW of installed wind power capacity per year (Delarue et al., 2009). Another article estimated that even accounting for the pollution emitted during construction, operation, and decommissioning, one 3.0 MW wind turbine would prevent 123,000 tons of GHG emissions over the course of two decades (Crawford, 2009).

Under the federal Greenhouse Gas Reporting Program (GHGRP), the reporting threshold was reduced (from 50 kt - 10 kt of CO_2eq.) Based on the GHG emissions estimates presented in recent literature, the life cycle GHG emissions for utility-scale wind power range from 3.0 - 45 kg CO_2-eq/MWh and a median of 11 kg CO_2-eq/MWh (Bonou et al., 2016; Dolan & Heath, 2012). The potential GHG emissions and annual MWh produced by single turbines of different capacities are presented in Table 10.3. Using "per MWh" calculations, the table below also calculates the total potential GHG emissions associated with single 4 MW and 6 MW monopile wind turbines over their life cycles and extrapolated to a scale of 10-turbine wind farms for each capacity, as an indication of the total levels of GHG emissions that could be associated with future offshore wind projects in the Focus Area.

Table 10.3. Potential GHG Emissions for Single Turbines and 10 Turbine Farms (4 MW and 6 MW Capacities)*

Turbine (MW)	4	6
Energy to grid/turbine/year (MWh)	20,528	31,045
tCO2-eq/MWh per turbine	0.0109	0.0078
tCO2-eq per turbine/year	223.7552	242.151
Lifetime (y)	20	25
Lifetime energy to grid/turbine (MWh)	410,560	776,125
Lifetime tCO2-eq/turbine	4,475.104	6,053.775
Lifetime tCO2-eq for ten turbines	44,751.04	60,537.75

Table Description: This table shows the calculations for potential GHG emissions produced by single four MW and six MW wind turbines and for ten-turbine wind farms of the same capacities. This includes calculations of energy produced per turbine in MW hours per year and per a turbines' lifetime; and tons of CO_2 produced per MW hour, per year, and per a turbines' lifetime.

* Values derived from article by Bonou et al., (2016). Calculations completed by RA Committee and Secretariat.

Source: Bonou et al., 2016.

The cumulative annual GHG emissions for one 6 MW turbine were then converted to annual cumulative emissions for 10, 6 MW turbines to allow for comparison to the federal GHG targets, the results of which are provided in Table 10.4. As indicated, the estimated annual GHG emissions for 10, 6 MW turbines are predicted to contribute < 0.05% of the federal 2020 and 2030 GHG targets.

Table 10.4. Estimated Annual GHG Emissions from 10, 6 MW Offshore Wind Turbines in Comparison to Federal Targets

	Calculate Annual GHG Emissions for 10 6MW Turbine Farm ($MtCO_2$-eq/year)	Federal GHG Emissions Targets ($MtCO_2$-eq/year)	
		2020	2030
	0.002237552	607	513
Contribution to GHG targets	-	<0.05%	<0.05%

T**able Description: T**his table shows the total annual GHG emissions for 10, 6 MW turbines based on calculations from Table 10.3 and the relative contribution to federal GHG emissions targets for 2020 and 2030.

Source: ECCC, 2019.

10.2.3 Engagement Outcomes

In general, feedback throughout the engagement process conveyed an understanding of the benefits of offshore wind as a renewable energy source and its role in reducing GHG emissions.

Much of the engagement the Committee received or heard from participants regarding sustainability, addressed broad concerns about how offshore wind development will affect marine mammals, sea turtles, invertebrates, fish, aerofauna, and the marine ecosystem. The effects of offshore wind development on these components are addressed in their respective sections (see Sections 7.3 - 7.6 and 7.9 of this Report). Tables 10.2 and 10.3 also addresses some of the provincial, federal, and international agreements in place to protect these components.

A specific concern related to sustainability, heard a number of times during engagement, was the economic viability of offshore wind energy in Newfoundland and Labrador. Some participants noted Newfoundland and Labrador has sufficient renewable energy sources from hydro-electric projects to meet its domestic needs and therefore assuming the most likely end use of offshore wind energy will be supplying other countries with Green Hydrogen or ammonia. Participants expressed concern that offshore wind project proponents may make use of federal and provincial subsidies and incentives to fund project start up, which means ultimately taxpayers will be paying for offshore wind projects, at least in part.

In a letter to the Committee on April 10, 2024, ECE Law suggested that marine spatial plans be developed for the region in future to support sustainable development of offshore wind energy in Newfoundland and Labrador as well as other measures such as centralized site identification by government, and tiered planning and assessment processes.

