DRAFT REPORT:

Regional Assessment of Offshore Wind Development in Newfoundland and Labrador

October 1, 2024

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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Preamble

Producing the Draft Report at this time was necessary to enable production in both official languages, accommodate a 60-day review period, and allow sufficient time for us to consider your review comments before submitting the Final Report to the Ministers by January 23, 2025. Allowing time for these processes was important to us, but doing so also meant facing a decision regarding how we would finish our mandate in these remaining months. We could produce a "complete" Draft Report if we ceased further engagement, information gathering, and analysis in the lead up to the Final Report. Or we could produce a Draft Report that identifies work in progress and forthcoming submissions that we know will be completed in time for inclusion in the Final Report. We chose the latter.

Time has been our greatest challenge in this Regional Assessment, and being transparent is fundamental to our process. We felt participants would ultimately appreciate our decision to continue working over the next 60 days, as long as we were up front about what remains outstanding at this time. We hope to leverage the next two months to do what we can to ensure we complete our mandate having done the best we can to help inform future offshore wind development planning, licencing, and impact assessment processes.

We have published this Draft Report for a 60-day public review and comment period. We welcome Indigenous peoples, fishers, other ocean users, government agencies, environmental organizations, research groups, industry stakeholders, and the public to review and submit feedback. We again thank all participants in this Regional Assessment process for continuing to share your knowledge and perspectives, providing your expertise, and responding to our questions.

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[1] 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. 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

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. Over the course of this Regional Assessment, participants questioned the need for and economic viability of offshore wind in this province.[3] Where participants have shared with the Committee completed or planned studies that address these aspects, that information is provided in this Report to support a more comprehensive understanding of the opportunities for offshore wind.

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

[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.
[2] The Committee sent a letter to the Ministers in October 2023 requesting amendments to the Agreement. The Ministers sent a response on March 15, 2024, along with the amendments to the 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.

that are subject to the IAA.[4] 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 that this Regional Assessment not only contributes to future impact assessments of offshore wind projects under the IAA, but also to future offshore wind planning and licensing 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-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).

[4] The Committee is aware of the Supreme Court of Canada opinion on the IAA and the proposed amendments to the IAA. Please refer to Section 3.4 of this Report.

1.3.1 Interim Report

The phased approach enabled the Committee to first focus their efforts on providing preliminary information, knowledge, and analysis to help inform and improve planning and licensing of offshore wind development projects. This included identification of preliminary offshore wind licencing areas. As described in Section 1.4 of this Report, the federal and provincial governments were well into developing the regulatory framework for offshore wind 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.[5]

As per the Agreement, the Interim Report included:

- the Committee's preliminary recommendations of particular locations that may and may not be suitable 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.

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.

The Committee will submit the final version of this Report (the Final Report) to the Ministers no later than January 23, 2025. Before submitting the Final Report to the Ministers, the Committee has published this Draft Report for a 60-day public review and comment period. The Committee welcomes Indigenous peoples, fishers and other ocean users, government agencies, environmental organizations, research groups, industry stakeholders, and the public to submit their feedback on this Report. The Final Report will be revised in consideration of feedback received.

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

1.4 Regulatory Context

This subsection 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 introduced *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. At the time of Report publication, the bill has completed its third reading in the House of Commons, and its second reading in the Senate, where consideration in committee is underway.

Bill C-49 includes proposed amendments to the Accord Act to support joint management of offshore renewable energy in the Offshore Area including:

- 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; and,

- establishing the regulatory and liability regime for abandoned facilities relating to offshore renewable energy projects.

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 does not affect the Committee's work. The Agreement states that "offshore area has the same meaning as set out in section 2 of the Accord Acts." Should the amended Accord Act come into force with a new definition of "offshore area", then the Agreement would adopt that new definition.

On February 24, 2024, the Government of Canada pre-published the proposed Canada Offshore Renewable Energy Regulations (ORER) in the *Canada Gazette, Part I* for public feedback. Publication of these regulations in the *Canada Gazette, Part II* is anticipated for Fall 2024. These regulations would apply only to renewable energy projects in federally managed offshore areas, though they will serve as a model for offshore renewable projects under the Accord Act. The Government of Canada anticipates publishing the Accord Act ORER in the *Canada Gazette*, *Part I* in Fall 2024, and in *Canada Gazette, Part II* in late 2024.[6]

The Committee understands the Governments of Canada and Newfoundland and Labrador anticipate identifying Strategic Priorities for the Call for Bids in late 2024 or early 2025, followed by the Call for Bids for Offshore Wind Areas sometime in 2025.

1.4.2 Offshore Wind Projects under the IAA

The second goal of this Regional Assessment is to provide information and recommendations to help inform future impact assessments of 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 sections 45 and 46 of the Schedule to the Physical Activities Regulations (the Project List) under the IAA:

- 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.

[6] Natural Resources Canada (NRCan) leads the ORER Initiative. The ORER initiative is separate from this Regional Assessment.

- 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.[7] The Committee is also aware that the IAA requires the Impact Assessment Agency of Canada (IAAC)[8] to review the Project List five years after the day on which these Regulations came into force (i.e. by August 2024). 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, to September 27, 2024.[9] 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 consultation opportunities. The IAAC expects that this regulatory process would begin in Fall 2024. Neither the IAA amendments nor the Project List review affect the Committee's work. The Agreement remains valid should the IAA be repealed, amended, or replaced by new legislation.[10]

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, 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.[11] 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.[12,13]

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.

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[7] On June 20, 2024, the *Budget Implementation Act, 2024*, received Royal Assent and brought into force amendments to IAA.
[8] 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.
[9] IAAC. 2024. Discussion Paper on Project List Review
[10] Agreement, "Interpretation", pg. 3.
[11] s. 109 and s. 112 of the IAA, s.s.2(2) of the Physical Activities Regulations.
[12] Letter from Shayne McDonald, Chair of the Regional Assessment Committee to The Honourable Steven Guilbeault, Minister of Environment and Climate Change, October 4, 2023.
[13] Letter from The Honourable Steven Guilbeault to Shayne McDonald, Chair of the Regional Assessment Committee, November 16, 2023.

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.

Section 4 of this Report provides a generic description of offshore wind development activities throughout the construction/expansion, operations, and decommissioning and abandonment phases.

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. 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 level assessments would consider any land-based infrastructure associated with an offshore wind development. That said, this Regional Assessment does consider land-based effects of offshore 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

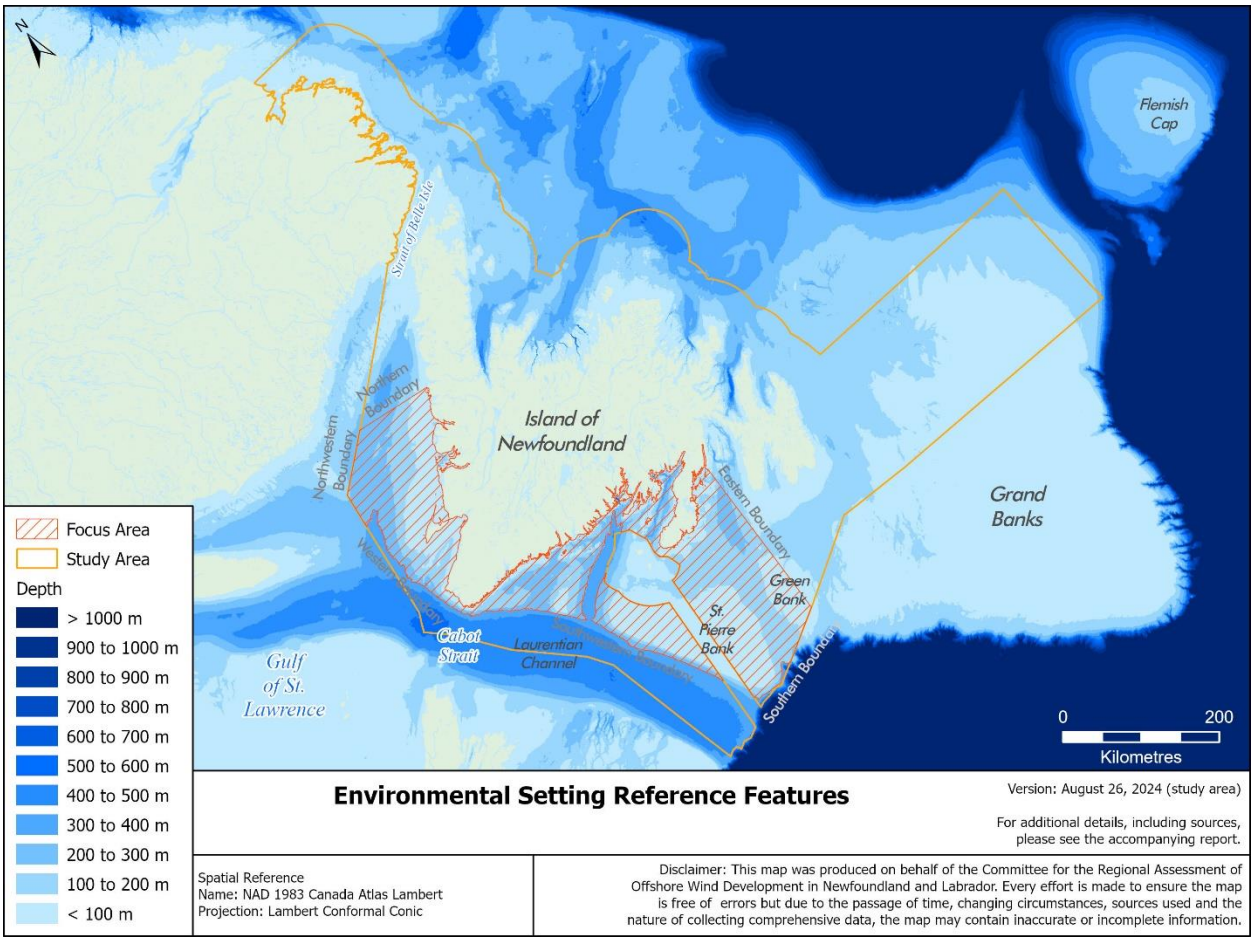

Figure Description: This figure shows the island of Newfoundland, southern Labrador, and parts of Quebec and the Maritimes. The Study Area surrounds the island of Newfoundland and southern Labrador. The Focus Area is generally around the south and west coasts of the island of Newfoundland. The figure also shows the Exclusive Economic Zone, and water depths ranging from 0 to over 10000m deep.

Data sources:

GEBCO Compilation Group. (2023). GEBCO 2023 Grid. [Dataset] (doi:10.5285/f98b053b-0cbc-6c23-e053-6c86abc0af7b)

IAAC. (2023). Focus Area for the Regional Assessment of Offshore Wind Development in Newfoundland and Labrador [shapefile]. Open Government. https://open.canada.ca/data/en/dataset/81560d1e-8394-4b51-8212-2bbe4d8a5ea2

IAAC. (2023). Study Area for the Regional Assessment of Offshore Wind Development in Newfoundland and Labrador [shapefile]. Open Government. https://open.canada.ca/data/en/dataset/e7dec0ae-f1dc-49ac-8230-5cb1a3b39c54

Natural Resources Canada. (2023). CanVec [dataset]. Topographic Data of Canada - CanVec Series. https://open.canada.ca/data/en/dataset/8ba2aa2a-7bb9-4448-b4d7-f164409fe056/resource/59968c05-6a94-4120-b525-947ca8298d7b

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.[14] 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 suitable 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 suitable for offshore wind as information and data gaps are filled and as technology advances. The Committee's process for selecting its recommended offshore wind licensing areas is detailed in Section 6 of this Report.

The assessment (i.e., description of existing conditions and consideration of effects across the various environmental, health, social, cultural, and economic components under Section 7 of this Report) is also conducted on 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 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

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

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.

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 largely applicable to planning, licencing, and impact assessment of offshore wind within the entire Study Area, and beyond.

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. 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 is very much dictated by technical feasibility (which in turn influences commercial viability),[15] the Committee found it prudent to focus on offshore wind technologies that may be in use in the reasonably foreseeable future. The Committee believes that portions of the Study Area they have currently not identified as suitable for offshore wind at this time may become suitable in time.

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. It is important to acknowledge that the Committee's recommendations are not binding. The Ministers have complete discretion to determine if and how the results of the Regional Assessment will be used.

As per the Agreement, the Committee will submit its Final Report directly to Ministers on or before January 23, 2025. The Ministers, not the Committee, will make the Final Report available to Indigenous groups and the public and will advise that is available on the Registry. The Ministers are not bound to any timeline for making the Final Report available.

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:

[15] 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 more economical, fixed turbines or concrete gravity-based structures (tested to withstand pack ice) are preferred in Newfoundland and Labrador.

- 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. 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 Appendix A
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 Appendix A
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
A1.6 Indigenous, Public, and Stakeholder Participation	

Regional Assessment Requirements (Terms of Reference)	**Report Section(s)**
a) Ensure that Indigenous peoples and the public are provided with opportunities to participate meaningfully in the Regional Assessment.	Section 3 Appendix A Appendix B
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 group with information and interests related to the Regional Assessment and who wishes to participate in it.	Section 3 Appendix A Appendix B
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 Appendix A Appendix B
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 Appendix A Appendix B
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	Section 3 Appendix A Appendix B

Regional Assessment Requirements (Terms of Reference)	**Report Section(s)**
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; 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 Appendix A Appendix B
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 Appendix A Appendix B

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 Appendix A Appendix B
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
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, 11
k) Make recommendations to address such information and knowledge gaps as appropriate.	Sections 5, 6, 7, 8, 9, 11
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

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
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
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	Section 10

Regional Assessment Requirements (Terms of Reference)	**Report Section(s)**
change, and make recommendations on the manner in which future licencing decisions and/or impact assessments should consider and address these factors.	
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
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 Appendix A Appendix B
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
c) Recommendations to address such information and knowledge gaps as appropriate.	Sections 5, 6, 7, 8, 9, 11
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
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	Sections 5, 6, 7, 8, 9, 10, 11

Regional Assessment Requirements (Terms of Reference)	**Report Section(s)**
ii. Any circumstances where the nature, location, timing and potential accumulation of these effects may result in potential cumulative effects (positive or adverse).	
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
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
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

Regional Assessment Requirements (Terms of Reference)	**Report Section(s)**
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 Appendix A Appendix B
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 Appendix A

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, application of the precautionary principle, and use of the Atlas.

2.1 Committee Composition

The Committee consists of five members appointed by the federal and provincial Ministers.[16] The Committee members come 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 is supported by a Secretariat, comprised of staff seconded from the IAAC. For the duration of the Regional Assessment, the Secretariat carries 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 is appointed by government, the Committee operates independently from government. Procedural fairness is fundamental to the Committee's governance. The Committee's priority is 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 elaborate upon the general principles and processes described in the Agreement and inform participants how the Committee functions. The procedures describe how the Committee maintains its independence, handles bias and conflict of interest, ensures information is publicly accessible in a timely manner via the Registry, and facilitates confidentiality. The procedures are available on the Registry.

2.2.2 Committee Meetings, Information Exchange, and Decision-Making

The Committee and Secretariat are afforded "deliberative privilege." Deliberative privilege ensures confidentiality in the decision-making process, which promotes 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 meetings are protected

[16] Committee member biographies.

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 discuss the Indigenous engagement planning topic only. 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 Principle

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 the precautionary principle means basing decisions on evidence available now that demonstrates technical feasibility of turbine technologies and shows potential impacts to environmental, health, social, and economic components can be avoided or mitigated before offshore wind development can proceed in a given area. While the Committee is drawing upon experience with the local offshore oil and gas industry and expertise from the offshore wind 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 study and monitoring of local projects to address current knowledge and data gaps. A key part of the Committee's mandate is 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, impact assessments are conducted, and local evidence and knowledge builds, governments may be able to gradually ease precautionary measures.

2.4 Use of the Canada Marine Planning Atlas

The Committee is mandated to conduct the Regional Assessment in a manner that promotes transparency and encourages public input and participation. Wherever possible, the Committee uses 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, offshore wind licensing areas), the Committee used the Canada Marine Planning Atlas – Atlantic (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 gives 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.

2.4.1 About the Atlas

Fisheries and Oceans Canada (DFO) works with federal, provincial, and Indigenous partners on developing and maintaining the Atlas as part of a broader Marine Spatial Planning (MSP) initiative. The Atlas is an interactive mapping tool that provides users with an overview of activities, and ecological processes and features. It is a place where all Canadians can go to find data on Canada's oceans and marine spaces. It has been developed through extensive collaboration with partners and stakeholders to cater to a range of user expertise. The scope of the data is curated to focus on published data that meets a national level of data quality standards. The Atlas is currently the Version 1 prototype, and DFO strives to evolve the product based on user feedback (DFO, 2024). The Committee has found the Atlas to be a valuable tool in this process and has made recommendations for DFO consideration as they develop future versions.

2.5 References

DFO (2024). Canada Marine Planning Atlas. https://www.dfo-mpo.gc.ca/oceans/planning-planification/atlas/index-eng.html

3. Indigenous, Public, Fisheries, and Stakeholder Engagement

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

- respects Indigenous rights, culture, and traditional knowledge;
- encourages stakeholders to actively participate in the Regional Assessment; and,
- establishes an open and constructive dialogue with participants.

Since May 2023, the Committee has been engaging with Indigenous peoples, fishers and other ocean users, municipal leaders, federal and provincial governmental agencies, environmental organizations, research groups, offshore wind developers and service companies, and individuals possessing information, knowledge, and interests relevant to the Regional Assessment. The Committee had 82 meetings and engagement sessions, attended by over 700 participants.

This section provides an overview of the Committee's engagement approaches, while 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). This Report describes how specific engagement outcomes have helped inform the Regional Assessment to date. It is important to note that the Committee continues to hear from participants leading up to the submission of the Final Report.

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 here.

This Regional Assessment is 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 above), 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 14 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, 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 QFN and MFN. QFN has more than 25,000 members and is made up of 67 traditional Mi'kmaq communities. QFN 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.[17] Additionally, there are several Indigenous organizations that are legally incorporated entities on the west coast whose members include QFN members. These Indigenous organizations assert land and Treaty rights independently of QFN. Based on suggestions received in public engagement sessions, the Committee decided to engage these Indigenous organizations directly.

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 MFN live at Conne River, with an additional 2,000 members living off-Reserve.[18]

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.[19] The Committee's Indigenous Engagement - What We Heard Report (Appendix A) is inclusive of the IPP contents.

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

[17] QFN Website, Qalipu Background
[18] MFN Website, About
[19] The last update to the IPP was for the Interim Report in March 2024. This Report is inclusive of all contents in the IPP, plus engagement activities and outcomes from March 2024 to early September 2024. The Final Report (January 23, 2025) will reflect additional engagement activities and outcomes from September 2024 to the end of the Regional Assessment process.

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 process, and the implications for Indigenous engagement. These concerns were central to the Committee's request to the Ministers to amend the Agreement.

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 has established the Indigenous Knowledge Advisory Group. Indigenous Knowledge Advisory Group formation, function, 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 over 80 engagement sessions and meetings attended by participants representing Indigenous groups and organizations, fishers and other ocean users, government agencies, environmental organizations, and members of the public. The Committee held two meetings each and provided three document review opportunities to the Fisheries and Other Ocean Users and Scientific Information and Community Knowledge advisory groups. 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. The Committee's Public, Fisheries, and Stakeholder Engagement - What We Heard Report (Appendix B) is inclusive of the PP contents.[20]

3.3.2 Advisory Groups

The Committee has 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 established a Gender Based Analysis Plus (GBA Plus) Advisory Group.[21]

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

[20] There will be no further updates to the PP. This Report is inclusive of all contents in the PP. The Final Report (January 23, 2025) will reflect additional engagement activities and outcomes from September 2024 to the end of the Regional Assessment process.
[21] 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

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.

Advisory group formation, function, membership, activities, and outcomes are detailed in the Committee's What We Heard Reports (Appendices A and B).

3.3.3 Federal and Provincial Authorities

The Committee engaged 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.[22] 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.

[22] 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
Introducing the Regional Assessment	May 2023 – September 2023	• Gathering Indigenous knowledge and perspectives • Overview of the Regional Assessment objectives, scope, and timelines • IPP and PP feedback • Promotion of advisory groups
Defining the Focus Area	August 2023 – October 2023	• Gathering Indigenous knowledge and perspectives • Proposed and Final Focus Area based on technical and economic constraints
Identifying Preliminary Offshore Wind Licencing Areas	November 2023 – March 2024	• Gathering Indigenous knowledge and perspectives • Proposed constraints analysis • Final constraints analysis and resulting preliminary offshore wind licencing areas for Interim Report
Preparing the Draft Report	March 2024 – September 2024	• Gathering Indigenous knowledge and perspectives • Adjustments to constraints analysis and offshore wind licensing areas • Input on setting,[1] effects, mitigation, follow-up, and monitoring
Finalizing the Report	September 2024 – November 2024	• Gathering feedback on Draft Report via the public review and comment period

Table Description: The table lists the five phases of engagement for the Regional Assessment, with timeframes for each phase, and the focus of discussion for each phase. Engagement started in May 2023 with introductory discussions and will end in November 2024 at the conclusion of the public review and comment period.

[1] Setting is used interchangeably with "existing conditions."

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, decommissioning, and abandonment phases.

4.1 Overview of Power Generation

Figure 4.1 provides an overview of how electricity generated from offshore wind turbines reaches 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

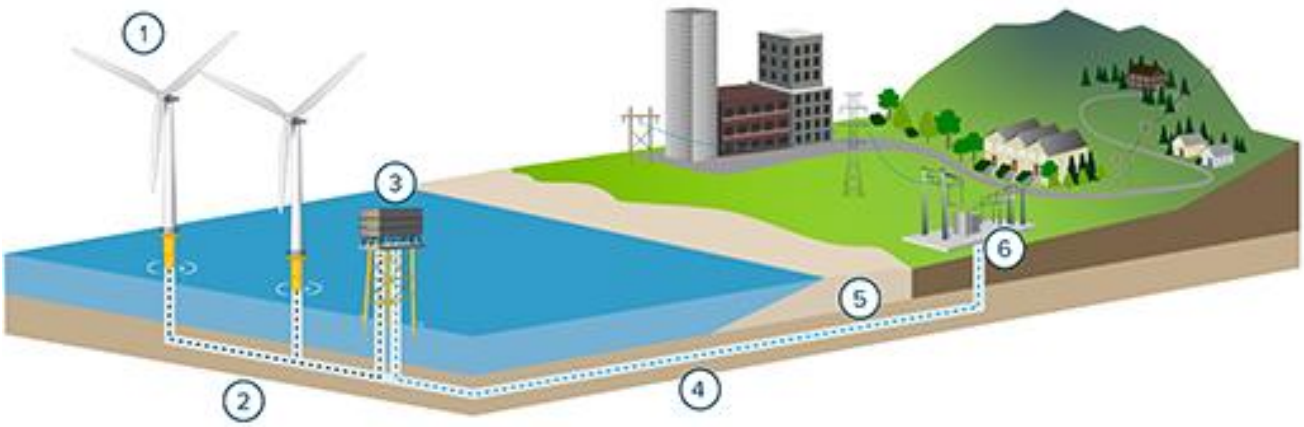

Figure Description: Image showing offshore and onshore landscape with respect to offshore wind energy generation and transmission. Two offshore wind turbines are depicted. Electricity from the turbines moves towards an offshore substation through undersea cables. From there, the electricity moves to the onshore substation through a buried cable where it is then transferred to the existing transmission network. Image 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 and 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 and rotate to capture the energy of the wind and convert it into mechanical energy. There are typically three blades, made primarily of fiberglass, carbon fiber material, and often balsa wood, and curved to create an air pressure difference across the two sides of the blades that make the blades spin.
- The nacelle (3) is the component that houses the internal infrastructure of the turbine, which converts the mechanical energy from the blades into electrical energy that is then transferred from the turbine to a substation (either on or offshore).
- 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 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

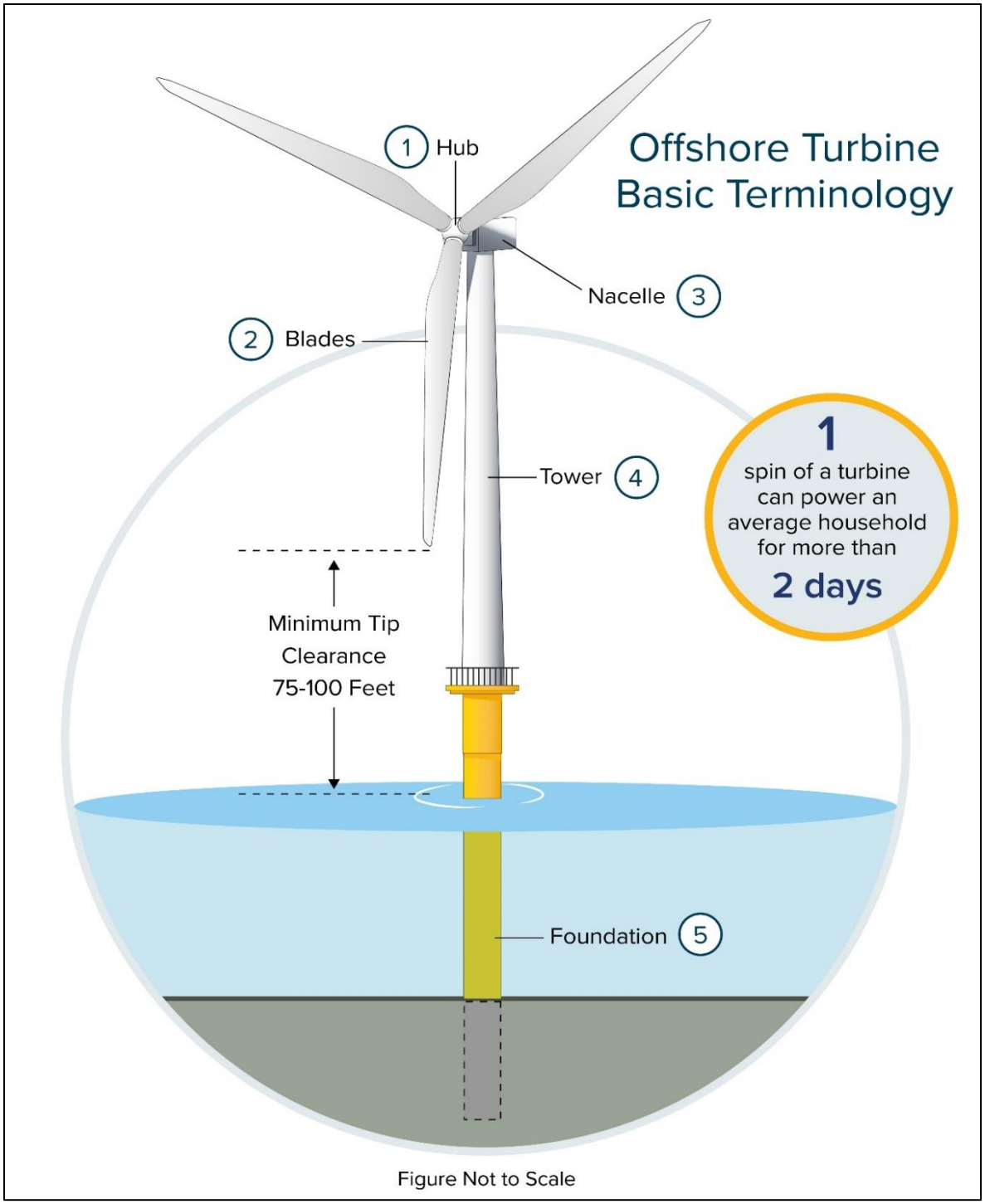

Figure Description: The image depicts a single offshore wind turbine. It is labelled to indicate the following components: (1) hub, (2) blades, (3) nacelle, (4) tower, and (5) foundation. Image Source: NYSERDA (2024).