In their submission to the Committee, MFN called on proponents of offshore wind development and the corporate sector in Canada to adopt the UNDRIP, and apply its principles, norms, and standards to corporate policy and core operational activities, involving Indigenous peoples and their lands and resources by, among other things, such as:[146]

- Ensure that Aboriginal peoples have equitable access to jobs, training, and education opportunities in the corporate sector, and that Aboriginal communities gain long-term sustainable benefits from economic development projects.
- Provide education for their management and staff on the history of Aboriginal peoples, including the history and legacy of the residential schools, UNDRIP, treaties and Aboriginal rights, Indigenous law and Aboriginal-Crown relations.

10.2.4 Committee Conclusions and Recommendations

Offshore wind development can pose risks to the environment, but experience elsewhere indicates that those adverse effects can be avoided or potentially mitigated. Offshore wind developments would be expected to contribute to Canada and Newfoundland and Labrador's environmental obligations and commitments in respect to climate change which are identified throughout this Report across various sections and components.

Any activity that adds to Canada's atmospheric emissions will have potential implications to meeting its emissions targets and climate change commitments. While offshore wind development will produce emissions (primarily during construction), the quantity is a fraction of that generated by the fossil fuel industry. Given the small portion of total GHG emissions generated by offshore wind energy, it is considered unlikely that the development of this industry would hinder Canada's ability to meet its emissions targets. As a renewable and low-emitting source of electricity, offshore wind development may contribute to Canada's ability to meet its emission targets and mitigate future global climate change as outlined in Canada's 2030 Emissions Reduction Plan, the Pan Canadian Framework on Clean Growth and Climate Change, and A Healthy Environment and a Healthy Economy (ECCC, 2016b; 2020a; 2022b).

The Committee recommends that:

- Offshore wind projects in the waters off Newfoundland and Labrador should be expected by the offshore energy regulator to utilize state of the art technologies for the sustainable management of waste, both during operations and maintenance and decommissioning stages of the project.

[146] This submission can be found on the Registry under document reference number 324.

11. Intersectionality

The Agreement directs the Committee to consider the intersection of sex and gender with other identity factors and to make recommendations for how future impact assessments should consider and address these factors. This requires application of GBA Plus.

In presenting this information and analyses on intersectionality and GBA Plus as a Report section onto itself, and in this order placement relative to the components and other topics, it is not the intention of the Committee to imply this topic is any less important than any component or topic preceding this section. The Committee has done this to clearly address the intersectionality requirement in the Agreement, and to also explain the Committee's approach to this complex topic. This section also draws connections to the other Report sections relevant to GBA Plus. This is most evident in, but not limited to Section 7.13 of this Report, on the topic 'Communities and Economy'.

11.1 GBA Plus

Women and Gender Equality Canada (WAGE) provides the following definition of GBA Plus:

> GBA Plus is an analytical tool used to support the development of responsive and inclusive policies, programs, and other initiatives. GBA Plus is a process for understanding who is impacted by the issue or opportunity being addressed by the initiative; identifying how the initiative could be tailored to meet diverse needs of the people most impacted; and anticipating and mitigating any barriers to accessing or benefitting from the initiative. GBA Plus is an intersectional analysis that goes beyond biological (sex) and socio-cultural (gender) differences to consider other factors, such as age, disability, education, ethnicity, economic status, geography (including rurality), language, race, religion, and sexual orientation (WAGE, 2024).

The IAAC has issued guidance for GBA Plus in impact assessment (IAAC, 2021b), and a tool for assessing the quality of GBA Plus in a proponent's Impact Statement (IAAC, n.d.). These guidance documents are specifically for project assessments rather than regional assessments. Following a presentation from the IAAC on GBA Plus in the context of regional assessments (IAAC, 2023c), the Committee decided to adapt the stepwise approach outlined for projects to help inform the approach to GBA Plus for this Regional Assessment.

11.2 Committee's Approach to GBA Plus

The Committee is following five key steps:

- Understand GBA Plus
- Identify the impacted communities
- Engage with diverse groups and individuals
- Establish a baseline

- Identify potential effects, and potential mitigation and enhancement measures

11.2.1 Understand GBA Plus

In the context of this Regional Assessment, application of GBA Plus will contribute to a better understanding of the positive and negative effects that future offshore wind development may have on diverse populations. Future impact assessments of offshore wind projects can then be tailored to better meet diverse needs in anticipating and mitigating barriers that various individuals and groups might face and to ensure that all people can benefit from offshore wind development (IAAC, 2023c). GBA Plus can refine the analyses in this Regional Assessment to establish linkages across the environmental, social, health, and economic components to illustrate intersectional and diverse effects, and mitigation and other measures (IAAC, 2021b).