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 improved. 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 and dimensions of hub heights of approximately 150 m and blade rotor diameters of approximately 220 m.

Specific examples of the enlarging wind turbines include: the 2015 Block Island Wind Farm in offshore State of New York which has turbines that are 180 m in height and rotor blade diameters of 150 m and generate 6 MW of electricity, recent turbines in the Netherlands which range from 100-200 m in height with diameters ranging from 80 to 200 m, and the General Electric's Haliade X offshore turbine (12 MW) which is approximately 260 m in height, with a rotational diameter of approximately 220 m. The Haliade X represents one of the largest turbines in the industry and is indicative of the current trend globally. Figure 4.3 also compares the heights of some turbines with a recognizable landmark, the Eiffel Tower.

Figure 4.3 Trends in the Development of Offshore Wind Turbines

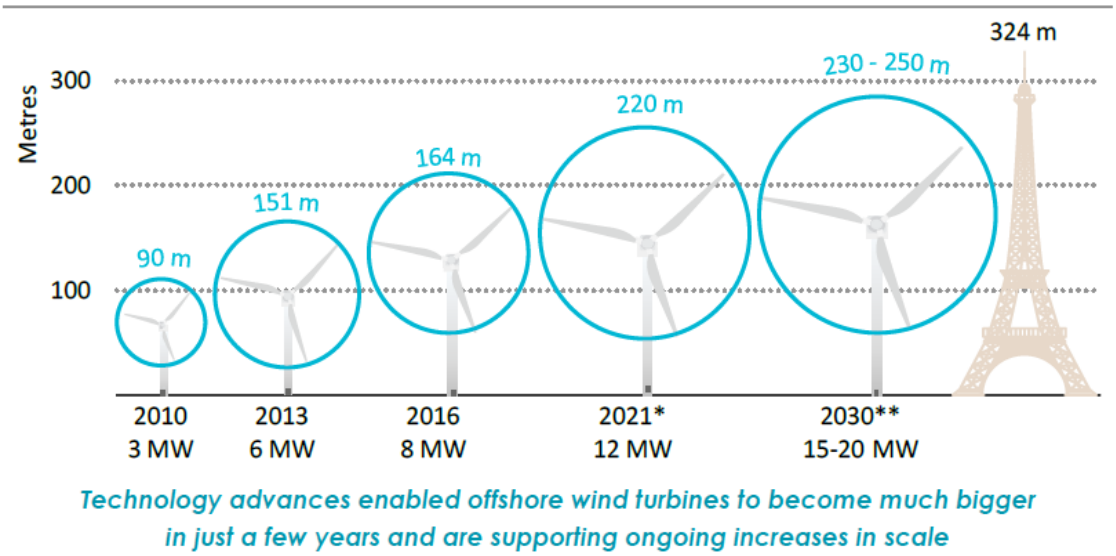

Figure Description: The figure above demonstrates how turbine technologies have increased in size since 2010 and are projected to continue increasing in size into the future. The turbine sizes range from 100 m in height in 2020 for a 3 MW turbine, to 200 m in height in 2030 for a 15-20 MW turbine. The Eiffel Tower (324 m in height) is provided for comparison.
Image Source: Lara, 2020

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, and include designs such as monopile, jacketed, tripod, suction bucket, gravity-based systems (GBS), and variations of each. Figure 4.4 illustrates some fixed foundation types. Fixed foundations are typically used in shallower water (up to depths of approximately 60 m). The footprint of the foundation on the seabed can range in size, depending on the scour protection and anchoring substrate that is used to help fortify the foundation during installation. This can include positioning rocks and other material around the base of the foundation prior to installation, to aid in stability. The larger the turbine design, the more foundation is required at the base to account for the weight and force of the turbine.

Figure 4.4 Fixed Foundation Types

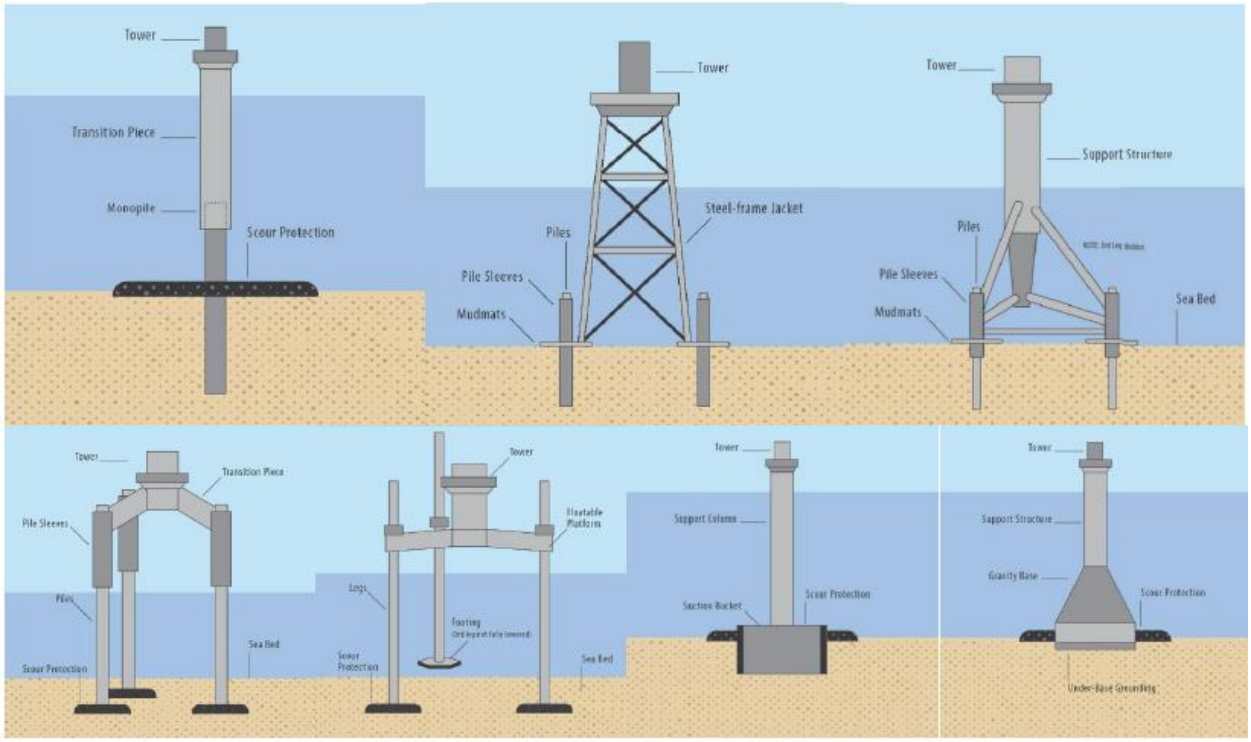

Figure Description: From top left to right: monopile, jacket foundation, tripod foundation; from bottom left to right: tri-pile foundation, jack-up foundation, suction bucket or caisson foundation, and gravity-based foundation.
Image Source: BOEM, 2020

Most fixed foundations penetrate the seafloor. An exception is the gravity-based foundation which is essentially a concrete block that is lowered to the seafloor. Its size and weight would be sufficient to hold the turbine infrastructure in place. The concrete block would need to be made at a laydown yard and transported to the offshore site.

Some turbine designs include the use of suction bucket foundations which can be included in the various fixed foundation types. These use a series of attachments at the base of the foundation that act similarly to a bucket placed upside down on the seabed. Once lowered and in position, water is then pumped out of the buckets, resulting in a suction effect that will anchor the foundation to the seabed. Figure 4.5 provides an illustration of this technology associated with a caisson foundation.

Figure 4.5 Caisson Foundation (Suction Bucket) Illustration

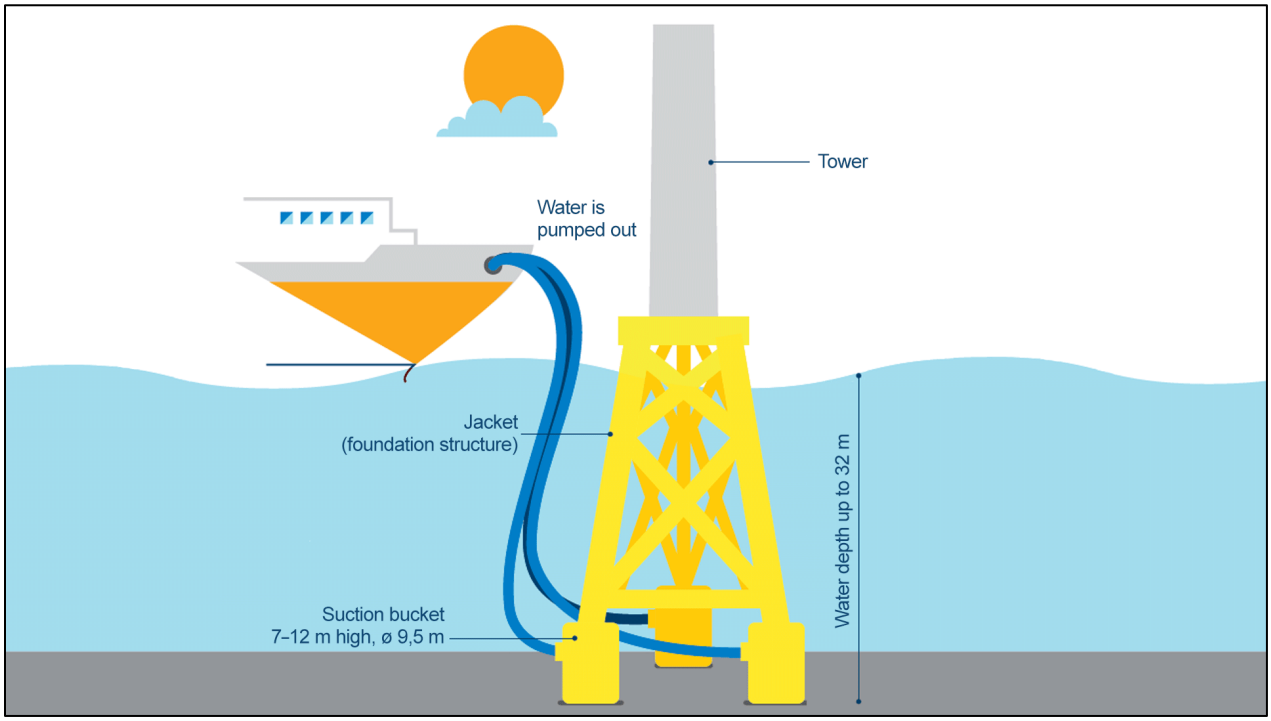

Figure Description: This image shows suction bucket foundations which can be included in the various fixed foundation types.
Image Source: Vattenfall, 2017

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 back to the seabed. Some common floating foundation designs include spar buoy, tension leg platform and semi-submersible (Figure 4.6). 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.

Figure 4.6 Floating Foundation Types

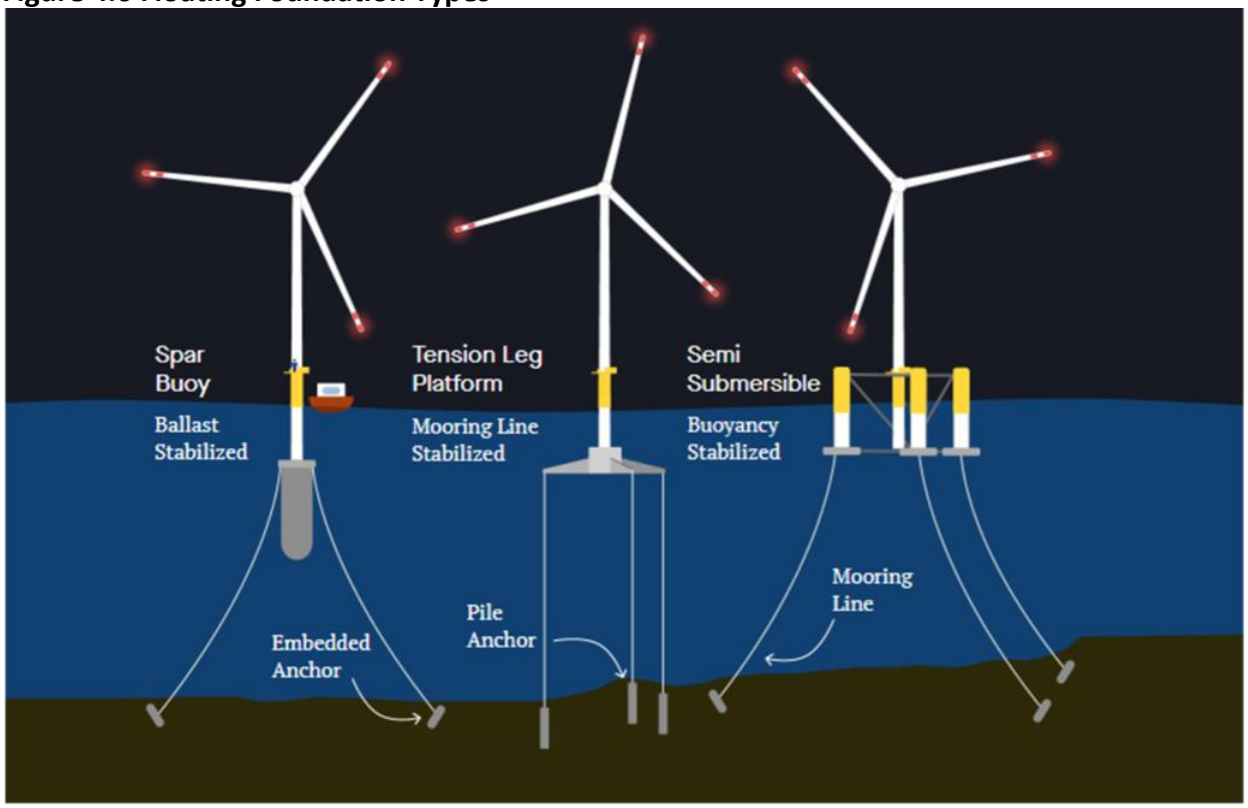

Figure Description: The image shows common floating foundation types: spar buoy, tension leg platform, and semi-submersible.
Image Source: Cleantech Group, 2021

The foundation type to be 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 4.1 provides an overview of this information (Eamer, 2021).

Table 4.1 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 (overconsolidated)	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	Refusal from any size hard bed
Floating	>60	<10	Sands and gravels Bedrock Glaciomarine/postglacial mud	Till (boulders may be ideal for anchors)	Range of embedment types

Table description: The 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 those cables that connect the 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, and 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.[23] 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

[23] 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.

years from project installation to decommissioning. The duration of these phases and activities 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 to 3 years in duration and includes the installation of foundations, turbines 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 design has been approved, the physical site preparation and installation of foundations and turbines can begin. This could involve some additional preparation work at each turbine location to make sure the seabed is ready for foundation installation. This can include 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 would start 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 would lower the foundation (using a crane or similar mechanism) onto the seabed and insert the foundation into the seabed. For monopile foundations, hydraulic hammers would pile-drive them 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. The chosen type would be determined based on seabed geological features.

Once the foundations are securely in place, the remaining components are lifted and secured onto the foundation. Lift vessels would be 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 would typically be installed in the project site before the foundations are brought to site. The floating foundations would be 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 would lift the remaining components onto the foundations and secure them.

4.3.2.2 Array and Export Cables Installation

There are different techniques used for laying the cables and providing protection for them. These include burying the cable in the seabed, riprap and concrete mattresses (Figure 4.7). Some of these methods can potentially create artificial habitat for benthic ecosystems and have been used in numerous projects globally. The burying methods include:

- Disturbing the seabed floor and inserting the cable in a trench, typically at a target depth of 1.5 – 2 m,
- Riprap using rock and other material to cover the cable on the top of the seabed floor to protect it,
- Mattresses (long rectangular concrete blocks) that are placed over top of the cable for protection, and
- Frond mats (Figure 4.8), another protective measure that also helps protect against scouring and provides artificial habitat for marine species (Tang and Kilpatrick, 2021).

The method chosen is based on the desired protection of the cable and the surrounding benthic ecosystem. In some instances, depending on project design, horizontal directional drilling may take place to create a route for the cable back to the converter station and the shore.

Figure 4.7 Methods for Burying and Protecting Cables

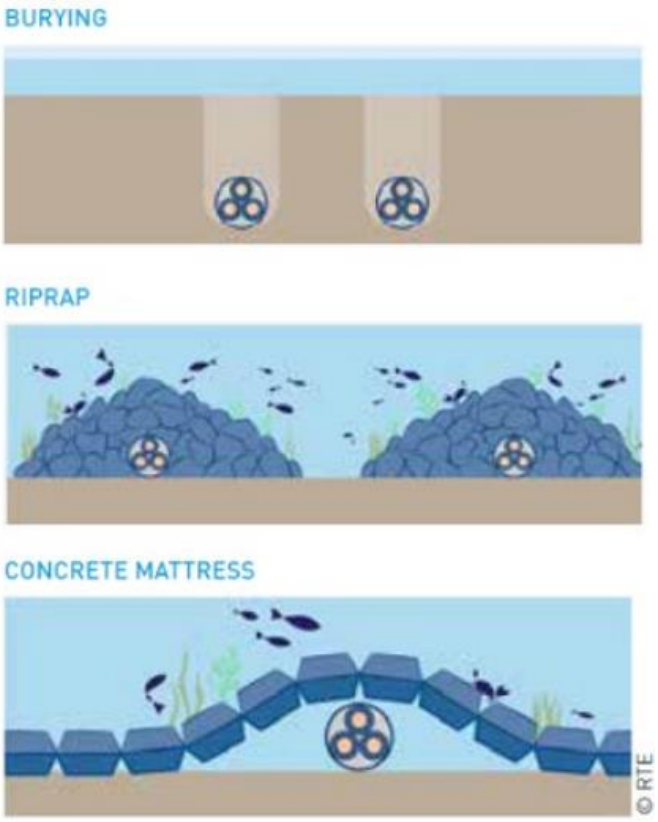

Figure Description: Three methods for burying and protecting cables are burying in cables in the sea floor, installing riprap around the cables, or placing a concrete mattress over the cables.
Image Source: Taormina et al., 2020

Figure 4.8 Frond Mat for Protecting Cables

Figure Description: A frond mat offers another protective measure to help protect cables against scouring and provides artificial habitat for marine species.
Image Source: Seabed Scour Control Systems, n.d.

Cable installation and burial equipment include burial plows, tracked burial machines, vertical injectors, Remotely Operated Vehicles (ROVs) with attached burial equipment, jet plows, trenching machines and burial sleds. Depending on project design, cables can either be laid or buried simultaneously by a single vessel or utilize two vessels – one for laying and the second for burial. The choice of burial methods and protection for subsea cables would be determined based on geological and physical oceanographic properties of the project site (NYSERDA 2017a).

4.3.2.3 Substation and Converter Station Installation

Fixed substations would require similar considerations as turbine installation. The foundation (e.g., monopile or jacketed structure) would be installed into the seabed using designated installation vessels. Topside components would be barged out, lifted and installed onto the foundation. Finally, the array and export cables would be connected and the system commissioned.

4.3.3 Operations

The operations phase can last 20 years or longer. While the longest phase of an offshore wind project, activities are less intense and less frequent compared to the construction phase. Following facility installation, testing and commissioning, the wind farm becomes operational. This includes routine and unscheduled maintenance involving the transportation of equipment and personnel throughout its operational life. Such transportation would occur 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
- Response to occupational health and safety emergencies.

4.3.4 Decommissioning and Abandonment

Decommissioning activities in the offshore wind industry are relatively new. One of the first offshore wind decommissioning projects (Vindeby) was completed in 2017 in Denmark where a facility was removed after 25 years in operation. Other wind farm decommissions have occurred in the North Sea region – three in the UK, one in Germany, and two in Sweden (Cruse, 2019).

It is envisioned that generally the decommissioning process would involve similar activities to those in the construction phase, with similar duration. Operators would need to secure the vessels needed to both disassemble and remove the above water wind turbine structures from the foundations and return to shore based facilities for further handling and processing. Below the water surface, planning and permitting would be required to determine if subsea infrastructure would be completely removed or left fully or partially in place within the project site.

4.3.5 Activities and Vessel Support for All Phases of Development

Construction (expansion), operation, and decommissioning and abandonment phases of offshore wind development require, to varying extents, the presence and operation of vessels to support the ongoing activities. The construction phase of offshore wind development would be the most intense and therefore poses higher potential for interaction, primarily due to the number of vessels and equipment involved and associated air and noise emissions. The operation phase would be focused on routine and emergency maintenance activities. The decommissioning phase would be expected to be comparable

to construction with regard to vessel requirements and resulting air and noise emissions (NRCan, 2021). Table 4.2 provides an overview of the types of vessels and equipment that would likely be required during the lifecycle of an offshore wind farm. Figure 4.9 provides a general schematic of what these vessels could look like.

Onshore supply bases (laydown yards) provide re-fueling, temporary storage, staging and loading of materials and supplies in support of offshore wind activities. Supply vessels and helicopters are used to transport personnel, equipment and materials to and from an offshore wind farm location. The number of trips will vary depending on the phase of the development, workforce numbers, distance, weather conditions and other factors. The operation of aviation equipment is regulated by Transport Canada, including various applicable regulations and operational requirements for helicopter flight traffic.

Table 4.2 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
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

Vessel/Equipment	Phase			Purpose
	C	O	D	
Ocean-Going Heavy Transport Vessels	X		X	Ocean-going vessels that may transport components (e.g., monopiles and blades) to and from the site
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 would likely be required during the lifecycle of an offshore wind farm.
Notes: C – Construction phase, O - operations phase, D – Decommissioning phase.
Sources: Corio, 2022; NYSERDA, 2017f; NYSERDA, 2017b

Figure 4.9 Overview of Potential Vessels Used in Offshore Wind Development

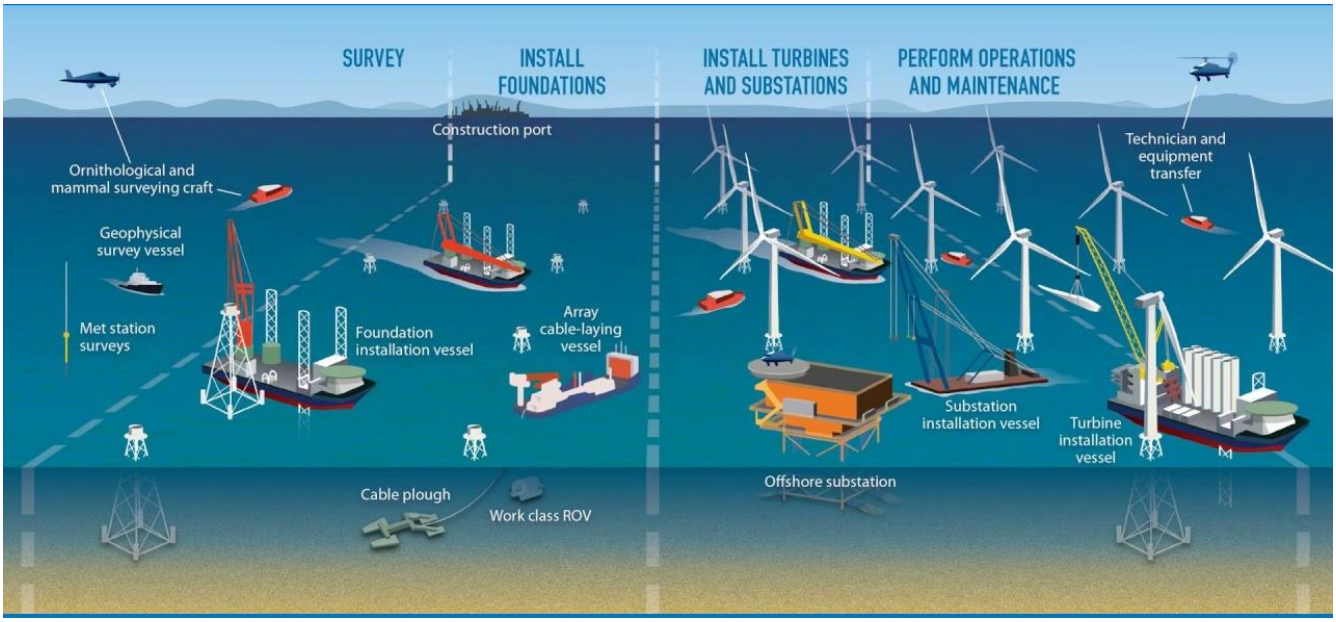

Figure Description: The image provides a visual representation of the types of vessels and equipment that would likely be required during the lifecycle of an offshore wind farm.
Image Source: Clean Energy Group (Webinar: An Offshore Wind Vessel and Other O&G Sector Opportunities (6.6.2017) - YouTube)

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5. Defining the Regional Assessment Focus Area

As outlined in Section 1.5.2.2 of this Report, the Committee identified a Focus Area within the Study Area. The Committee centered its information gathering and analysis within this area.

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.[24] On March 12, 2024, the Minister of Environment and Climate Change Canada wrote to the Committee indicating acceptance of the Focus Area.[25]

This section describes the Committee's approach, considerations, and decision to identify the Focus Area.

5.1 Constraints Used to Define the Focus Area

The Committee reviewed several considerations that could influence offshore wind development interest and found icebergs and water depth are likely among some of the most limiting physical constraints for offshore wind development in Newfoundland and Labrador. The following sections describe the Committee's findings at the time of its evaluation (up to November 7, 2023).

5.1.1 Considering Icebergs

Regarding icebergs, 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

[24] 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.
[25] The Minister's letter to the Committee is available on the Regional Assessment Registry Page under document reference number 228.

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.

5.1.2 Considering Water Depth

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

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 more economical, fixed turbines or concrete gravity-based structures (tested to withstand pack ice) are preferred in Newfoundland and Labrador. Fixed turbines are currently suitable for depths up to 60 meters (ICF, 2020; Tang and Kilpatrick, 2021).

The Committee decided to include areas with water depths less than or equal to 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.

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 their work. The Committee's What We Heard Reports (Appendices A and B) 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 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 licencing areas.

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

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 meters 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 their 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 be expanded to 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 which would provide a risk assessment of ice encounters within the area and information on ice management planning, including a history of ice management by oil producing operators and how ice management would include the offshore wind development operations.

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6. Identifying Recommended Offshore Wind Licencing Areas

This section includes an overview of offshore wind development licencing and project siting practices in other jurisdictions, and describes work undertaken by the Committee to identify areas it recommends the Ministers consider using as offshore wind licencing areas. A technical methodology report including the steps undertaken in GIS to identify licencing areas is in progress and will be appended to the Final Report.

As some important background for reviewing this section, readers should note that NRCan has also undertaken work to support the identification of candidate regions that could become designated offshore wind energy areas in the future. NRCan's work was published in February 2024 as an initial analysis of spatial consideration for potential future offshore wind areas in Atlantic Canada.[26] Currently, this is the only publicly available study completed on identifying potential offshore wind areas in Newfoundland and Labrador.

The Committee is undertaking 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 has reviewed offshore wind licencing processes in the United Kingdom of Great Britain and Northern Ireland (UK), New England (United States of America (US)), Belgium, the Netherlands, France, Denmark, Germany, and Albania. In these jurisdictions, potential impacts of offshore wind are considered at various stages from area identification to licencing, and project approval processes (BOEM, 2023a; 2023c; Danish Energy Agency, 2022; Mahdi, 2022; Ministère de la transition écologique, 2019; 2021; The Crown Estate, 2019; 2021; Wind and Water Works NL, 2022).

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

At the licencing stage, a central body typically selects a designated area within which licenses would be issued. Bidders are required to submit 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

[26] 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

governing body (BOEM, 2023b; 2023c; Danish Energy Agency, 2015; 2020; 2022; Government of Netherlands, 2021; The Crown Estate, 2022; 2023a; 2023b; 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 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. This report explores the assessment and regulation of offshore wind development in Germany, the UK, and the US. It ultimately showed the assessment of regulation of offshore wind development benefits from coordinated planning and assessment processes that are conducted from the highest to the lowest levels of planning, assessment, and decision-making. They identified the following best practices that could be considered in the Canadian context:

- 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.

They 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 Impact Assessment Act to exclude offshore wind developments proposed within the Regional Assessment Study Area from Impact Assessments under the IAA.
    - 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 Newfoundland and Labrador Offshore Wind Regional Assessment (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 assessment are best-suited to providing 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; 2023c; European Commission, 2024a; 2024b; 2024c; 2024d; The Crown Estate, 2019; 2021). As described in the following sections, the Committee considered these and other factors when identifying offshore licencing areas.

6.2 Approach for Identifying Licencing Areas

The Committee identified offshore wind licencing areas using a stepwise approach (Figure 6.1). Beginning with the Study Area outlined in the original Agreement, the Committee defined a more precise Focus Area where they would prioritize the remainder of their work. The Committee proceeded to identify preliminary offshore wind licencing areas, which were published in the Interim Report in March 2024.

The Committee used a constraints analysis to identify the Focus Area and, subsequently, to identify offshore wind licencing areas. The process used to identify the Focus Area involved removing portions of the Study Area where the Committee expects offshore wind development would be less likely in the foreseeable future.[27] The process to identify

[27] Information on the Committee's work to define the Focus Area is available under *Section 5 of this Report*

licencing areas involved successively removing constraints from the Focus Area, where offshore wind development should not occur 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 licencing areas.

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

Following completion of the Interim Report, the Committee concentrated on assessing potential impacts of offshore wind development on environmental, social, health and economic components in the Focus Area. However, the Committee also continued to accept participant feedback on the preliminary licencing areas and considered whether to refine those areas. The refined areas are presented in this Report.

Figure 6.1. Approach for Identifying Offshore Wind Licencing Areas

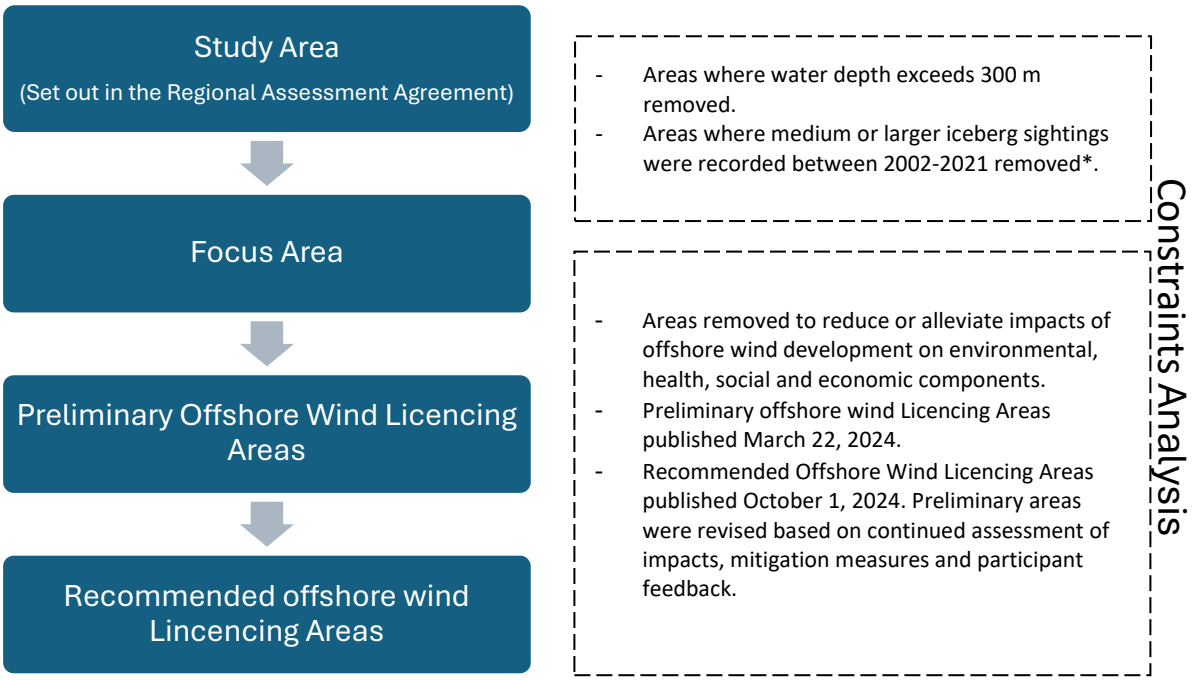


Figure Description: This figure summarizes the Committee's approach for identifying offshore wind licencing areas. Beginning with the Study Area set out in the original Agreement, a constraints analysis was used to identify the Focus Area. The Committee sought public feedback on the Focus Area before finalizing it in November 2023. The Committee continued the constraints analysis (from the Focus Area) to identify Preliminary Offshore Wind Licensing Areas. The Committee published these areas in March 2024, and the areas have since been updated. The Recommended Offshore Wind Licencing Areas are presented in this Report.
*For this analysis, areas with at least one iceberg classified as medium to very large (as outlined in Canadian Ice Service Manual, 2005) in the last 20 years were excluded from the Study Area. Some sections around the southeast and northeast portions of the Study Area were not excluded despite the recorded iceberg presence because a low number of icebergs were recorded in these areas. During October 2023 engagement sessions (held to seek feedback on physical constraints used to identify the Focus Area) 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 (see Registry document183). Potential iceberg and drift ice presence in these areas should be considered during project impact assessments.

A key assumption informing the Committee's approach 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 licencing areas they recommend. The Committee strongly recommends additional work be carried out in advance of offshore wind projects to identify more specific setback distances from various

constraints, informed by scientific study and Indigenous, fisheries, and stakeholder engagement. These setback distances should inform considerations during project-level impact assessments.

Overall, the Committee advocates for the use of a precautionary principle when siting offshore wind development projects. Applying the precautionary principle 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 is mandated to conduct the Regional Assessment in a manner that promotes transparency and encourages public input and participation.

Wherever possible, the Committee uses publicly available information and data to complete their work. Most geospatial data used to identify the offshore wind licencing areas can be found on the Open Government Portal and/or the Atlas.

The Study Area, the Focus Area and the Preliminary Offshore Wind 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 the recommendations and view those areas in relation to other data curated on the Atlas.

To find the Study Area, the Focus Area and the Preliminary Offshore wind Licensing 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.

The Committee has agreed to keep select information provided by NRCan, ECCC, and an offshore wind developer confidential,[28] as per the Committee’s Confidentiality Procedure.

6.3 Constraints Analysis

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

- Processes used in other jurisdictions for identifying offshore wind 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;

[28] Please refer to Registry documents 137 (NRCan), 179 (NRCan), 222 (ECCC), and 190 (Simply Blue Group).

- 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 provides a summary of the Committee's analysis used to identify the Recommended Offshore Wind Licencing Areas. The considerations outlined in the table primarily recount information and engagement outcomes up to March 22, 2024 (when the Preliminary Offshore Wind Licencing Areas were published in the Interim Report) or considerations that informed changes to the Preliminary Offshore Wind Licencing Areas. Additional information and engagement outcomes related to each of the components assessed under the Regional Assessment are under Section 7 of this Report.

6.3.1 Changes to the Preliminary Offshore Wind 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 Licencing Areas published in the Interim Report. Changes were mostly made in response to engagement outcomes. They include four key updates.

Firstly, the Committee has removed more areas where there could be spatial conflict with commercial fisheries. When selecting the Preliminary Offshore Wind Licencing Areas, the Committee removed any areas above the 50th percentile of commercial fishing density in the 2023 DFO, Eastern Canada Commercial Fishing dataset. The current Recommended Offshore Wind Licencing Areas avoid 90% of commercial fishing density. A lower threshold was used 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 7.7.7 of this Report).

The Committee also removed areas identified in DFO's publicly available Community-based Coastal Resource Inventory (CCRI) and groundfish data from the 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 traditional knowledge of local residents. It contains several decades' worth of local knowledge, including Indigenous and Community knowledge. Avoiding areas identified in the CCRI dataset is intended to address these gaps, and better consider local ocean users. Two Committee members disagreed with using both the publicly available and unpublished update to the CCRI data in the constraints analysis. The Committee received more detailed context on the unpublished data following their final deliberations on Report contents but is currently reviewing the detailed information. They believe the CCRI might be best used to provide local knowledge during project level impact assessments.

As another update to Preliminary Offshore Wind Licensing Areas, the Committee removed areas with high vessel traffic density for 2012-2021 available 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.

Finally, the Committee removed a 65 km buffer around Cape St. Mary's to reduce potential impacts to Northern Gannet. 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 Licencing Areas and Offshore Wind Licencing Areas in this Report are the result of updated datasets or improved GIS workflow. For example, the publicly available DFO Critical Habitat dataset was updated in 2024 and has an additional Northern Wolffish area in the Focus Area that was not included/removed in the Interim Report.

6.3.2 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 Preliminary Offshore Wind Licencing 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 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) makes 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 presents 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 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 compatibility with other marine and offshore activities and did not reference evidence or proof of the actual effects of offshore wind on such other activities. They referred to previous feedback they provided on the Focus Area.[29] They indicated the selected "Focus Area" coupled with the application of the constraint analysis, is leading to an end result that is not reflective of Newfoundland and Labrador's true offshore wind 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 about 30 km from Cape St. Mary's, and well

[29] 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.

within the foraging range of the species during breeding season. ECCC indicated that Northern Gannet populations have 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. ECCC's options for compensatory mitigation (i.e., to offset mortalities) will be very limited due to other compensation activities that are in the pipeline (i.e., Northern Gannet Nesting Colony Restoration in Eastern Canada).

In their August 2024 letter, MFN, indicated that they support the Focus Area and applying constraints to identify preliminary offshore wind 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 similarly should take into account Indigenous knowledge and involve engagement of officially recognized First Nations that are adjacent to any proposed development.
- That the CNLOPB (to be rebranded as Canada-Newfoundland and Labrador Offshore Energy Board, or C-NLOEB) Board of Directors have Indigenous representation at the board level 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. 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 Offshore Wind 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 (2024) *Critical Habitat of Species at Risk* dataset	• Critical habitats on federal lands are protected under the *Species at Risk Act* 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 habitat for bank swallow (*Riparia riparia*), bobolink (*Dolichonyx oryzivorus*), and piping plover (*Charadrius melodus melodus*), and northern wolffish (*Anarhichas denticulatus*) 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, 2023). • 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 the federal *Species at Risk Act* (e.g., lesser yellow legs, eastern red bat, hoary bat, leach's storm-petrel, and silver-haired bat). 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 (2023) *Marine Protected Areas* dataset	• Marine Protected Areas (MPA) are designated under the federal *Oceans Act* 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, 2023d). • DFO Newfoundland Region recommended that offshore wind development licencing areas avoid the MPA (DFO, 2023e). • 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, Granot & Belmaker, 2021). • Expert authorities did not provide the Committee with advice or information about 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	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
			understanding of conservation, and providing benefits for Indigenous peoples and coastal communities (Parks Canada, 2023a). • 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.	7.1, 7.3, 7.6

Constraint	Avoided	Approach (Removed from the Focus Area)	Key Considerations	Report Sections for Relevant Components
			• 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.	
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. 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, 2004). • 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: • providing habitat for the Blue Whale and other marine mammals, • supporting high concentrations of groundfish and being a significant area for pelagic fish, • including sea pen and sponge sensitive benthic areas, • 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. • 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 offshore wind development licencing areas. • Engagement did not result in any feedback specific to avoiding SBAs when identifying offshore wind development 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.	7.1, 7.6, 7.7

Constraint	Avoided	Approach (Removed from the Focus Area)	Key Considerations	Report Sections for Relevant Components
			• Indigenous groups and Indigenous Knowledge Advisory Group members expressed the importance of protecting Atlantic salmon and American eel, including avoiding migratory routes of these species. • Public stakeholders suggested the exclusion of the Bay of Islands to protect the Atlantic salmon and other fish migratory routes within the preliminary offshore 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 offshore wind 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. Setback distances from specific fisheries or from turbines are based on these plans and are decided on a project-by-project basis.	7.1, 7.7, 7.13

Constraint	Avoided	Approach (Removed from the Focus Area)	Key Considerations	Report Sections for Relevant Components
			• Expert authorities emphasized the importance of commercial fisheries to the province. • In their response to the Committee's August 2023 Request for advice, DFO noted that non-georeferenced vessels should not be overlooked. They reiterated 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. • avoidance of high-density fishing areas to prevent conflict. • 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 35ft do not carry Automatic Identification Systems (AIS), and not rely solely on data from the DFO Marine 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 feet) 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.).	

Constraint	Avoided	Approach (Removed from the Focus Area)	Key Considerations	Report Sections for Relevant Components
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. • Public participants and the AGC have also recommended the Committee avoid historical ground fisheries, as these could become active 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	7.1, 7.7, 7.13

Constraint	Avoided	Approach (Removed from the Focus Area)	Key Considerations	Report Sections for Relevant Components
			Committee's use in the Regional Assessment. Most CCRI areas overlapping the Focus Area 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. • 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. • 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 offshore wind licencing areas. • Engagement did not result in any feedback specific to avoiding aquaculture sites and licenses when identifying offshore wind licencing areas.	7.1, 7.7, 7.13
Viewscapes – Gros Morne National Park	X	80 km buffer perpendicular to Gros Morne National Park's	• 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.	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
and World Heritage Site		coastal boundaries	• 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 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, & UN EWCMC, 2011). • Parks Canada (2023a) 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 should 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.	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 (2023a) 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 advice on avoiding viewscapes from Sandbanks Provincial Park when identifying offshore wind development 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.	
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 (Newfoundland and Labrador Department of Environment and Climate Change, 2020). Furthermore, the province recognizes benefits of provincially protected areas include providing for the enjoyment and appreciation of outstanding scenery, land cape, and wildlife (Newfoundland and Labrador Department of Environment and Climate Change, 2020). Visibility distances and impacts on viewscapes are highly dependent on project- site- and viewer- specific factors. • Expert authorities did not provide the Committee advice on avoiding viewscapes from provincially protected areas when identifying offshore	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
			wind development licencing areas. The province provided the Committee 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.	
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 advice on avoiding viewscapes or noise from communities and cottages when identifying offshore wind licencing areas. • 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, 7.9, 7.13
Bird Colonies and Foraging Areas	X	10 km coastal buffer around the islands of	• Several bird colonies occur near the Focus Area and support high densities of birds during sensitive life periods.	7.1., 7.3

Constraint	Avoided	Approach (Removed from the Focus Area)	Key Considerations	Report Sections for Relevant Components
		Newfoundland and Ramea 5 km buffer around coastal islands with bird colonies 65 km buffer around Cape St. Mary's	• Birds 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 vary across colonies, species, individual traits, years, and project factors. ECCC is currently developing a risk assessment model to aid in project- and species- specific setback distance determinations. • In response to the Preliminary Offshore Wind Licencing Areas, ECCC also advised the Committee to consider larger buffers around at least some bird colonies. • 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, since 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.	

Constraint	Avoided	Approach (Removed from the Focus Area)	Key Considerations	Report Sections for Relevant Components
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 and 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 advice on setback distances for avoiding Sea Duck Key Habitat Sites when identifying offshore wind development licencing areas. • Engagement did not result in any feedback specific to avoiding Sea Duck Key Habitat Sites when identifying offshore wind development licencing areas.	7.1, 7.3
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 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 offshore wind development licencing areas.	7.1., 7.3
Important Shorebird Sites	X	10 km coastal buffer around the islands of Newfoundland and Ramea	• 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.	7.1, 7.3

Constraint	Avoided	Approach (Removed from the Focus Area)	Key Considerations	Report Sections for Relevant Components
		5 km buffer around coastal islands with bird colonies	• Expert authorities did not provide the Committee 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 development licencing areas.	
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 an important area for birds. • No recommendations or information provided by the province.	7.1., 7.3, 7.5, 7.6
Aerofauna Movement Patterns		Not avoided due to information and data gaps.	• Avoiding known flyways and migration routes when siting offshore wind 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	7.3

Constraint	Avoided	Approach (Removed from the Focus Area)	Key Considerations	Report Sections for Relevant Components
			the Committee acknowledged bird migratory routes are data gaps at this time. • 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 offshore wind licencing areas. • Data only includes airports served by NAV Canada control towers or flight service stations.	7.13

Constraint	Avoided	Approach (Removed from the Focus Area)	Key Considerations	Report Sections for Relevant Components
			• Safeguard distance between airports and windfarms is unclear. The distance varies across jurisdictions and is dependent on project-specific factors.	
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	• 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 km to 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.). • setback distances at a project-specific level (Maritime & Coastguard Agency, n.d.). • The Committee asked Transport Canada for any recommendations on buffers to apply to marine traffic routes either in general or related specifically to offshore wind or other marine activities. Transport Canada 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 to 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
		dataset (all AIS carrying vessels)		
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 offshore wind 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 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 Department of National Defence (DND) has designated areas for exercises that involve only sub-surface activities, and those that may	7.8

Constraint	Avoided	Approach (Removed from the Focus Area)	Key Considerations	Report Sections for Relevant Components
			involve live firing and testing of ammunition and explosives. There is potential for live firing exercises in the Focus Area 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 UXO sites located in or around the Focus Area. Expert authorities did not provide the Committee advice on avoiding military use sites or UXO sites when identifying offshore wind licencing areas. • Engagement did not result in any feedback specific to avoiding military use sites or UXO sites when identifying offshore wind development 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 offshore wind licencing areas. • In their November 2023 meeting with the Committee, MFN indicated support for further consideration of historical and culturally significant	7.1, 7.11

Constraint	Avoided	Approach (Removed from the Focus Area)	Key Considerations	Report Sections for Relevant Components
			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. • 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 licensing 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

This table summarizes the Committee's analysis used to identify the Recommended Offshore Wind Licensing Areas. Considerations outlined in the table primarily recount information and engagement outcomes up to March 22, 2024 (when the Preliminary Offshore Wind Licencing Areas were published in the Interim Report) or considerations that informed changes to the Preliminary Offshore Wind 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'.

Note: * indicates new or updated constraint application since Interim Report.
Data and information sources for analysis: Birds Canada, 2024; DFO, 2004; DFO, 2017a; 2017; 2017c; 2019a; 2019b; 2023a; b; c; d; e; DND, 2021; ECCC, 2022a; 2022b; ECCC, 2023; ECCC, 2024; ECCC-CWS, 2023; Environment and Climate Change Newfoundland and Labrador, 2023; FFA, 2020; Gahrmanov & Beji, 2023; Hüppop *et al.* 2006; IUCN & UN EWCMC, 2011; Jago & Tailor, 2002; Kenchington *et al.* 2016; Key Biodiversity Areas, n.d.;; Maritime & Coastguard Agency, n.d.; NRCAN, 2022; Newfoundland and Labrador Department of Environment and Climate Change, 2022; Nielson & Hemmer, 2017; Ohayon & Belmaker, 2021; Parks Canada, 2023a; 2023b; 2023c; 2024; Ronconi *et al.* 2022; Sea Duck Key Habitat Sites Atlas , n.d.; SEANSE Project Partners, 2019; *Species at Risk Act,* 2002; Templeman, 2007; Transport Canada, 2021; UNESCO World Heritage Centre, 2023; Wieduwilt & Wirth, 2018; *Wilderness and Ecological Reserves Act*, 1990; Willmot *et al.* 2013.

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 Community-based coastal resources inventory (1996-2007 dataset, and the unpublished CCRI update) from the Focus Area to identify offshore wind development 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 removed because of the previously applied coastal buffers.