Importantly, in their efforts to understand GBA Plus, the Committee acknowledged that practitioners conducting GBA Plus should:

- have broad knowledge of cultural sensitivity, safety, reciprocal relationships, ethical protocols, and reflexive practices to identify unconscious biases, beliefs and assumptions;
- understand trauma-informed best practices for collecting sensitive data confidentially and of community-based research methods; and
- be flexible in adapting methods and practices to the community context.

As such, the Committee retained the services of the Canadian Research Institute for the Advancement of Women (CRIAW) to provide expertise on the GBA Plus aspect of the Regional Assessment.[147] CRIAW has produced a report, Harnessing the Potential for a More Equitable Future in Newfoundland and Labrador: Applying Gender-Based Analysis Plus to Offshore Wind Development (CRIAW, 2025).[148] CRIAW's scope of work involved:

1. Completing a review of publicly available data to support GBA Plus in Newfoundland and Labrador and identifying data gaps and recommendations for addressing data gaps.
2. Providing a discussion of the likely impacts of offshore wind development on diverse populations in the province and potential indicators relevant for a GBA Plus analysis.

[147] The Committee followed the Government of Canada procurement process for retaining CRIAW to assist with the Regional Assessment. To remove any perception of bias, the Committee members did not participate in the review and selection process; it was completed by the IAAC.
[2] CRIAW's report is available on the Registry under document reference number 386 and is also in Appendix G of this Report.

CRIAW and the Committee agree that GBA Plus for offshore wind activities in Newfoundland and Labrador should not be considered complete. The work completed for this Regional Assessment is only a first step.

While CRIAW's report to the Committee is published as a stand-alone document on the Registry, it is an important supporting document to the Regional Assessment. Project proponents should review CRIAW's report for consideration in future impact assessments. Key findings and recommendations from the CRIAW report are mentioned throughout this Section and Section 7.13.

11.2.2 Identify the Impacted Communities

Not all projects impact all people in the same way. In Canada, research indicates that resource development projects impact women, Indigenous peoples, and other historically excluded groups in unequal ways (e.g., Czyzewski et al., 2016; Manning et al., 2018; Native Women's Association of Canada, 2020; Oxfam Canada, 2023; Steinstra et al., 2020). For example, research has highlighted the links between Canadian resource development projects and risks of gender-based violence and sexual harassment for Indigenous, Métis and Inuit women in Canada (e.g., National Inquiry into Missing and Murdered Indigenous Women and Girls, 2019; Pauktuutit Inuit Women of Canada, 2021; Standing Committee on the Status of Women, 2022). Little is known about the experiences of other marginalized populations related to impact assessments and resource development projects, including non-Indigenous racialized people, 2-Spirit, lesbian, gay, bisexual, transgender, queer, questioning, intersex, asexual, and more (2SLGBTQQIA+) peoples, youth, and people with disabilities (Stienstra et al., 2020). In their review of Environmental Impact Statements for federal IA processes, MacKellar et al. (2023), found little understanding of the impacts of projects on 2SLGBTQQIA+ communities. Where documented, it was noted that persistent hypermasculinity perpetuated homophobia, sexism, and risk-taking behaviours resulting in workplace and community-based harm. Work is also emerging on the related topic of "blue justice," which aims to address the potential social injustices that can result from the "blue economy," including displacement of other ocean users, undermining the livelihoods of fishers, and inequitable distribution of economic benefits (e.g., Bennett et al., 2020).[149]

In Newfoundland and Labrador, research and initiatives have focused on facilitating employment of a diverse workforce and supporting businesses owned and operated by diverse groups (e.g., Cox and Mills, 2015; Stantec Consulting Limited, 2023). Research pertaining to GBA Plus in the European offshore wind industry tends to focus on employment of diverse populations, particularly women (e.g., International Renewable

[149] The World Bank (2017) defines the blue economy as "the sustainable use of ocean resources for economic growth, improved livelihoods and jobs, and ocean ecosystem health."

Energy Agency, 2020; WWF, 2023). Research in the U.S. and Australia regarding effects on offshore wind development on Indigenous peoples points to similar concerns and potential opportunities as those identified for Canadian natural resource projects (e.g., Bacchiocchi et al., 2022; Kerr et al., 2015; Rainnie & Snell, 2023). CRIAW's literature review yielded similar findings (CRIAW, 2024).

Based on the Committee's research and participant engagement, the Committee anticipates the communities that will be most impacted by offshore wind development, relative to the initial offshore wind energy licencing areas, are:

- Potentially negative impacts on Indigenous peoples, especially Indigenous women and children, and particularly those living on the south and west coasts of the Island of Newfoundland.
- Potentially negative impacts on fishers who harvest on the south and west coasts of the Island of Newfoundland.
- Potentially negative impacts on populations living on the west and south coast of the Island of Newfoundland.
- Potentially positive impacts on populations living on the west and south coast of the Island of Newfoundland.

Potentially positive impacts on specific segments of the population in the context of health/climate change. CRIAW selected interview candidates based on potentially impacted communities (see Section 11.2.3 of this Report).

11.2.3 Engage with Diverse Groups and Individuals

The Committee engaged with diverse groups and individuals throughout the Regional Assessment process (see Section 3 of this Report, and Appendices A through D). Participants in the Indigenous and public, fisheries, and stakeholder engagement programs, including the advisory groups, represent diverse viewpoints and have provided outcomes relevant to GBA Plus. Recognizing the importance of GBA Plus, the Committee established a GBA Plus Advisory Group, which CRIAW leveraged to help inform their work. Engagement outcomes are mentioned throughout this Report.

As part of their scope of work, CRIAW conducted key informant interviews with a cross-section of organizations in Newfoundland and Labrador representing diverse sub-groups including those organized around race, ethnicity, religion, age, (dis)ability, gender, geography, language, economic status, sexual orientation, education, sex and any other community-relevant identity factors. Participating organizations included: The Corner Brook Status of Women Council, Quadrangle NL, The NL Federation of Labour, The Transition House Association of NL, The Multicultural Women's Association of NL, The Association for New Canadians, The Office to Advance Women Apprentices NL, and the Provincial Advisory Council on the Status of Women NL (CRIAW, 2024).

The Committee and CRIAW agree that engaging Indigenous peoples, and Indigenous women in particular, on this Regional Assessment was challenging. These perspectives are critical to GBA Plus but are also lacking in project impact assessments. One participant in this Regional Assessment, Keepers of the Circle and the AnânauKatiget Tumingit Regional

Inuit Women's Association, is doing important work in this area, and has made recommendations regarding more meaningful and inclusive engagement processes (Bridges et al., 2023; Bridges & Skelding, 2024). Governments and project proponents should consider these key works to inform future engagement programs on offshore wind projects.

11.2.4 Establish a Baseline

When undertaking GBA Plus, various identity and social factors need to be considered including, age, economic status, education, ethnicity, gender, (dis)ability, geography, language, racialization, religion, sex, and sexual orientation. Therefore, in addition to the perspectives of diverse individuals to help shed light on the range of experiences, barriers, and inequalities certain people face, GBA Plus also relies on availability of disaggregated data (IAAC, 2021b).

CRIAW completed a review of publicly available data to support GBA Plus/intersectional analysis for this Regional Assessment (CRIAW, 2024). CRIAW identified and reviewed three major data sources that could be helpful for GBA Plus Analysis in the context of offshore wind development in Newfoundland and Labrador. These include the Newfoundland and Labrador Statistics Agency dataset, the Newfoundland and Labrador Community Accounts, and Statistics Canada. They found that disaggregated data is not available for many identity and social factors.

Where disaggregated data is available, it is most frequently based on gender and/or age. Disaggregation by other factors related to other forms of discrimination and inequality are not common (e.g., race, ability, income). However, CRIAW was able to identify some Statistics Canada data with greater disaggregation and noted that Statistics Canada is developing specialized data hubs that will be valuable sources as new data is published. (CRIAW, 2024). CRIAW has recommended ways to address data gaps, which the Committee has adopted (see Section 11.3 of this Report).

11.2.5 Identify Potential Effects, and Mitigation and Enhancement Measures

Without an accurate baseline, it is difficult provide a comprehensive intersectional analysis of the positive and negative effects that future offshore wind development may have on diverse populations. In turn, it is challenging to identify mitigation and enhancement measures from an intersectional standpoint.

CRIAW's analysis of public data on key indicators for GBA Plus in impact assessments shows there are major gaps, especially to be able to monitor a variety of potential changes that could result in affected communities from the introduction of an offshore wind industry. That said, CRIAW did identify unequal economic benefits and negative effects on community well-being, and proposed strategies for how these may be addressed (CRIAW, 2024). The Committee has adopted these recommended strategies in Section 7.13 of this Report.