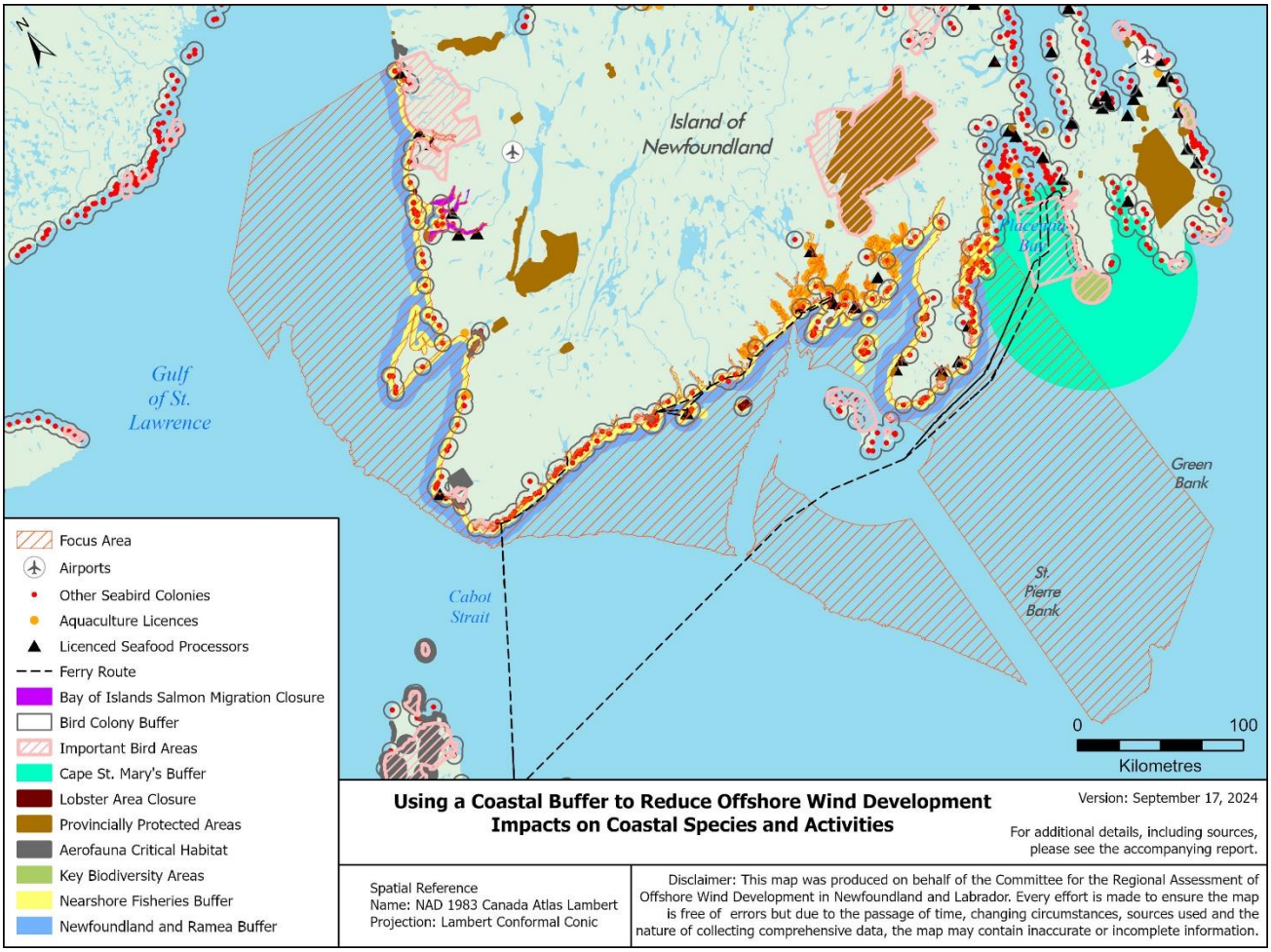
6.3.3 Using a Coastal Buffer

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 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 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 during the licencing stage to alleviate various impacts of offshore wind. 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.
- Aquaculture Sites and Licenses.
- Airports and Marine Aerodromes.
- Provincially protected areas.
- Community and Cottage Viewscapes.

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



This map depicts how the application of a coastal buffer could reduce or avoid impacts of offshore wind on various components. 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:

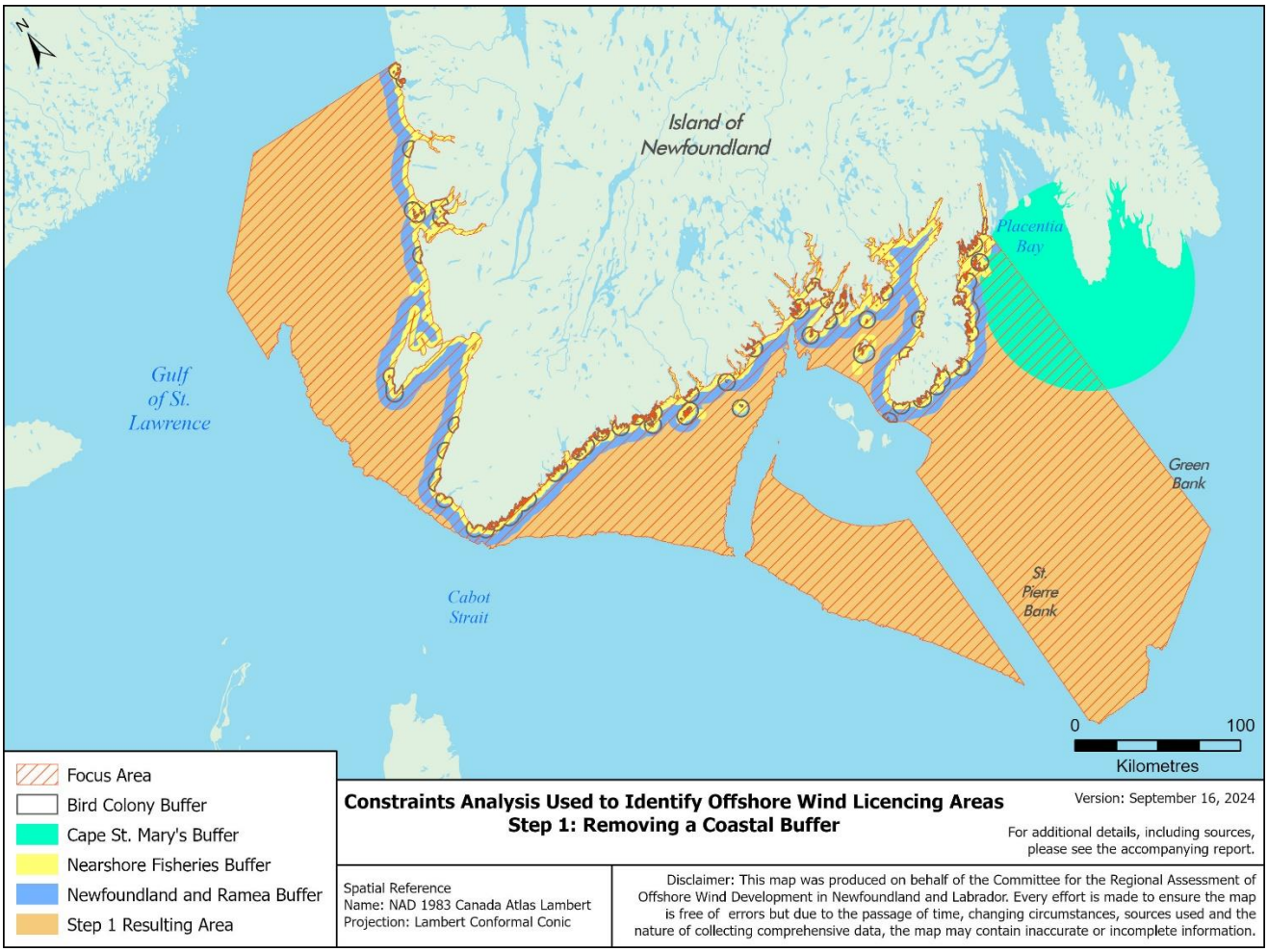
- Newfoundland and Ramea buffer: 10 km buffer around the islands of Newfoundland and Ramea.
- Bird Colony Buffer: 5 km buffer around each island with bird colonies.
- Cape St. Mary's Buffer: 65 km buffer around Cape St. Mary's
- Nearshore Fisheries Buffer: 3 km buffer around any coastal islands if the other buffers were not already applied.

Sources: Canadian Hydrographic Service, 2024; ECCC, 2022a; 2022b; ECCC-CWS, 2023; FFA, 2020; n.d.; IAAC, 2023; KBA, n.d.; NRCan, 2023; Regional Assessment Committee, 2024a; 2024b; 2024d; 2024e; Transport Canada, 2021.

6.3.4 Constraints Analysis Steps

The following map series shows each step in the constraints analysis.

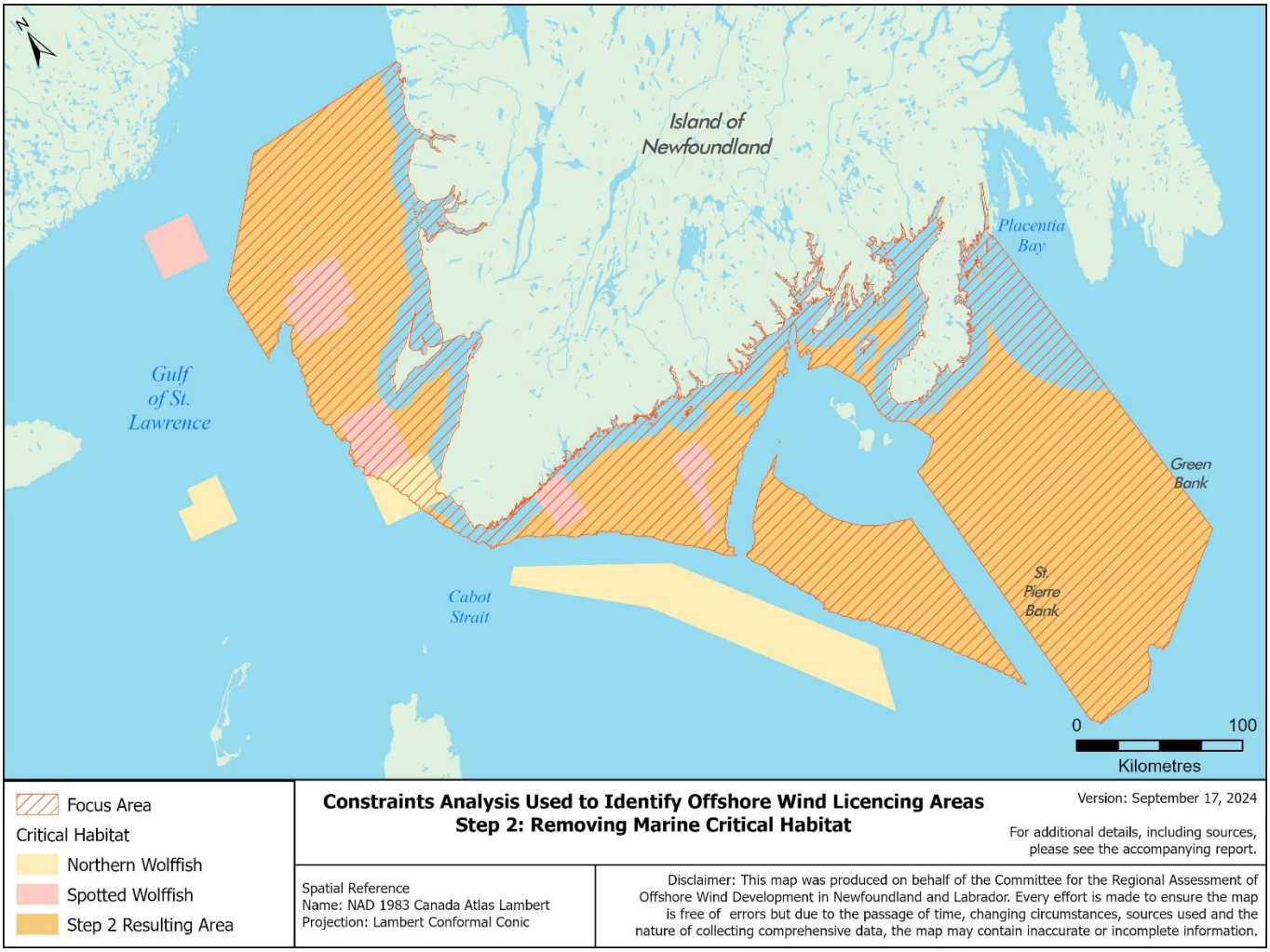
Figure 6.3. Step 1: Removing a Coastal Buffer



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 withs 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 offshore wind licencing areas.

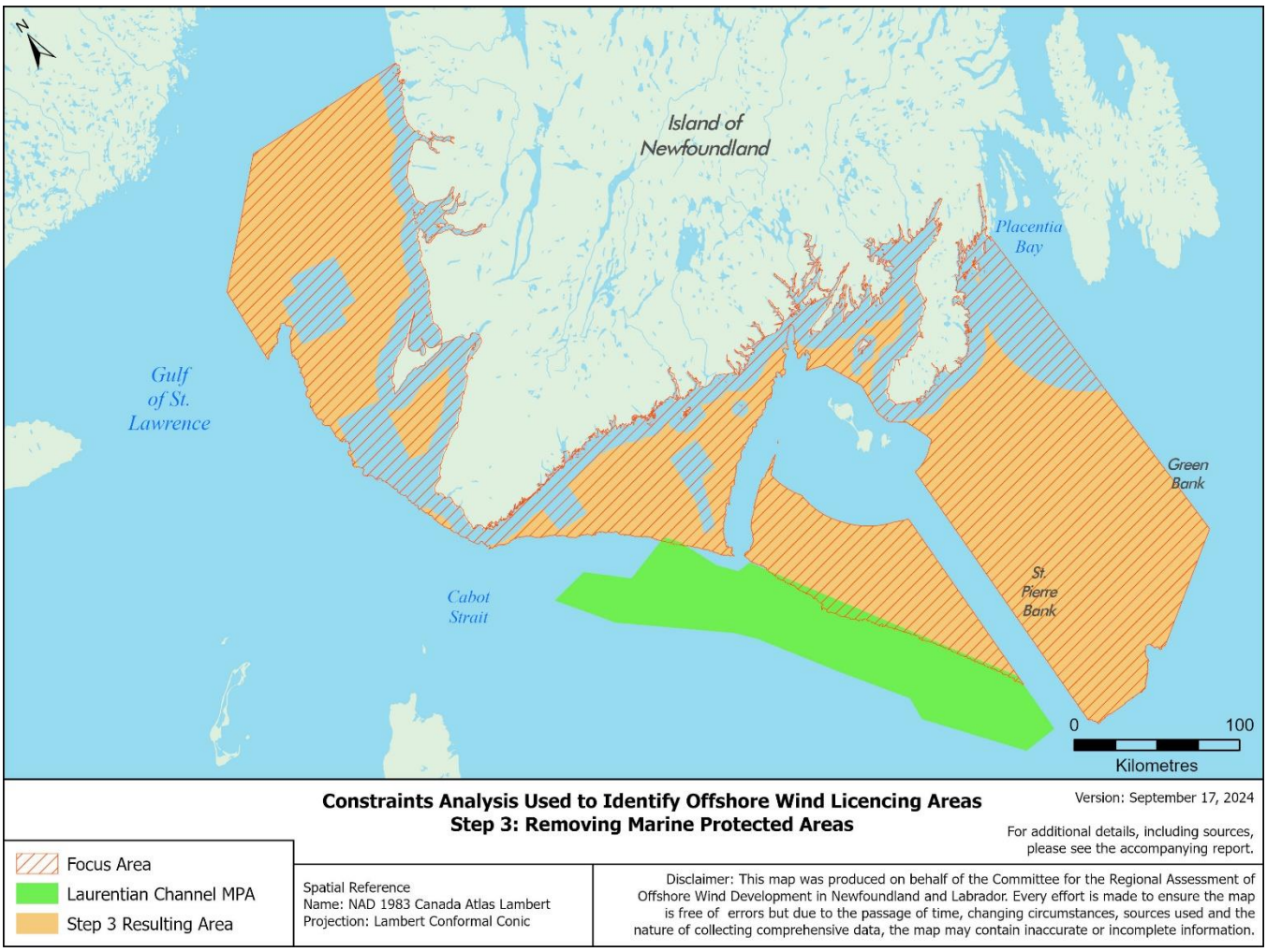
Sources: IAAC, 2023; NRCan, 2023; Regional Assessment Committee, 2024a; 2024b; 2024d; 2024e; 2024h.

Figure 6.4. Step 2: Removing Marine Critical Habitat



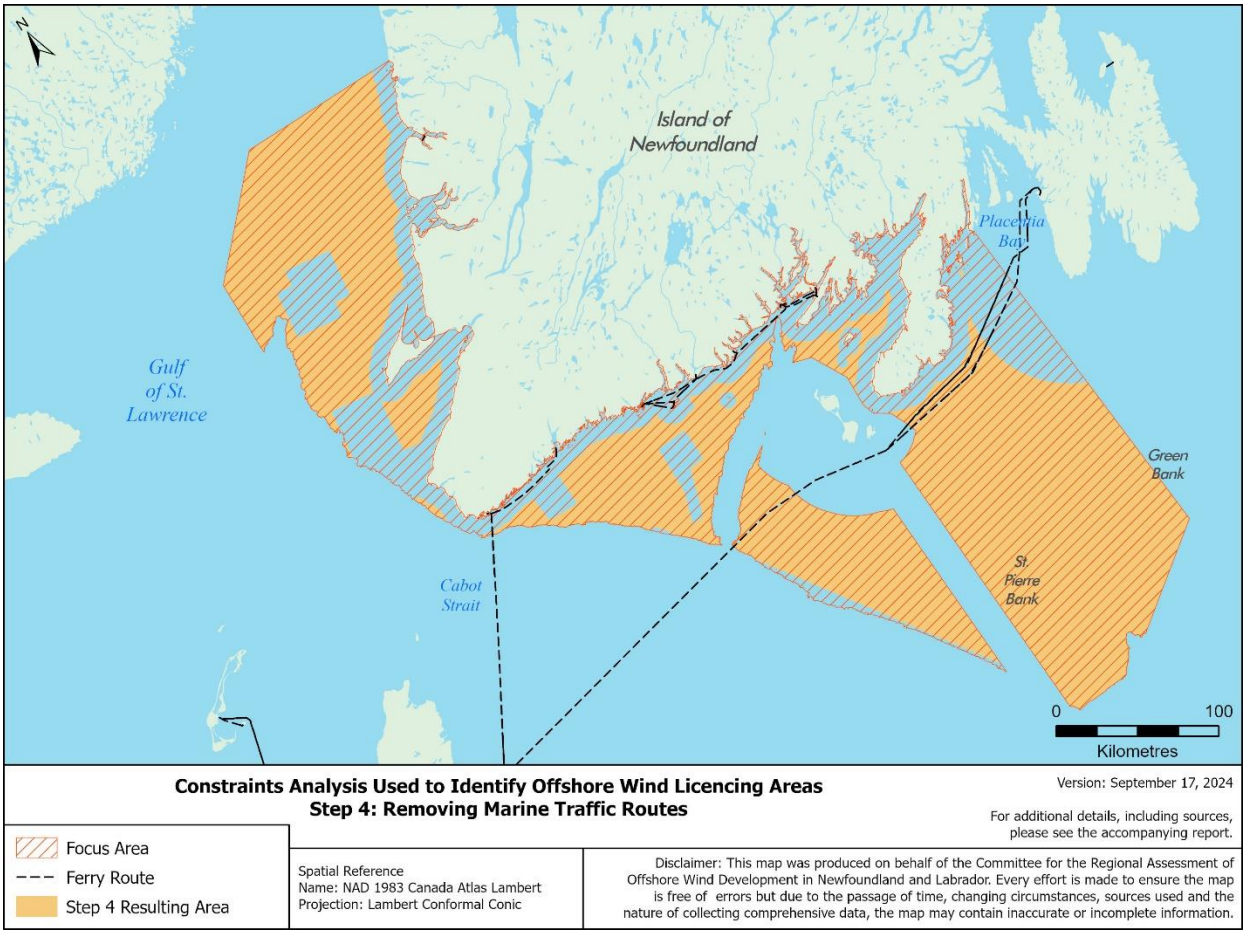
This map depicts the removal of all the above constraints and marine species at risk critical habitat from the Focus Area, and the Resulting Area 2.
Sources: DFO 2024; IAAC, 2023; NRCAN, 2023; Regional Assessment Committee, 2024i.

Figure 6.5. Step 3: Removing Marine Protected Areas



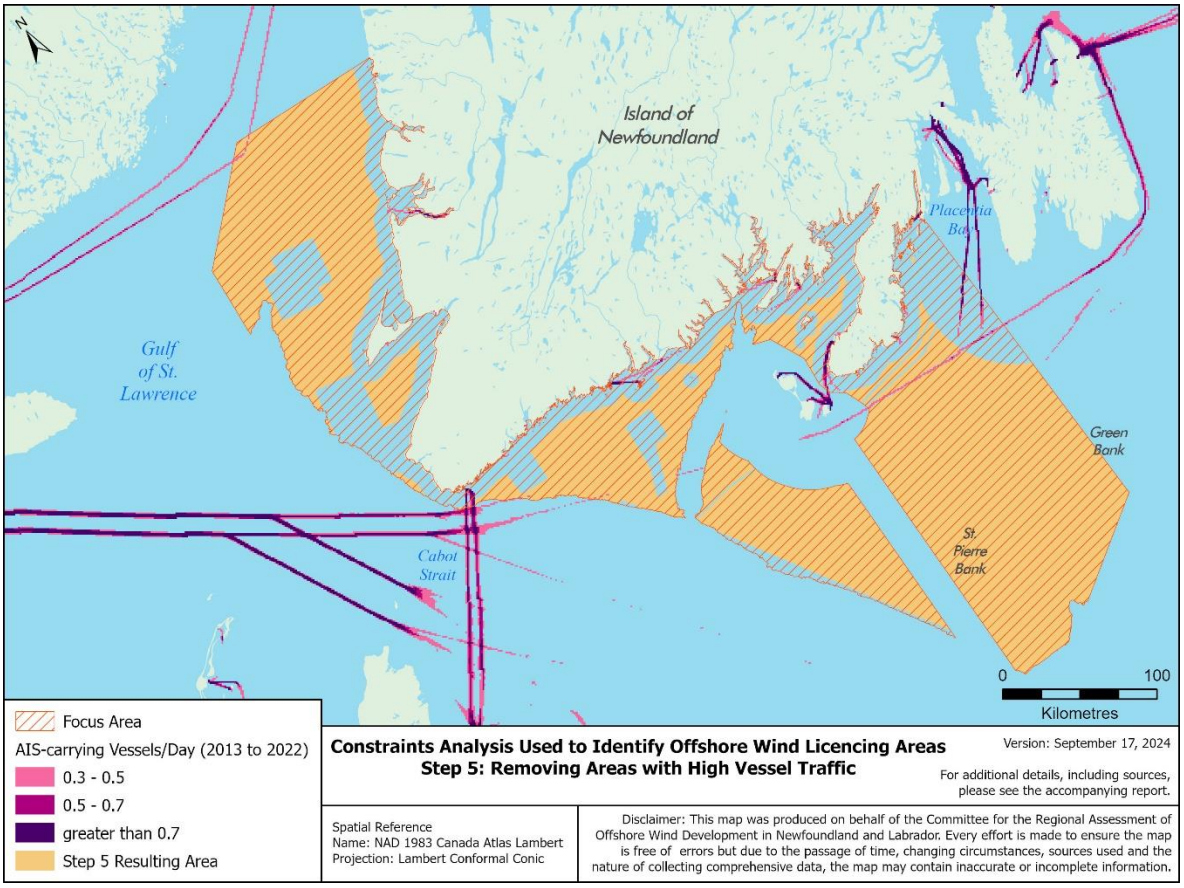
This map depicts the removal of all the above constraints and MPAs from the Focus Area, and the Resulting Area 3.
Sources: DFO, 2023c; IAAC, 2023; NRCan, 2023; Regional Assessment Committee, 2024j.

Figure 6.6. Step 4: Removing Marine Traffic Routes



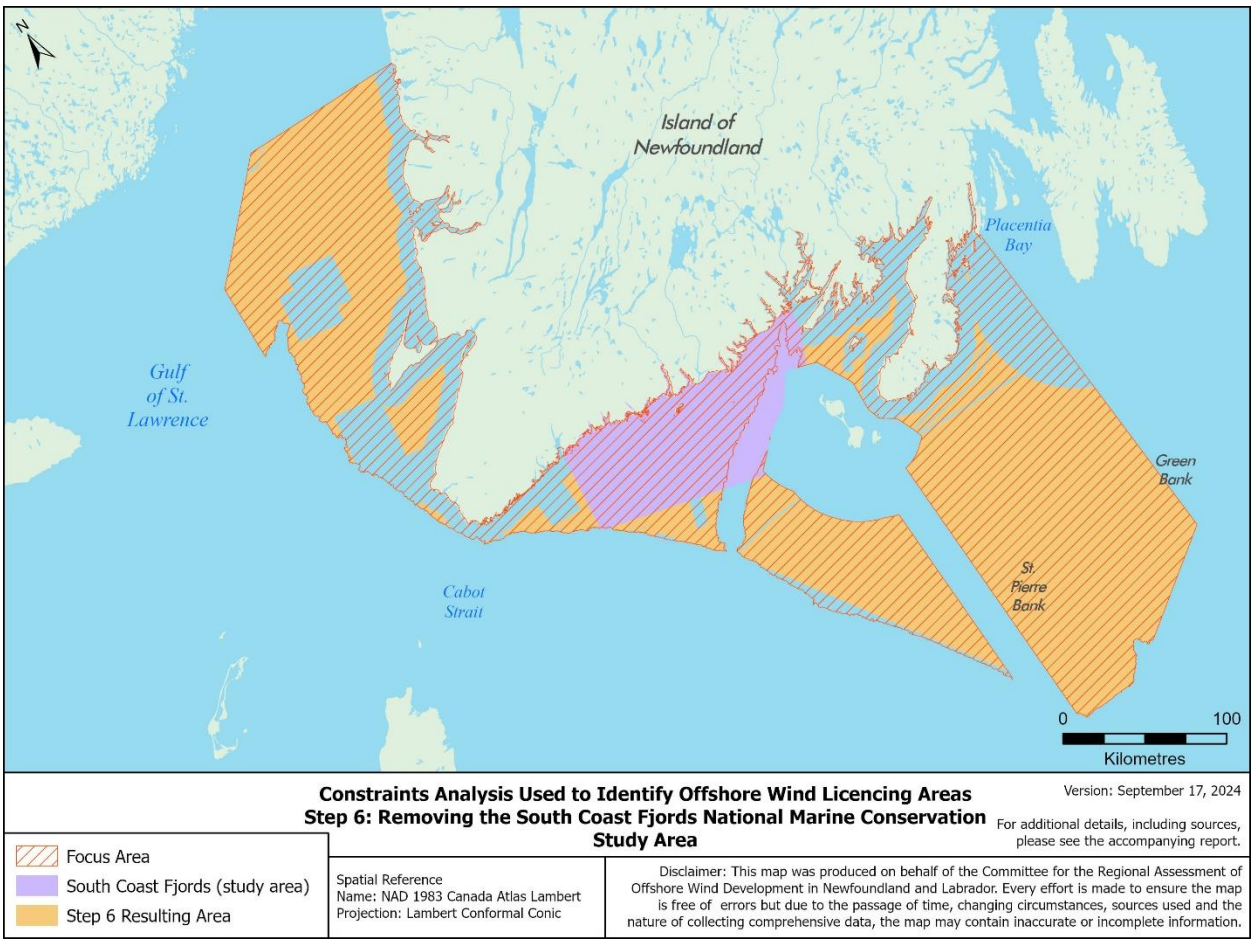
This map depicts the removal of all the above constraints and marine traffic routes from the Focus Area, and the Resulting Area 4.
Marine traffic routes removed include only those delineated in the Canadian Hydrographic Service (2024) Vessel Traffic Routes dataset.
Sources: Canadian Hydrographic Service, 2024; IAAC, 2023; NRCan, 2023; Regional Assessment Committee, 2024k.