11.3 Committee Recommendations

The Committee adopts the following recommendations from the CRIAW report (2024):

To address data gaps to facilitate more fulsome GBA Plus analyses in future impact assessments of offshore wind projects in this province, the Government of Newfoundland and Labrador should:

- Expand existing government data for GBA Plus.
  - Develop an inter-departmental plan for a GBA Plus data collection strategy, with NL Women and Gender Equality playing a leadership role
  - Identify needed data, with community input, and build a strategy to publicly share data for GBA Plus
  - Encourage provincial ministries to systematically gather and report on relevant data that is submitted to them
  - Add additional identity-based variables to the NL Community Accounts so that intersectional analyses can be conducted

Develop a stronger connection between the NL Statistical Agency and Statistics Canada with the aim of adding more disaggregated data to the NLSA website

- Build on community knowledge.
  - Support research already being done at the community level.
  - Gather intersectional data through engagement with diverse provincial and community-based organizations.
  - Create a GBA Plus data working group that includes representatives from, and engages with, community organizations as well as government agencies.

The CRIAW report (Appendix G of this Report) expands on these recommendations.

12. Conclusion

The Committee was appointed in March 2023. Early in the process, the Committee was briefed by several federal agencies, particularly NRCan, which had been investigating the potential of offshore wind development on the east coast of Canada for several years.

Newfoundland and Labrador is fortunate to have winds of speed and consistency over land and sea that have the potential as a reliable source of renewable energy to help alleviate reliance on energy derived from fossil fuels. Over the past year, wind energy in the province is moving from the theoretical to reality with five onshore wind energy projects under active consideration. Offshore wind energy is being used or being developed in many areas of the world to provide an alternative source of power for electricity to communities and industry.

A Regional Assessment of the potential for offshore wind energy development in the province was initially viewed by the Committee as a straightforward undertaking. Offshore wind energy projects are typically feasible when there are several turbines working together in a cluster. For this Regional Assessment "offshore wind development activities" is defined as having 10 or more turbines. As such, future offshore wind projects in Newfoundland and Labrador will involve taking up space in the ocean. When consideration is given to fishers and other ocean users, and to potential impacts (positive and negative) on environmental, health, economic, and social conditions, the Regional Assessment was a challenging exercise in marine spatial planning, constraints analysis, and risk avoidance and mitigation.

In early discussions, the Committee decided that, in the absence of any Canadian or provincial experience with offshore wind development and since offshore wind will be a new marine industry, it would be prudent to apply a precautionary approach. The Committee considered existing technical requirements for offshore wind farms such as depth, seafloor conditions, and factors unique to this offshore environment such as pack ice and icebergs. The Committee also identified areas that should be avoided, such as areas set aside for conservation, seabird colonies, aquaculture, tourism, and areas with a high density of fishing effort.

The Regional Assessment is based on existing, available public information. The Committee has benefited greatly from the input from various federal and provincial departments, Indigenous communities, advisory group members, commercial fishers, fisheries organizations, environmental groups, energy organizations, offshore wind developers, and a range of public engagement initiatives over the last year and a half.

One phrase the Committee heard from offshore wind developers was that the first offshore wind industry efforts would be 'the low hanging fruit,' meaning monopile foundations in water depths of 60 m or less, where the monopiles can be embedded in the seafloor, close to deep-water ports where the offshore wind facilities could be supported, and the electricity could be delivered and/or used.

Perhaps the most notable feature over the past year and a half of investigating the potential for offshore wind development off our coasts, is the rapid pace at which offshore wind technology is evolving. Turbines heights are much greater, turbine blades are much longer, new materials for blades are being researched in part for concerns for recycling. Deeper depths are being considered as shallow areas become occupied. There are focused efforts to further develop and possibly standardize floating foundations for use in deeper water or where seabed does not support the use of fixed turbine foundations to facilitate use of these previously unsuitable areas.

This Report is far longer than anticipated at the start of the Committee's work. The Terms of Reference provided by the Ministers required a thorough foundation of information be built to support their early planning, regulatory and licencing decisions. This Report is an objective, fact-based document based on current information. It provides a starting point for consideration of specific offshore wind energy project development.

The Committee extends a sincere thanks and appreciation to all participants who have contributed information, knowledge, and advice, which has greatly helped in carrying out this Regional Assessment.

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