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



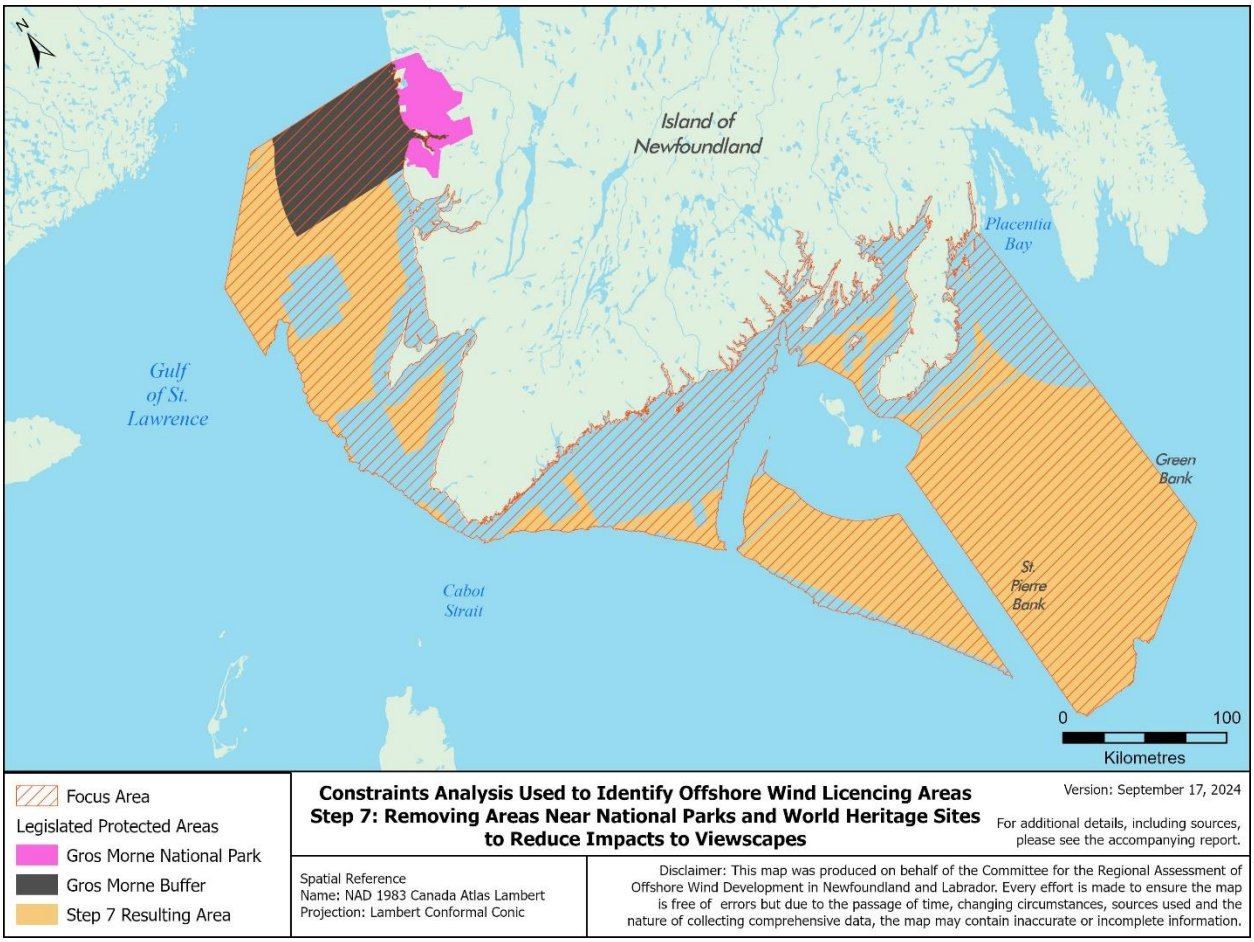
This map depicts the removal of all the above constraints and any areas with greater than 0.3 vessels per day, and the Resulting Area 5. All AIS carrying vessels were considered in the analysis.
Sources: DFO, 2024b; IAAC, 2023; NRCan, 2023; Regional Assessment Committee 2024l.

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



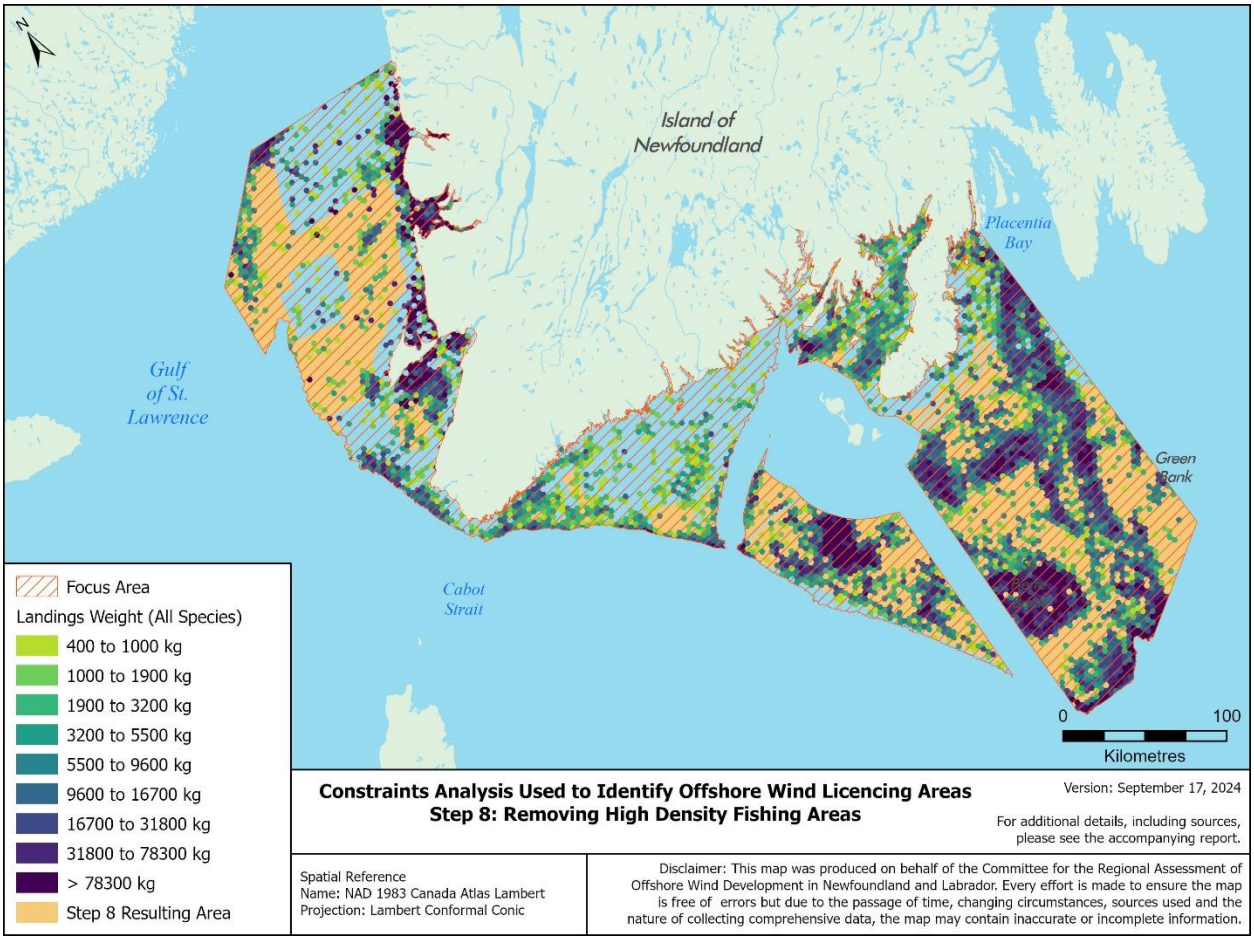
This map depicts the removal of all the above constraints and any existing or proposed NMCAs from the Focus Area, and the Resulting Area 6. As shown in the map, the proposed South Coast Fjords NMCA Study Area is the only NMCA in the Focus Area.
Sources: IAAC, 2023; NRCAN, 2023; Parks Canada, 2024; Regional Assessment Committee, 2024m.

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



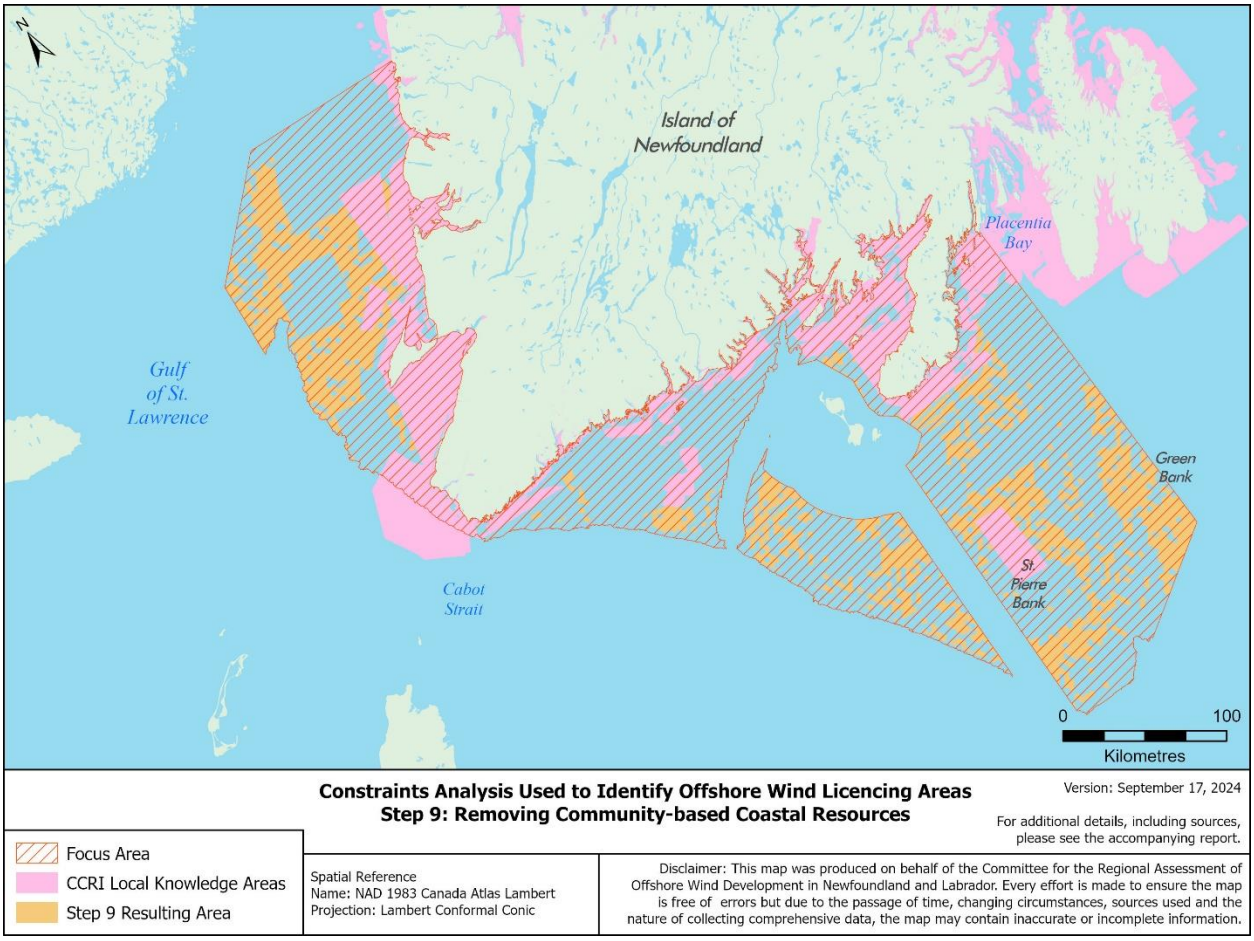
This map depicts the removal of all the above constraints and areas around national parks and WHSs from the Focus Area, and the Resulting Area 7. The Committee applied and removed an 80 km buffer perpendicular to the coastal boundary of Gros Morne National Park and WHS. Sandbanks Provincial Park (proposed 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.
Sources: IAAC, 2023; NRCAN, 2022; 2023; Regional Assessment Committee, 2024c; 2024n.

Figure 6.10. Step 8: Removing High Density Fishing Areas



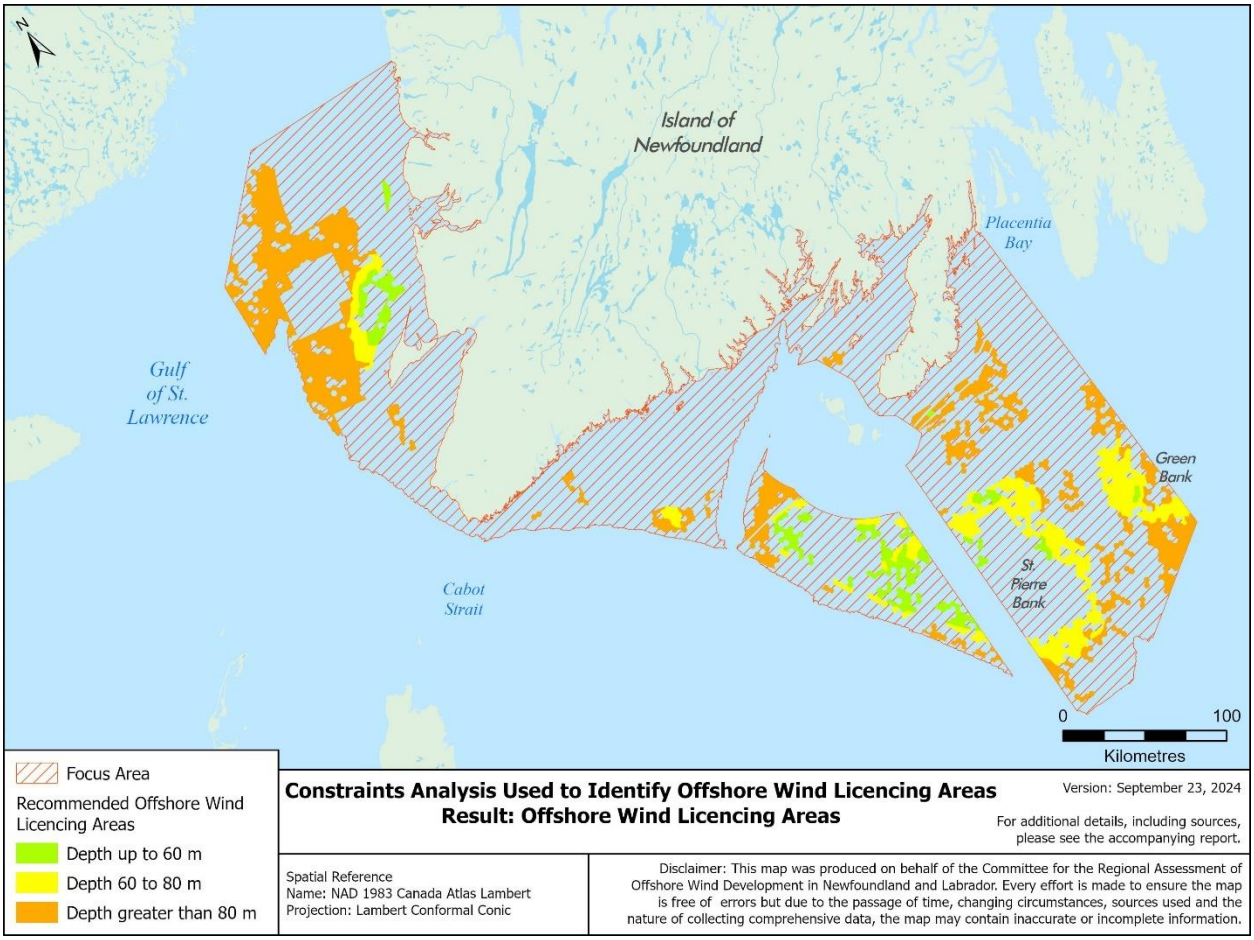
This map depicts the removal of all the above constraints and high-density fishing areas from the Focus Area, and the Resulting Area 8. High density fishing areas were identified based on DFO's (2023) Eastern Canada and Commercial Fishing, All Species dataset. Areas with an average catch density greater than 400 kg were removed from the Focus Area. This represents 90% of commercial fishing density accounted for in the dataset.
Sources: DFO, 2023b; IAAC, 2023; NRCan, 2023; Regional Assessment Committee, 2024o.

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



This map depicts the removal of all the above constraints and features identified in the Community-based Coastal Resources Inventory, 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 (2023) 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.
Sources: DFO, 2023f; 2024c; IAAC, 2023; NRCan, 2023; Regional Assessment Committee, 2024p.

Figure 6.12. Result: Offshore Wind Licencing Areas



This map depicts offshore wind licencing areas, 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 60m, 60-80m and greater than 80m) and small, isolated resulting areas were combined with surrounding areas. A technical methodology report including the steps undertaken in GIS to develop this map is in progress and will be appended to the Final Report.
Sources: NRCan, 2023; Regional Assessment Committee 2024f.

6.4 Recommended Offshore Wind Licencing Areas

Recommended offshore wind licensing areas are shown in Figure 6.12 above. Overall, these areas total 16, 996 km^2. 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).

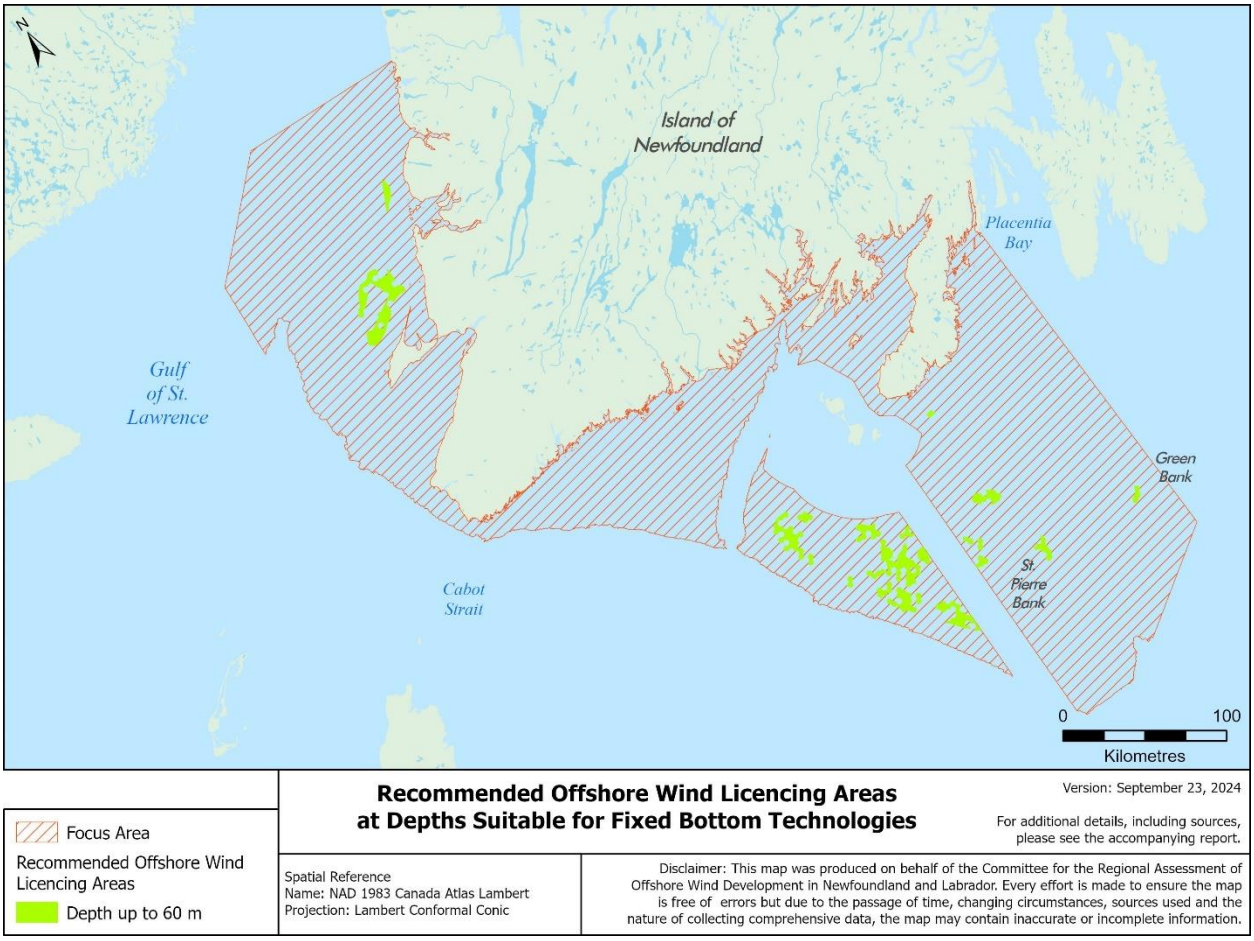
Specifically, the Committee identified:

- 24 areas where depths do not exceed 60m, totaling an area of approximately 1,994 km^2.
- 19 areas where depths are between 60 – 80m, totaling an area of approximately 4,942 km^2.
- 66 areas where depths are between 80 – 300m, totaling an area of approximately 10,060 km^2.

In the case that offshore wind development proceeds in the recommended licencing areas, the Committee anticipates developers would prefer shallower areas, where fixed bottom foundations are technically feasible (Figure 6.13)[30]. Geological substrate will also be an important consideration for where, and what type of offshore wind development would proceed.[31] The Committee is aware of NRCan's plans to undertake more detailed studies of the seabed geology offshore Newfoundland and Labrador.[32]

[30] This assumption is based on meetings held with offshore wind developers in October 2023.
[31] See Section 4 of this Report for information on foundation types, suitable depths, and ideal substrate type.
[32] 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. Recommended Offshore Wind Licencing Areas at Depths Suitable for Fixed Bottom Technologies



This map illustrates the offshore wind licencing areas recommended 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 offshore wind licencing areas recommended by the Committee are shown in Figure 6.12 above.
Sources: NRCan 2023; Regional Assessment Committee, 2024g.

The licencing areas identified in this Regional Assessment are Committee recommendations. They are not to suggest offshore wind development will occur in those areas. The governments of Canada and Newfoundland and Labrador will ultimately decide on licencing areas.

Furthermore, the Committee does not expect the areas they recommend would be the only licencing areas over time. 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 and that multiple rounds of offshore wind licencing will take place in the Offshore Area. Finally, the areas identified by the Committee were selected because, as a starting point, they could have a lesser impact on the environmental, health, social and economic components considered under the Regional Assessment. Furthermore, several constraints the Committee used to delineate licencing areas are dynamic in nature.

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 continue to support DFO's continued development and maintenance of the Atlas to assist in MSP.
    - The Government of Canada should continue to support NRCan's continued development and maintenance of the OSDP.
- The Committee recommends that, as a high priority, the Governments of Canada and Newfoundland and Labrador should develop a marine spatial plan.
    - The Government of Canada should continue to support DFO's MSP initiative for the Newfoundland and Labrador Shelves Planning Area.
    - The plan should incorporate known biotic and abiotic features of the area; current human uses, including all data submitted by fishers to DFO; 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 in consultation with 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, at fixed intervals. This work should be done in consultation 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.
    - 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 recommended offshore wind licencing areas.
- 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 within the Study Area undergo environmental assessments. The Committee also recommends that these assessments be considered as a case where cooperation and coordinated action between the federal government and the province (and possibly another jurisdiction) is needed. 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;* aquatic species, as defined in subsection 2(1) of the *Species at Risk Act*; 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*, 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.
- 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 industry develops in the province.

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[33] Excerpts from this submission are posted on the Registry Page under Document 275. The Regional Assessment Secretariat, on behalf of the Committee, received permission from ECCC to post specific materials in September 2024. Some sections are redacted or not posted due to the inclusion of unpublished, confidential data.
ECCC is continuing to provide updated and additional material to the Committee. Report content is up to date as of information provided by August 23, 2024. Additional submissions maybe posted on the Registry. Any discrepancies in this Report will be resolved in the Final Report.

[34] See footnote above.

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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.

Relationship Between Constraints and Components

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 recommended offshore wind licencing areas and the components assessed in the proceeding section. Table 7.1 summarizes those relationships.

Table 7.1: Relationship between constraints and components

Constraints	Relevant Components
Critical Habitat	Aerofauna; Marine Fish and Fish Habitat; Indigenous Communities Activities, Interests, and Rights, Protected and Special Areas
Bird Colonies and Foraging Areas	Aerofauna; Indigenous Communities Activities, Interests, and Rights
Key habitats and Important Stopover Areas	Aerofauna; Indigenous Communities Activities, Interests, and Rights
KBAs	Aerofauna; Indigenous Communities Activities, Interests, and Rights
MPAs	Marine Mammals and Sea Turtles; Protected and Special Areas; Indigenous Communities Activities, Interests, and Rights; Fisheries
NMCAs	Marine Mammals and Sea Turtles; Protected and Special Areas; Indigenous Communities Activities, Interests, and Rights; Fisheries; Other Ocean Uses; Communities and Economy
Marine Refuge and Fisheries Closure Areas	Protected and Special Areas; Indigenous Communities, Activities, Interests, and Rights; 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	Protected and Special Areas; Indigenous Communities, Activities, Interests, and Rights; Other Ocean Uses; Visual Aesthetics and Viewscapes; Communities and Economy

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

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

Mitigation Hierarchy

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 a new and emerging industry, 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.

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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 placed to identify potential positive and adverse effects of offshore wind on their communities, activities, interests, and rights. Since offshore wind 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 south 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 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, and water, and all living things. Information, perspectives, and recommendations provided by Indigenous groups are therefore not limited to this specific component section and are instead presented throughout this Report (Table 7.1.1).

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

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

The table indicates the Report section(s) that describe(s) how input from Indigenous groups informed the Regional Assessment.

Submissions to the Committee and Registry comments from Indigenous groups can be found under Registry document reference numbers: 125, 150, 176. A Registry link was not available for all Indigenous group input for inclusion in time for this Report but will be available for the Final Report. WNNB did not submit written feedback, and instead met with 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 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 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.

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. Committee Recommendations are presented throughout the report. Report sections with recommendations related to Indigenous Communities, Activities, Interests, and Rights include:

- Section 6.4.1
- Section 7.3.7
- Section 7.9.6
- Section 8.6

7.2 Air Quality and GHGs

7.2.1 Existing conditions

This section provides an overview of existing conditions of air quality and GHG emissions within Newfoundland and Labrador, with particular attention to air quality monitoring stations within the province.

7.2.1.1 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 selected 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 shows the operating industries, location of their monitoring stations and the number of locations in Newfoundland and Labrador.
The 2023 air quality monitoring report (DOECC, 2024) 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 2-year tabular information set and a 5-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, 2024). 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

This table provides a list of industries, the location of their monitoring stations, and the number of stations within each area. Source: The 2023 air quality monitoring report (DOECC, 2024).

Air quality in Newfoundland and Labrador communities is generally considered to be good as the ambient air quality standards are rarely exceeded for the pollutants being measured (DOECC, 2024). 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, 2024). The Newfoundland and Labrador Air Pollution Control Regulations (NLR 11/22 Air Pollution Control Regulations, 2022 under the Environmental Protection Act, 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	30582 13107	 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

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.
N/A = not applicable

Sources: https://www.assembly.nl.ca/Legislation/sr/regulations/rc220011.htm ((NLR 11/22 Air Pollution Control Regulations, 2022 under the Environmental Protection Act, 2022)

7.2.1.2 Air Quality Health Index (AQHI) in Newfoundland and Labrador

The AQHI is a health protection tool designed to help individuals understand what the air quality means to their health and to make informed decisions to adjust their activity levels during increased levels of air pollution. The AQHI is a scale from 1 to 10+ and the higher the number on the scale, the greater is the health risk associated with the air quality. It is calculated on an hourly basis and takes into account the combined relative health risks associated with ground level O_3, $PM_{2.5}$/PM_{10} and NO_2. Current and forecasted information on AQHI for different areas across the province can be found at ECCC weather office website. Table 7.2.3 shows the AQHI health messages.

Table 7.2.3: Summary of Air Quality Health Messages

AQHI Reading	Health Risk Level	Health Messages	
		At Risk Population	**General Population**
1-3	Low Risk	Enjoy your usual outdoor activities.	Ideal air quality for outdoor activities
4-6	Moderate Risk	Consider reducing or rescheduling strenuous activities outdoors if you are experiencing symptoms.	No need to modify your usual outdoor activities unless you experience symptoms such as coughing and throat irritation.
7-10	High Risk	Reduce or reschedule strenuous activities outdoors. Children and the elderly should also take it easy.	Consider rescheduling strenuous activities outdoors if you experience symptoms such as coughing and throat irritation
Above 10	Very High Risk	Avoid strenuous activities outdoors. Children and the elderly should also avoid outdoor physical exertion.	Reduce or reschedule strenuous activities outdoors, especially if you experience symptoms such as coughing and throat irritation.

This table provides a summary of air quality health messages for the different health risk levels, for both at-risk populations and the General public.
Adapted from: ECCC weather office website

7.2.1.3 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 2021 from human activities. The air pollutant emissions indicators track emissions of these six key air pollutants. The interactive figures at the Air Pollutant Emissions' website, highlight the main emission sources as well as the provincial and territorial distributions of these pollutants from 1990-2021. The highest sources of each of the six key pollutants in Newfoundland and Labrador for 2021 are shown in Table 7.2.4 below.

Table 7.2.4: Air Pollutants and their Highest Emission Sources in Newfoundland and Labrador for 2021

Pollutant	Highest source	2021 emissions – all sources in kilotonnes (kt)	Emissions - highest sources (kt)	% of 2021 total
NH_3	Agriculture (livestock, crop production and fertilizer)	0.9	0.7	77.8%
CO	Off-road vehicle and mobile equipment	69.7	20.3	29.1%
$PM_{2.5}$	Dust and fires	13.2	8.1	61.4%
NO_x	Transportation (road, rail, air and marine)	54.0	35.7	66.1%
SO_x	Ore and mineral industries	10.0	6.1	61.0%
VOCs	Home firewood burning	17.3	4.6	26.6%

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 2021 emission numbers (the latest data at the time of compiling this Report).
Data source: Air pollutant emissions - Canada.ca (ECCC, 2010)

7.2.1.3.1 Data Source and Methods From ECCC

The emissions data are from Canada's Air Pollutant Emissions Inventory (APEI) for the years 1990 to 2021. 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 take into account 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, 2024).

The NPRI is ECCC's database of pollutant releases (to 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* (the Act). Under the Act, 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 the interactive map.

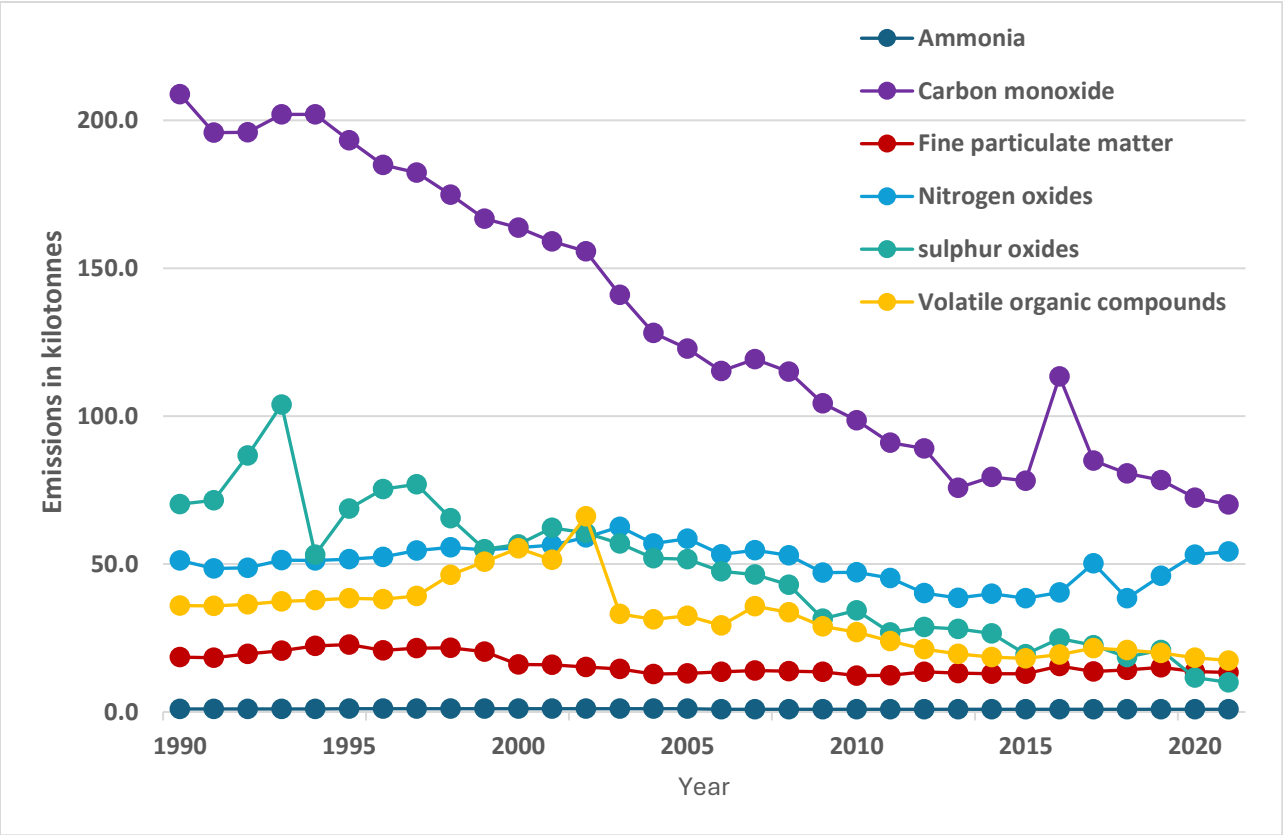
Emissions data from individual facilities to the NPRI remains the primary source of industrial air pollution data in Canada, and are supplemented with well-documented, science-based estimation tools to quantify total emissions (ECCC, 2024). To produce a complete national inventory of emissions, complementary 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 provides 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.[35] Activity data is 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 update each year.

Figure 7.2.1 shows the emission trends of the six key pollutants in kt for Newfoundland and Labrador from 1990-2021. Except NO_x's which showed an increase in emissions in 2021 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 86% (10 kt) relative to 1990 (70.3 kt). This was followed by CO emissions (66% reduction), VOCs (52%), $PM_{2.5}$ (28%) and NH3 (10%). On the other hand, NO_x emissions were up by 6% in 2021 compared to emissions in 1990 (Air pollutant emissions - Canada.ca). According to ECCC (2023a), 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.

[35] 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).

Figure 7.2.1: Emissions of Six Air Pollutants, Newfoundland and Labrador, 1990 to 2021



This figure shows the emission trends of the six key pollutants in Newfoundland and Labrador from 1990 to 2021. Source: Air pollutant emissions - Canada.ca (ECCC, 2010)

7.2.1.4 Greenhouse Gas (GHG) emissions

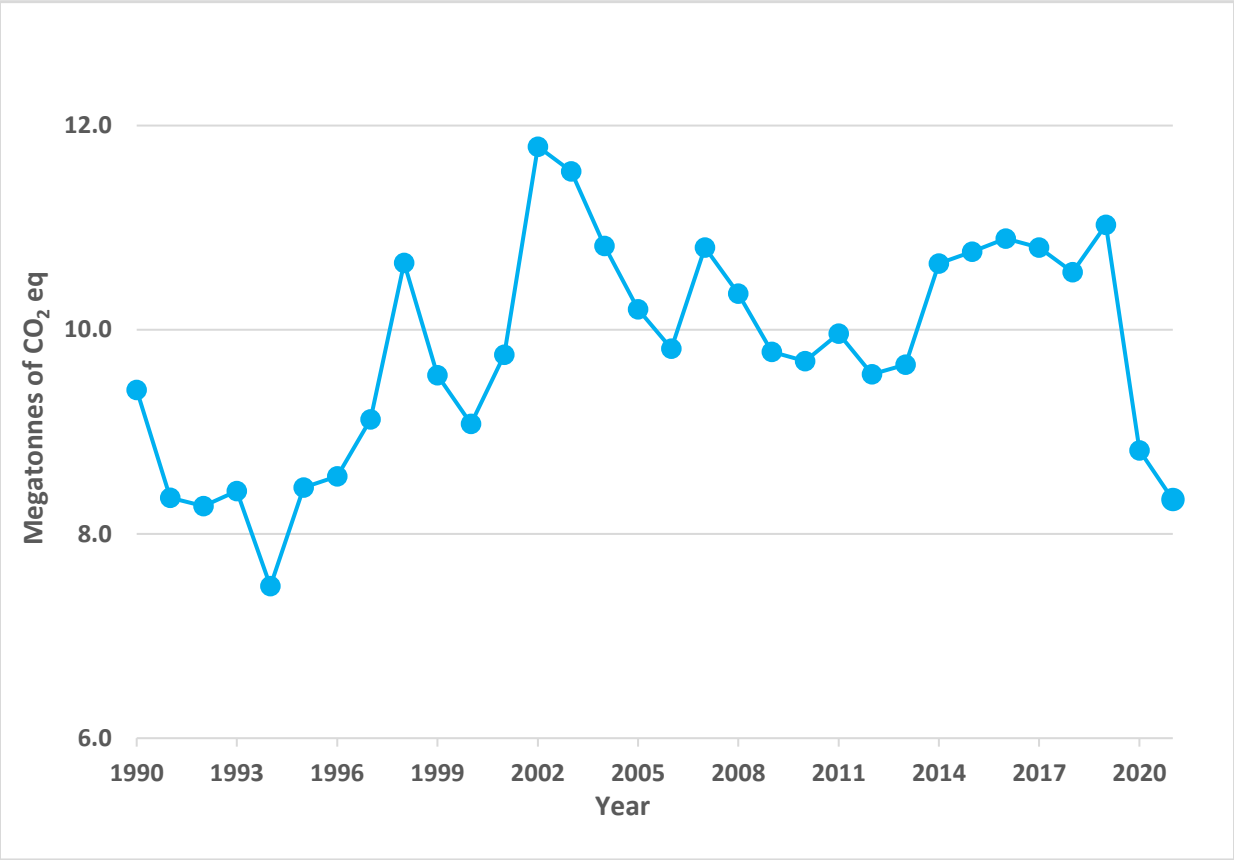
Following the Paris Agreement in 2015, Canada adopted 2005 as the base year for its GHG emission reduction targets and has committed to reduce its GHG emissions by 40-45% below 2005 levels by 2030. Prior to that, Canada had 1990 as its base year. The national environmental indicators for which emissions are estimated include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons, sulfur hexafluoride and nitrogen trifluoride (ECCC, 2023b). Canada's National Inventory Report (NIR) 1990-2021, released in April 2023 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 (1990-2021) 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).

7.2.1.5 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 2021, making it the ninth largest provincial/territorial emitter in the country. GHG emissions in Newfoundland and Labrador were 8.3 megatonnes of CO_2 equivalent (Mt CO_2 eq) in 2021, decreasing by 5.7% (0.5 Mt CO_2 eq) from 8.8 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 Labradors GHG emissions decreased by 18.6% (1.9 Mt CO_2 eq) between 2005 and 2021, and 11.7% (1.1 Mt CO_2 eq) between 1990 and 2021 (ECCC, 2023b, 2023c). 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, 1990-2021.



This figure shows the historical GHG emission trend in Newfoundland and Labrador from 1990 to 2021. Data source: NIR 1990-2021 (ECCC, 2023c); Historical GHG emissions summary, NL, 1990-2021.

7.2.1.5.1 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 1990-2021, are energy, industrial processes and product use, agriculture, and waste. Chapters 3 to 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, 2023b). Activity data refer to the quantitative amount of anthropogenic activity, resulting in emissions during a given time period. Emission factors on the other hand 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 in some 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[36]
	kt CO_2 eq				
Energy	8,722	9,411	10,164	7,935	7,458
Industrial Process and Product use	98	162	232	250	241
Agriculture	49	61	79	78	77
Waste	542	567	552	558	559
Total GHG	9,411	10,201	11,027	8,820	8,336

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 and 2021. Data source: NIR 1990-2021 (ECCC, 2023c); Historical GHG emissions summary, NL, 1990-2021 .

Key notes from Table 7.2.5 are:

- Between 2020 and 2021, GHG emissions from Energy, Industrial Processes and Agriculture decreased by 477 kt CO_2eq (6%), 9 kt CO_2eq (4%) and 1 kt CO_2eq (1%) respectively, while emissions from Waste increased by 1 kt CO_2eq (0.2%).
- Between 1990 and 2021, GHG emissions from Energy decreased by 1264 kt CO_2eq (57%), while emissions from Industrial Processes, Agriculture and Waste increased by 143 kt CO_2eq (146%), 28 kt CO_2eq (57%) and 17 kt CO_2eq (3%) respectively.
- Between 2005 and 2021, GHG emissions from Energy and Waste decreased by 1953 kt CO_2eq (21%) and 8 kt CO_2eq (1.4%) respectively, while Industrial Processes and Agriculture increased by 79 kt CO_2eq (49%) and 16 kt CO_2eq (26%) respectively.

7.2.2 Potential 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 in achieving its environmental obligations and climate change commitments (see Section 10 of this Report). It is known that wind energy can be successfully integrated into the electricity grid, and doing so can reduce combustion-based electricity generation and provide air quality and GHG emission

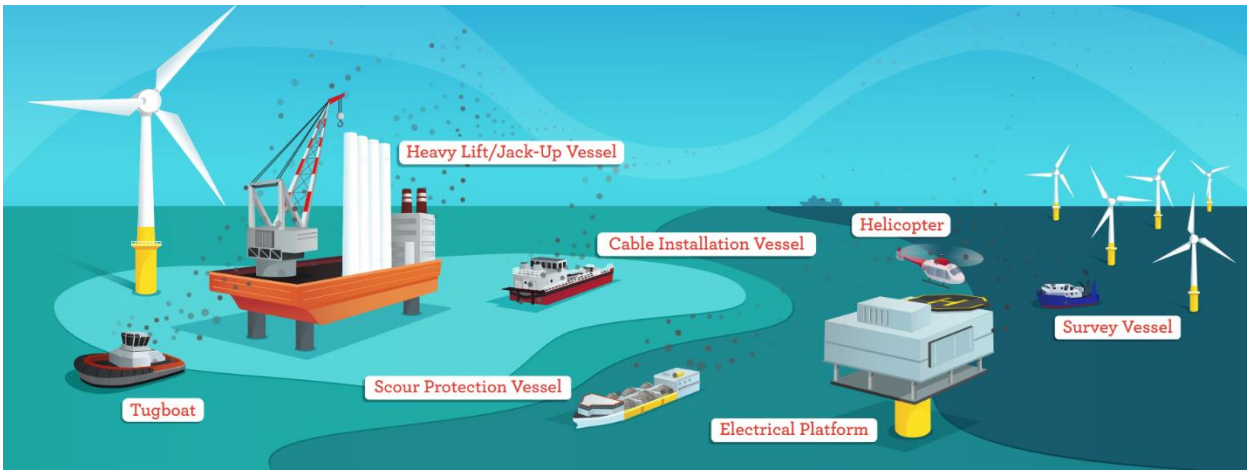
[36] Estimates for 2021 are based on preliminary information, and are subject to revision in the next submission year (Historical GHG emissions summary, NL, 1990-2021).

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 more polluting the displaced fuel, the more the environment benefits from the generated wind energy. For example, if a coal-fired power plant is displaced, the wind farm could reduce air pollution significantly. The amount of CO_2 avoided depends on the production type and fuel that is replaced when wind power is produced (Holttinen & Tuhkanen, 2004). The pollution-reduction potential of wind energy has been studied extensively, and Nordman & VanderMolen (2014) provides a list of some peer-reviewed, scientific literature, and a summary of their conclusions on the pollution-reduction potential of wind energy.

Despite its GHG reduction potential and the associated air quality benefits, wind energy, like any other industrial activity, can cause impacts on the environment which should be mitigated (Corio, 2022). Air emissions occur during equipment manufacture, transportation, construction, operation/maintenance, and decommissioning phases of offshore wind farm development (Dolan & Heath, 2012). The contaminants are mainly caused by fossil fuel combustion during vessel operations (International Council on Clean Transportation [ICCT], 2020), with major air contaminants being NO_x, SO_2, particulate matter, CO_2, and CH_4 (NYSERDA, 2018). 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 greatest impacts are known to be in the construction and decommissioning phases as many work boats and associated equipment will be used. As part of the Regional Assessment, ECCC provided the Committee with an outline of potential equipment used in the construction, operations, and decommissioning phases.[37] Vessel activities during an offshore wind project lifetime includes use of tugboats, 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 shows typical vessel activities during offshore wind project lifetime.

[37] A link to the Registry post was not available in time for inclusion in this Report, but it should be uploaded to the Registry in the near future.

Figure 7.2.3: Offshore Wind Farm Activities and Emission Sources



This figure shows examples of typical vessel activities 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) The Emissions Impact of Offshore Wind Farms

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. During the average two-year construction phase of an offshore wind farm, much higher quantities of emissions occur compared to a much lower rate of emissions that happens throughout the operation/maintenance phase (Corio, 2022). Table 7.2.6 shows the yearly average emissions (tons) for various pollutants in both construction and operation/maintenance phases.

Table 7.2.6: Average Tons per Year of the Various Emissions in Construction and Operation/Maintenance Phases

Pollutant	Average emissions (tons* per year)	
	Construction	Operation/Maintenance
NOx	2500	70
$PM_{2.5}$	80	2.3
CO	550	20
VOC	60	2
CO_{2e}	160000	8000

This table provides an annual average of pollutant emissions for NO_X, $PM_{2.5}$, CO, VOC, and CO_{2e} during both construction and operation/maintenance phases of offshore wind development. Values presented are in tons.
*1 ton is equivalent to 0.907185 tonnes.
Source: The Emissions Impact of Offshore Wind Farms (Corio, 2022).

Project specific impact assessments would very likely be conducted and would consider project air emissions. The many environmental assessments conducted in the U.K. North

Sea waters up to 2022 for offshore wind, have concluded that air emissions would result in negligible to no effects in the offshore (UK Department for Business, Energy and Industrial Strategy, 2022). According to Corio (2022), offshore wind farms provide significant GHG reduction and other air quality improvements compared to fossil fuel-powered generation sources.

7.2.2.1 Air Quality, GHGs and Human Health Impact

7.2.2.1.1 Air quality

Poor air quality has been linked to respiratory and cardiovascular illness, hospitalization and mortality. Harmful health outcomes related to air pollution can range from respiratory symptoms to the development of disease and premature death – including acute irritation and respiratory problems, the development or worsening of existing respiratory and/or cardiovascular disease, and cancer (Health Canada, 2016). Table 7.2.7 summarizes the human health impacts of each of the six key pollutants discussed above (Section 7.2.1.3 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.

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: Air pollutant emissions - Canada.ca (ECCC, 2010); (DOECC, 2024)

7.2.2.1.2 GHG emissions

GHG emissions and their increasing concentrations in the atmosphere are already having an impact on the environment, the economy, and human health (ECCC, 2023b). 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

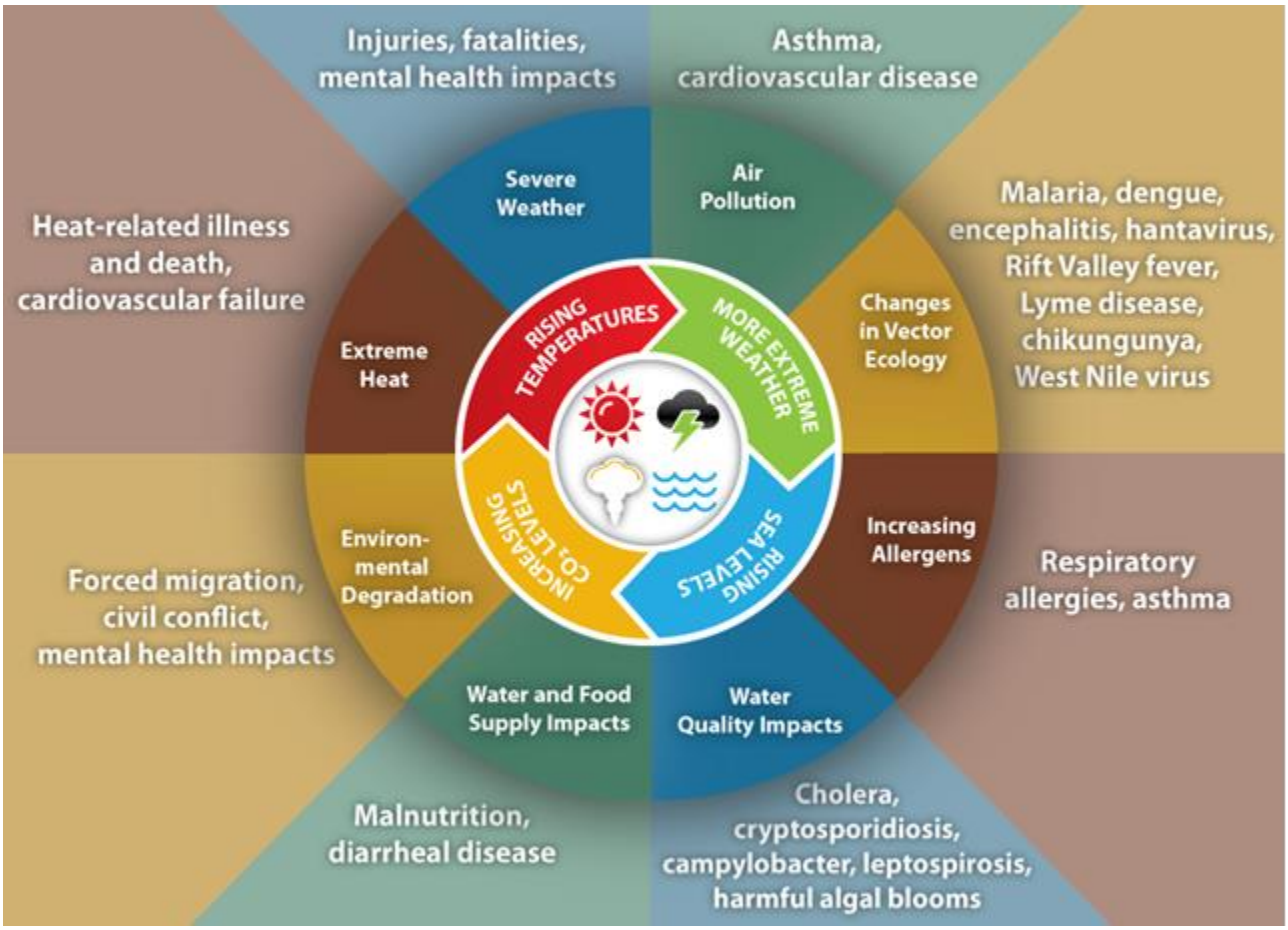


Figure Description: This figure shows the direct and indirect effects of climate change on the environment and human beings, as a result of increasing concentration of CO_2, rising temperatures, rising sea levels, and extreme weather events. Adapted from Climate Effects on Health | CDC (U.S. CDC, 2022)

7.2.3 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 at the planning phase. 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 (NYSERDA) (2017), air pollutant emission inventories and ambient air monitoring plans are standard practices for projects that are anticipated to impact the atmospheric environment for the offshore.

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 fuels that are used, and the emissions control mechanisms put in place – which can also lead to the release of pollutants in some cases (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:

- Plan the use of vessels in the construction and decommissioning phases in a way to reduce the number of transports.
- Regulate emission levels by using high-quality fuel that contains low sulfur levels to the extent practicable.
- Ensure emission control technologies 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.

7.2.4 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 (e.g., warming of the ocean) on fisheries (see Section 7.7 of this Report).

7.2.5 Data Gaps and Limitations

No direct data gaps relative to air quality, GHG emissions and offshore wind farms were identified by the Committee. However, the Committee is of the view that by accurately assessing and forecasting wind resources, more offshore wind could be deployed, reducing emissions of CO_2 (Showalter, 2022). Addressing the following gaps would likely improve understanding of offshore wind'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).

7.2.6 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 greenhouse gas 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.

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7.3 Aerofauna

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 and 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, 2023; 2024; Stantec, 2016). Similarly, insects, such as the Monarch (Endangered under SARA), may occur offshore and interact with offshore energy infrastructure (ECCC, 2023). In response to advice from ECCC (ECCC, 2023f). The Committee changed the "avifauna" component to "aerofauna" so that bats and flying insects could also be considered in addition to birds.

Acknowledgement Note

This section is largely attributed to information 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. The Committee took this information into account 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 Page under Registry document 275.

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, s 22(1)). This may include changes to the atmosphere, soil, wetlands, marine areas, vegetation, animals, fish, and birds (Canada, 2020). 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, s 16(2), 60(1)). Regarding aerofauna, species at risk and migratory birds are within federal jurisdiction.

More information on the *Species at Risk Act* (SARA), 2022, and its protections is under Section 7.6 of this Report, Protected and Special Areas. Information on aerofauna species at risk in the Focus Area is under Section 7.3.2.2.1 of this Report, Critical Habitat and Important Areas for Species at Risk.

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* and the Migratory Bird Regulations, 2022 (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 (Canada, 2018). MBS are listed under the Schedule in the Migratory Bird Sanctuary Regulations, which prescribe rules and prohibitions regarding the taking, injuring, destruction. No MBS currently occur in the Regional Assessment Focus Area.

ECCC provides guidelines and requirements for assessing impacts on aerofauna during project-level impact assessments. In April 2007, the Canadian Wildlife Service published *Wind Turbines and Birds, A Guidance Document for Environmental Assessment*. The purpose of this document is to outline the nature of information needed in an environmental assessment to identify, assess, monitor and mitigate the potential adverse effects of wind energy projects on birds, especially migratory birds and species at risk (CWS, 2007). [38]

Regarding provincial protections, wildlife in Newfoundland and Labrador is managed under the provincial *Wildlife Act* and its regulations. The Newfoundland and Labrador *Endangered Species Act* also protects aerofauna species at risk and their habitats. Provincial regulatory bodies like the Newfoundland and Labrador Department of Environment and Climate Change 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* 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 hosts 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 and Atlantic Puffins) and

[38] This guidance document was developed to support environmental assessments under the *Canadian Environmental Assessment Act, 2012*. This Act was repealed and replaced by the IAA in 2019. On June 20, 2024, the *Budget Implementation Act, 2024*, received Royal Assent and brought into force amendments to the IAA. The Guidance document may not reflect current impact assessment requirements and processes. The IAA and its regulations should also be consulted.

birds that breed in temperate regions (e.g., shearwaters, gannets, and storm petrels). Newfoundland is 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, overwintering etc.) and many species fly through or use stopover sites 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 include avian species that 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.

Figures 7.3.1, 7.3.3, and 7.3.5 show marine bird density and distribution across the Focus Area. These findings are based on publicly available Eastern Canada Seabirds at-Sea (ECSAS) data. Findings should be considered in conjunction with maps on temporal and spatial gaps in ECSAS survey effort, especially in winter months (Figures 7.3.2, 7.3.4, and 7.3.6).

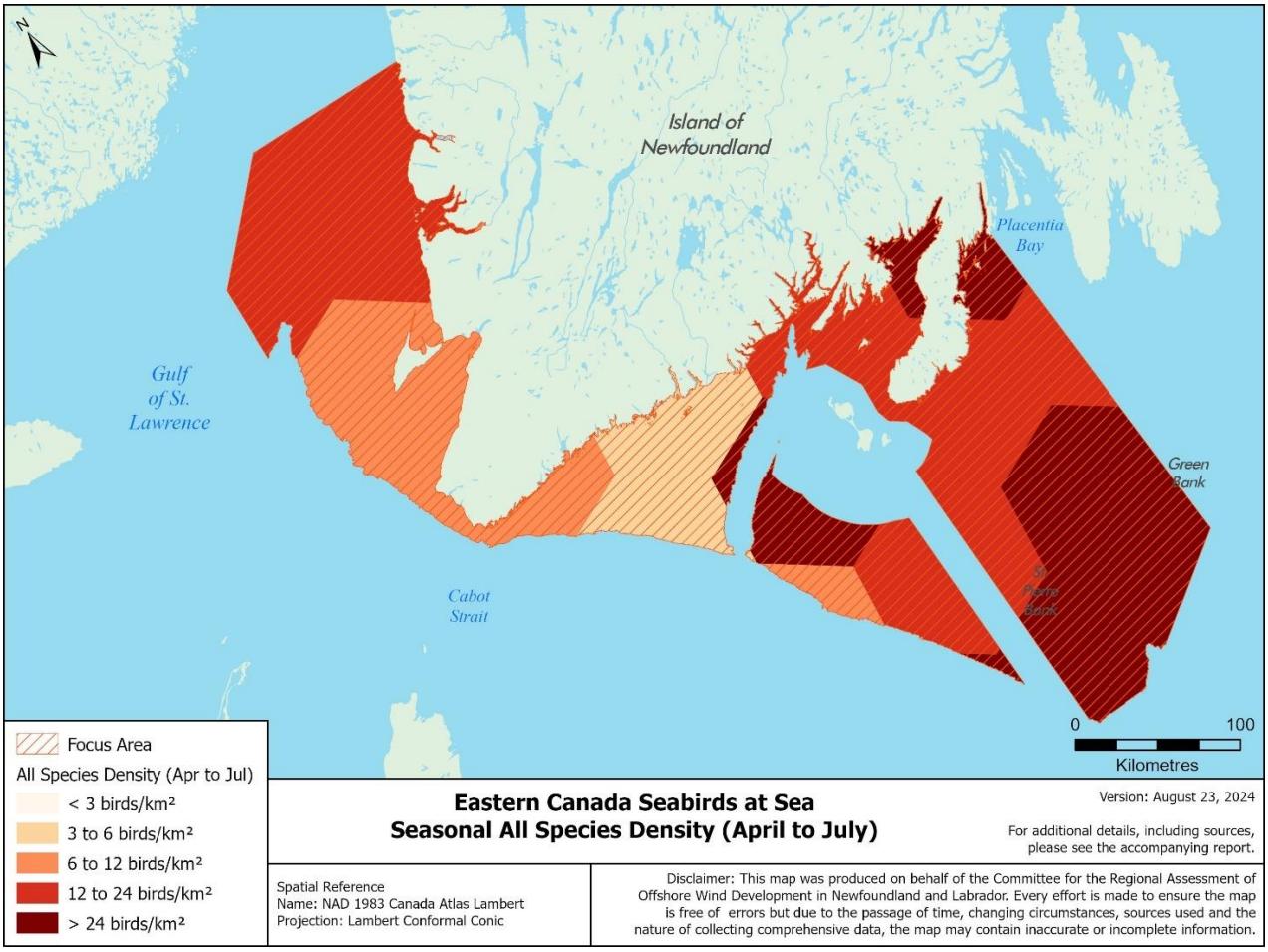
Data and visuals showing density and distribution estimates for individual marine bird species (and some shorebirds) can also be accessed through the Open Science and Data Platform (Government of Canada, 2023). ECCC provided the Committee with similar confidential maps (ECCC, 2023; 2024). Based on the provided maps, the Focus Area may overlap relatively high-density areas for the following species in Atlantic Canada: Atlantic Puffin (*Fratercula arctica*), Black-legged Kittiwake (*Rissa tridactyla*), Large Gulls (*Larus* spp.), murres (*Uria* spp.), Northern Gannet (*Morus bassanus*), Razorbill (*Alca torda*), Black Guillemot (*Cepphus grille*), Dovekie (*Alle alle*), loons (*Gavia* spp.), Northern Fulmar (*Fulmarus glacialis*), phalaropes (*Phalaropus* spp.), shearwaters (*Ardenna gravis, Ardenna grisea, Puffinus puffinus, Calonectris borealis*), and Wilson's and Leach's Storm-petrels (*Oceanites oceanicus, Hydrobates leucorhous*).[39] This may suggest the Focus Area is

[39]Products provided by ECCC 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.

important for these species. However, distribution and density information alone does not necessarily convey significance of an area for a species. Specific habitat characteristics, for example, are also important to consider.

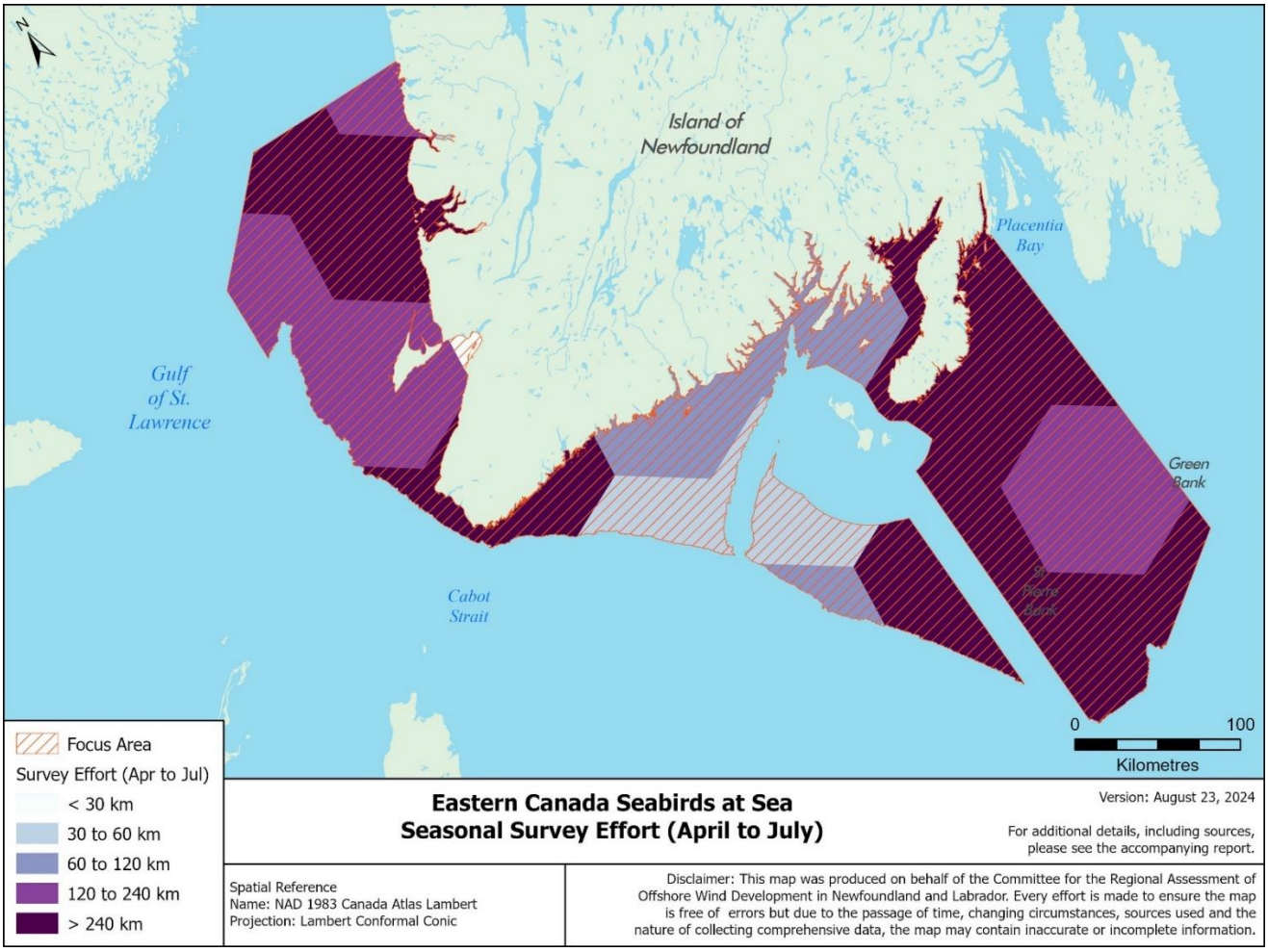
Both products were based on an updated, unpublished version of ECSAS data. Publicly available data is post-stratified using 100 km hexagonal cells (i.e., shows average individual/km^2 for 100 km hexagonal cells across Atlantic Canada) while the updated version applies a finer scale (50 km hexagonal cells). 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. It should also be noted that the predictive density models are preliminary, and results are subject to change. ECCC advised the do not anticipate this will greatly change the general distribution patterns currently presented.

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



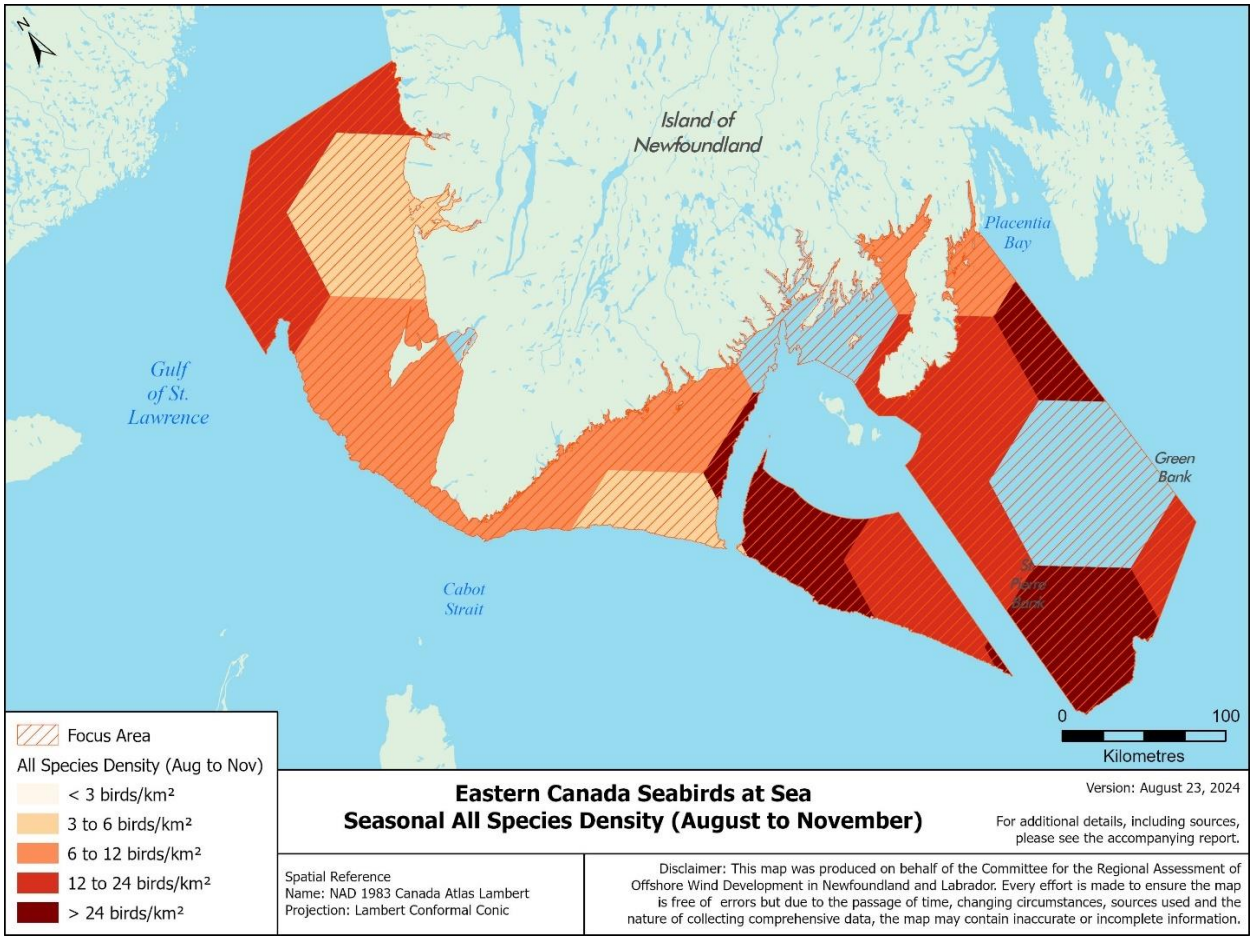
This map shows marine bird density and distribution across the Focus Area from April to July. Figure 7.3.2 shows survey effort during this period. April to July, August to November, and December to March roughly represent Spring migration and nesting periods of nidifugous species; moult, chick-rearing 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.
Sources: Government of Canada, 2023; IAAC, 2023; NRCan, 2023.

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



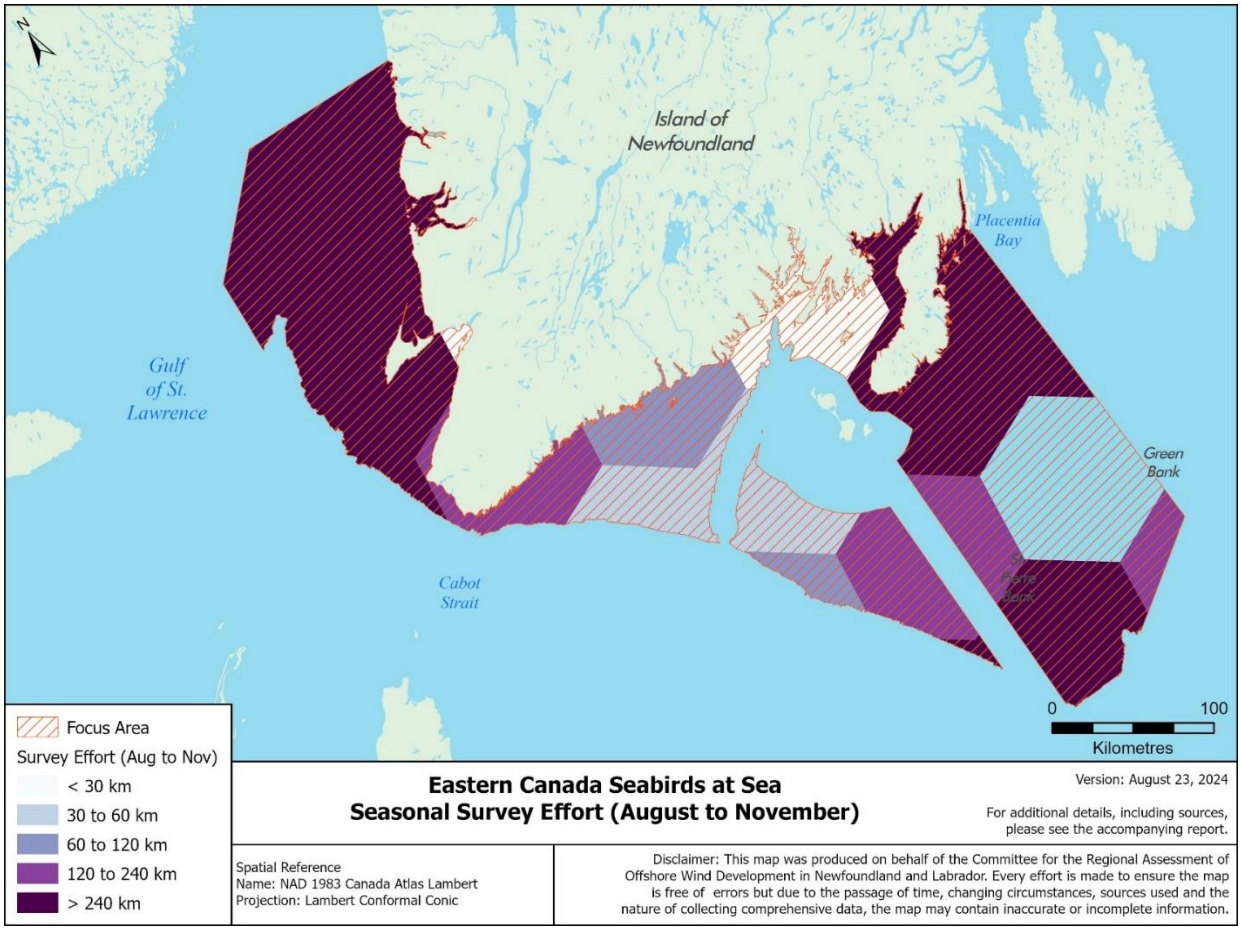
This map shows Eastern Canada Seabird at Sea survey effort across the Focus Area from April to July. Survey effort is measured as kilometers surveyed within each 100 km hexagonal cell. Variation in survey effort could influence density information shown in Figure 7.3.1.
Sources: Government of Canada, 2023; IAAC, 2023; NRCan, 2023.

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



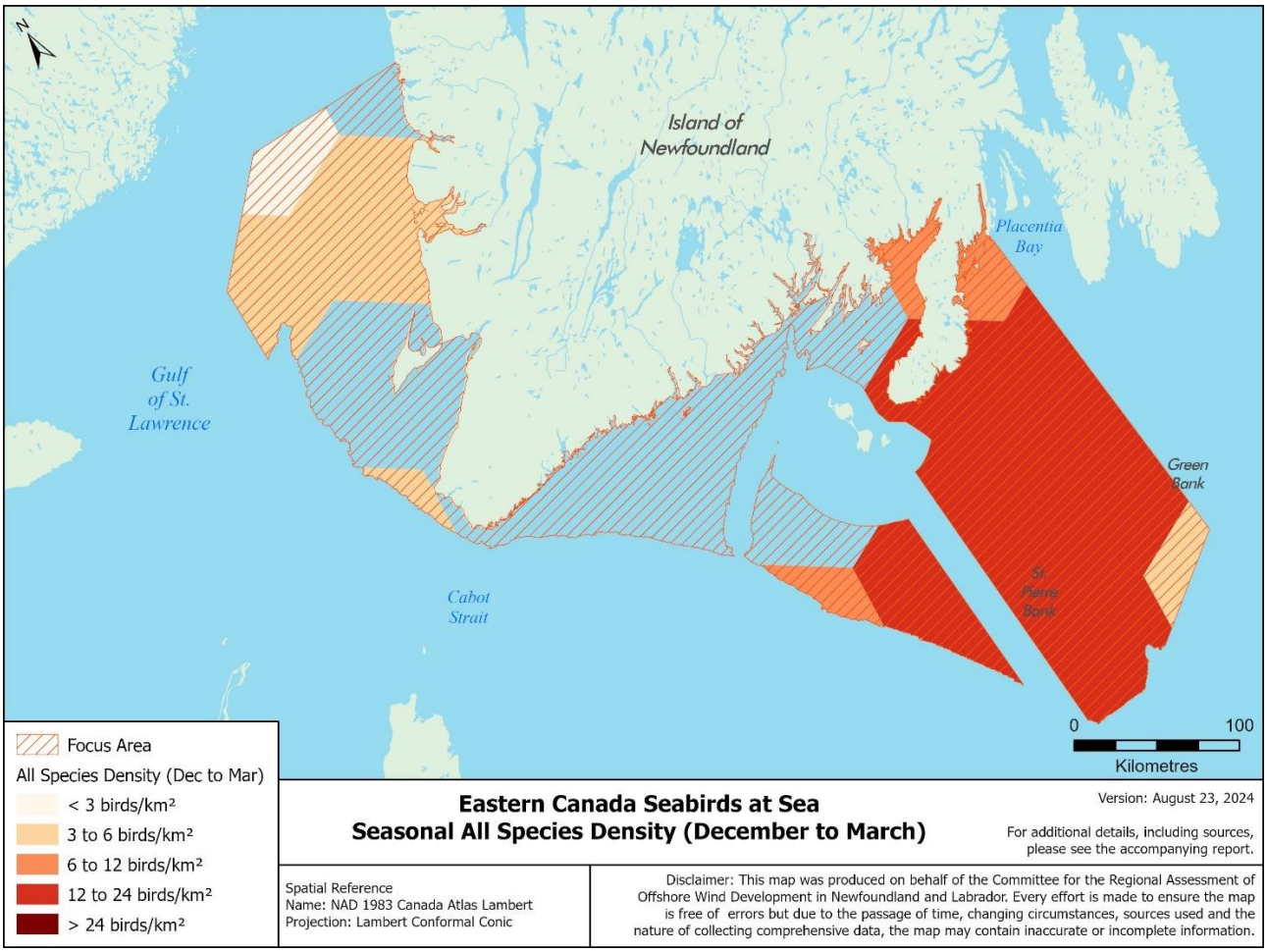
This map shows marine bird density and distribution across the Focus Area from August to November. Figure 7.3.4 shows survey effort during this period. April to July, August to November, and December to March roughly represent Spring migration and nesting periods of nidifugous species; moult, chick-rearing 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.
Sources: Government of Canada, 2023; IAAC, 2023; NRCan, 2023.

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



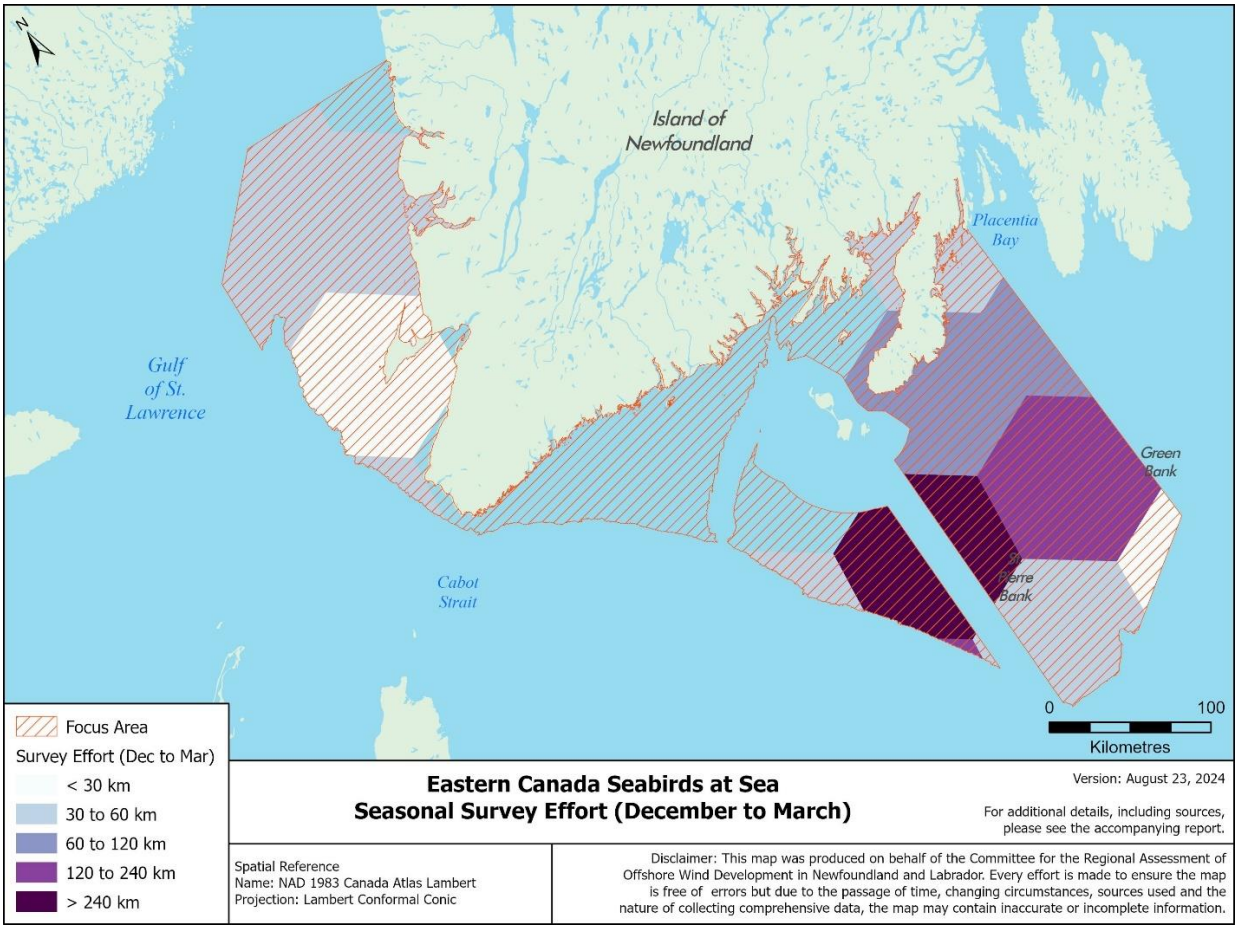
This map shows Eastern Canada Seabird at Sea survey effort across the Focus Area from August to November. Survey effort is measured as kilometers surveyed within each 100 km hexagonal cell. Variation in survey effort could influence density information shown in Figure 7.3.1.
Sources: Government of Canada, 2023; IAAC, 2023; NRCan, 2023.

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



This map shows marine bird density and distribution across the Focus Area from December to March. Figure 7.3.2 shows survey effort during this period. April to July, August to November, and December to 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.
Sources: Government of Canada, 2023; IAAC, 2023; NRCan, 2023.

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



This map shows Eastern Canada Seabird at Sea survey effort across the Focus Area from December to March. Survey effort is measured as kilometers surveyed within each 100 km hexagonal cell. Variation in survey effort could influence density information shown in Figure 7.3.5.
Sources: Government of Canada, 2023; IAAC, 2023; NRCan, 2023.

In addition to information on density and distribution, ECCC provided the Committee with maps showing fine-scale use and movement for Northern Gannet (*Morus bassanus*), Red-throated Loon (*Gavia stellata*), and Surf Scoter (*Melanitta perspicillata*) during fall and spring migration (ECCC, 2023f). Based on these maps, only Northern Gannet distribution showed overlap with the Focus Area. All models were based on large sample sizes (greater than or equal to 75 individuals). For Northern Gannet, a total of 75 adult Northern Gannets were captured and tagged with Argos platform terminal transmitters (PTT) during 2012-2015, 66 in wintering areas and 9 at the Cape St. Mary's colony during fall. Data for the model came from Spiegel et al., (2017); Stenhouse et al., (2020); Northeast Ocean Data, (2023).[40] Utilization distribution was determined by calculating individual level dynamic Brownian-bridge movement model surfaces for spring, fall and winter.

The fall migration model showed movement distribution along the southwestern boundary of the Focus Area, at St. Piere Bank, and adjacent to the Focus Area in Placentia Bay. Spring migration movement is shown in the Focus Area around St. Pierre and Miquelon, some parts of St. Pierre Bank, off Cape St Mary's and into the Focus Area, and along the western and northwestern boundaries of the Focus Area. In both seasons, movement utilization is more concentrated through the Scotia Shelf. The winter movement model showed Northern gannets mostly outside of Atlantic Canada (ECCC, 2023; Spiegel et al., 2017).

Bird Colonies and Foraging Distribution

Bird colonies support high densities of marine birds, shorebirds and waterfowl during sensitive life periods, like breeding. Birds congregate and nest at colonies and use the surrounding area for foraging. 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, 2016).

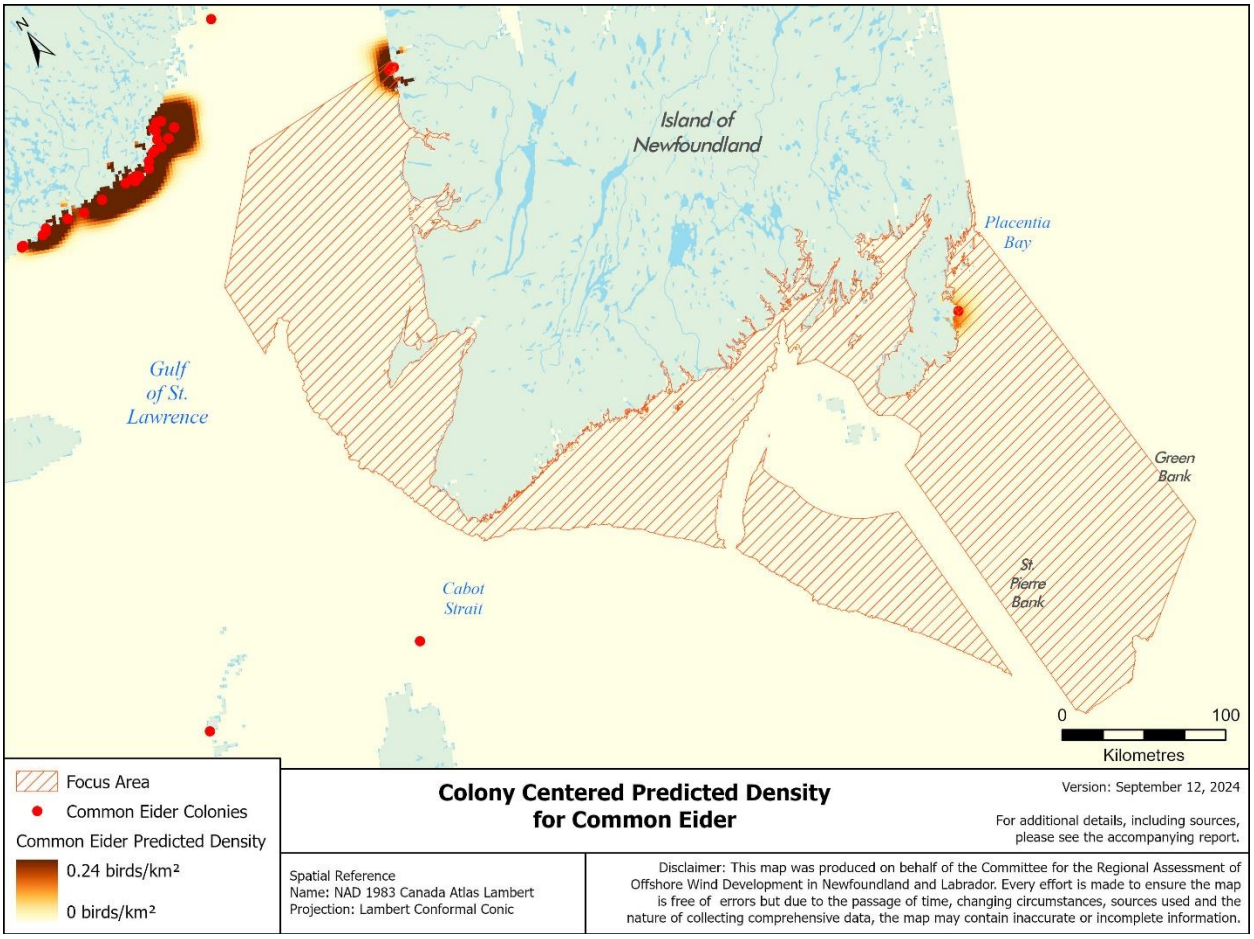
Some work has also been completed by Ronconi et al., (2022) to model seabird foraging distribution around colonies during breeding season. They used tracking data around 'training colonies' from 520 individuals of 14 seabird species, and machine learning to build predictive models for each species. These 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

[40] The Northeast Ocean Data portal has an interactive data explorer where some data could be visualized.

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, 2023f; 2024). Study species included Common Eider (*Somateria mollissima dresseri*), Leach's Storm-petrel (*Hydrobates leucorhous*),[41] Northern Gannet (*Morus bassanus*), Great Black-backed Gull (*Larus marinus*), Herring Gulls *(L. smithsoniansus*), Black-legged Kittiwake (*Rissa tridactyla*), Common Tern (*Sterna hirundo*), Arctic Tern (*S. paradisaea*), Roseate Tern (*S. dougallii*), Razorbill (*Alca torda*), Atlantic Puffin (*Fratercula arctica*), Common Murre (*Uria aalge*), Thick-billed Murre (*U. lomvia*), and Black Guillemot (*Cepphus grylle*). Limitations associated with this information source should also be noted. As a part of their study, Ronconi et al., (2022) scored the reliability of their model inputs on a scale of 4 (minimum) to 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) to high (3) 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 quantity and quality (i.e., accuracy based on devices used) of avifauna tracking data, in general, is a limitation for understanding species distribution (see Section 7.3.6 of this Report, Data Gaps and Limitations). Therefore, this information should be interpreted with caution.

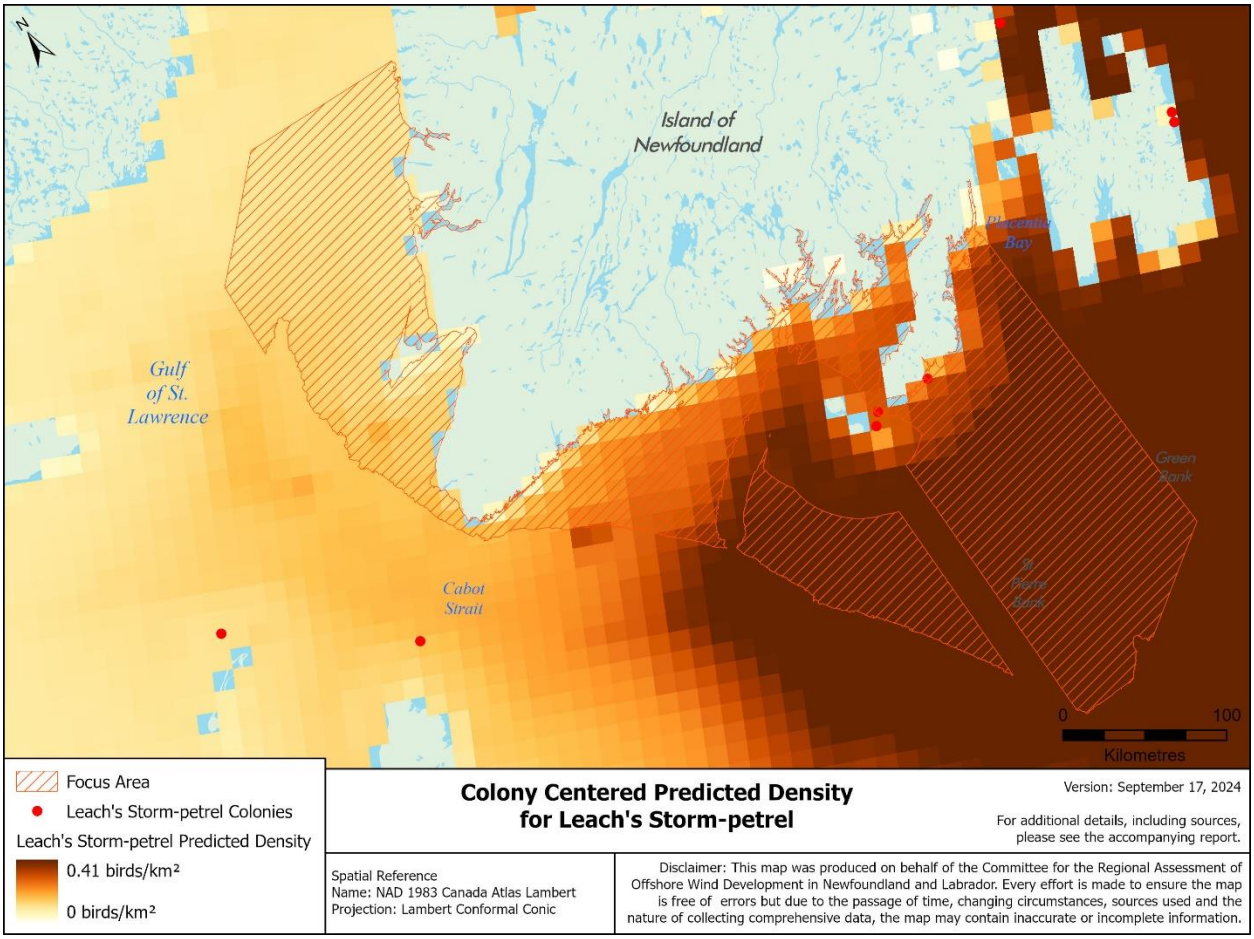
[41] ECCC advised against using predicted foraging distribution (Ronconi et al, 2022) or theoretical foraging radii for Leach's Storm-petrel because the foraging distribution model for storm-petrels does not capture the foraging levels of the smaller colonies.

Figure 7.3.7. Colony Centered Predicted Density for Common Eider



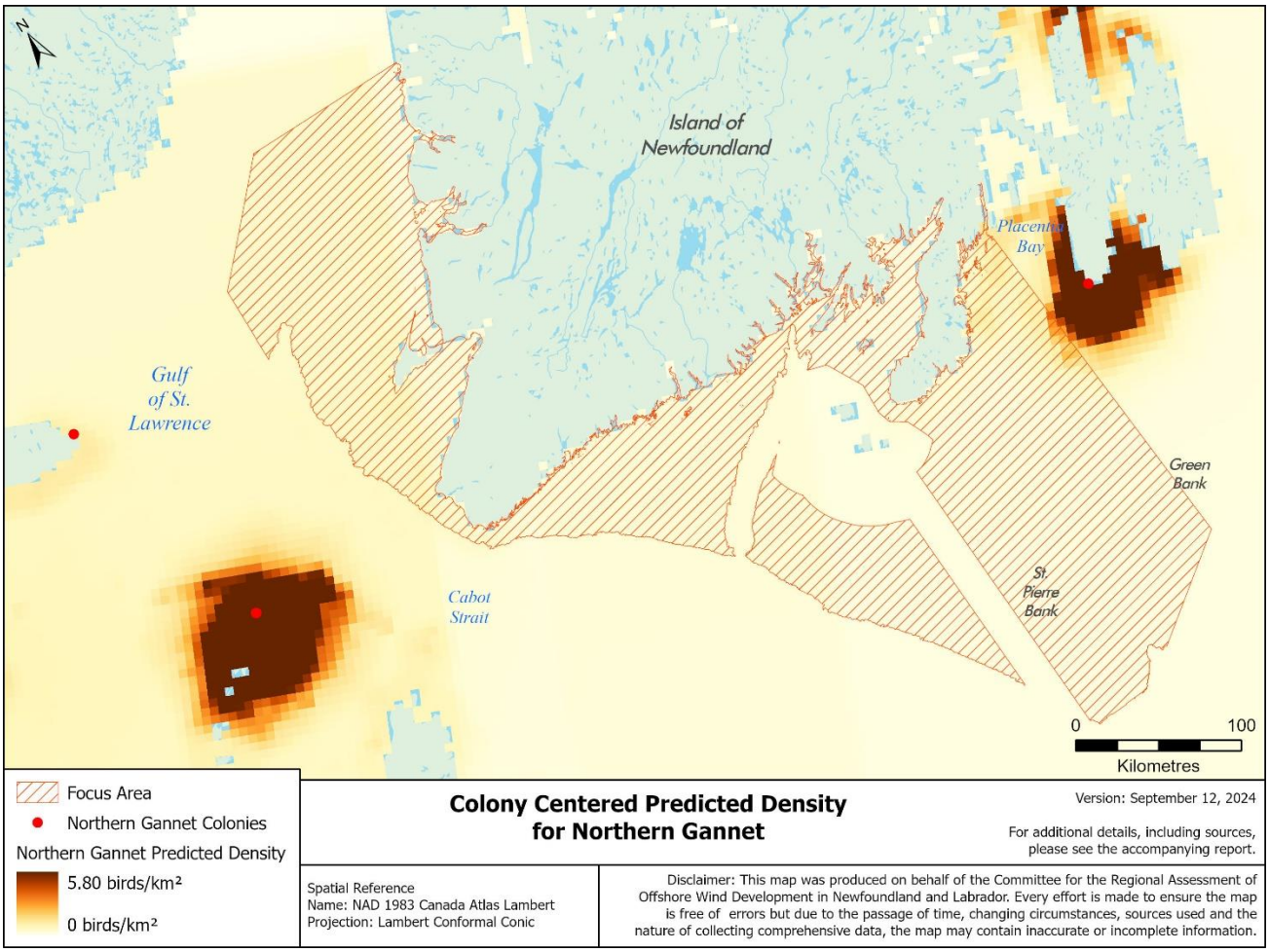
This map shows predicted density for Common Eider around bird colonies. Predictions are based on modelling completed by Ronconi et al., (2022). Models were built based on tacking data from individuals around select colonies; environmental variables expected to predict species' presence (based on the 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) to 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) to high (3) 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.
Sources: IAAC, 2023; NRCan, 2023; Ronconi et al.,2022

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



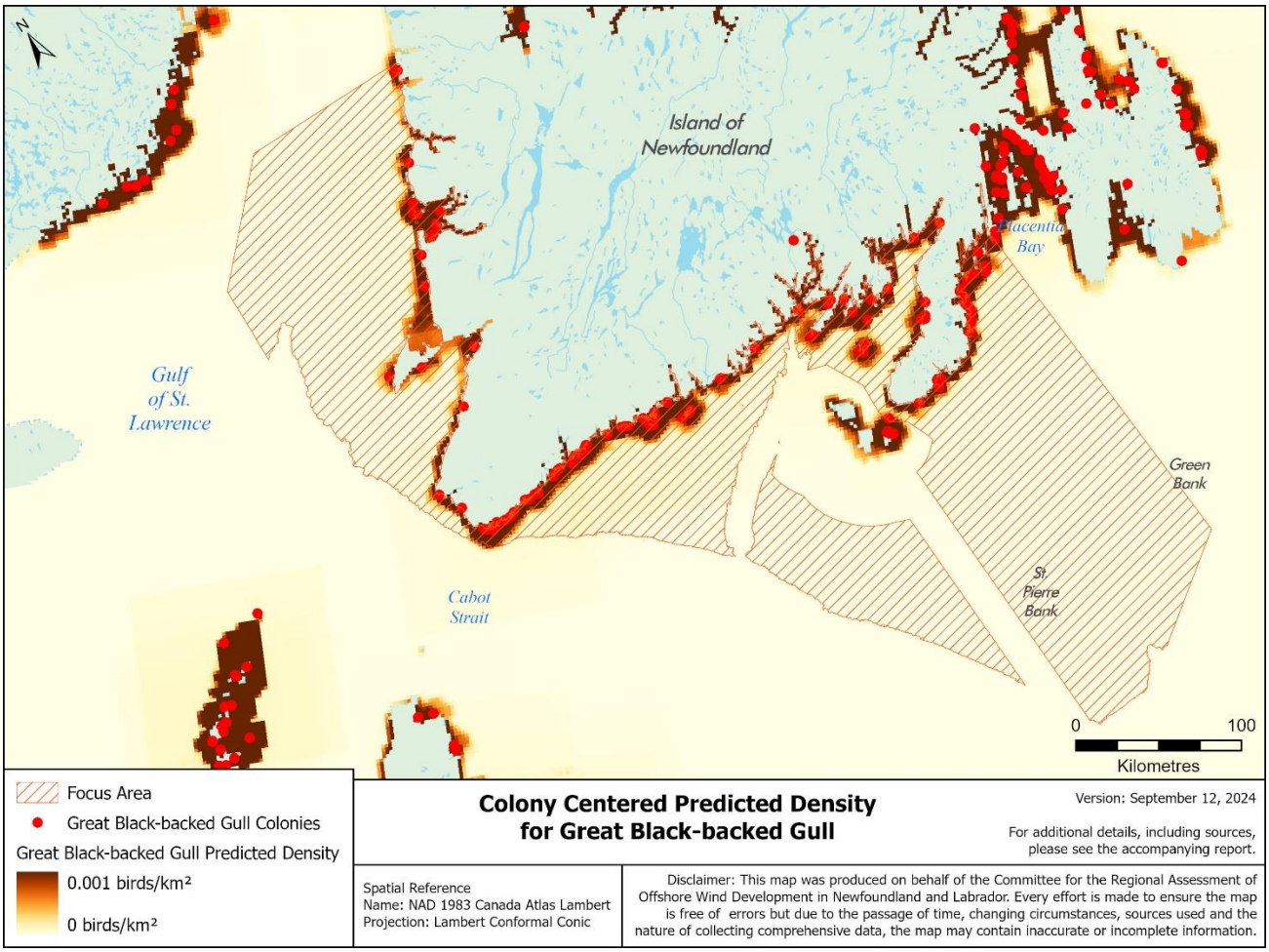
This map shows predicted density for Leach's Storm petrel around bird colonies. Predictions are based on modelling completed by Ronconi et al., (2022). Models were built based on tacking data from individuals around select colonies; environmental variables expected to predict species' presence (based 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) to 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) to high (3) 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. Sources: IAAC, 2023; NRCan, 2023; Ronconi et al., 2022

Figure 7.3.9. Colony Centered Predicted Density for Northern Gannet



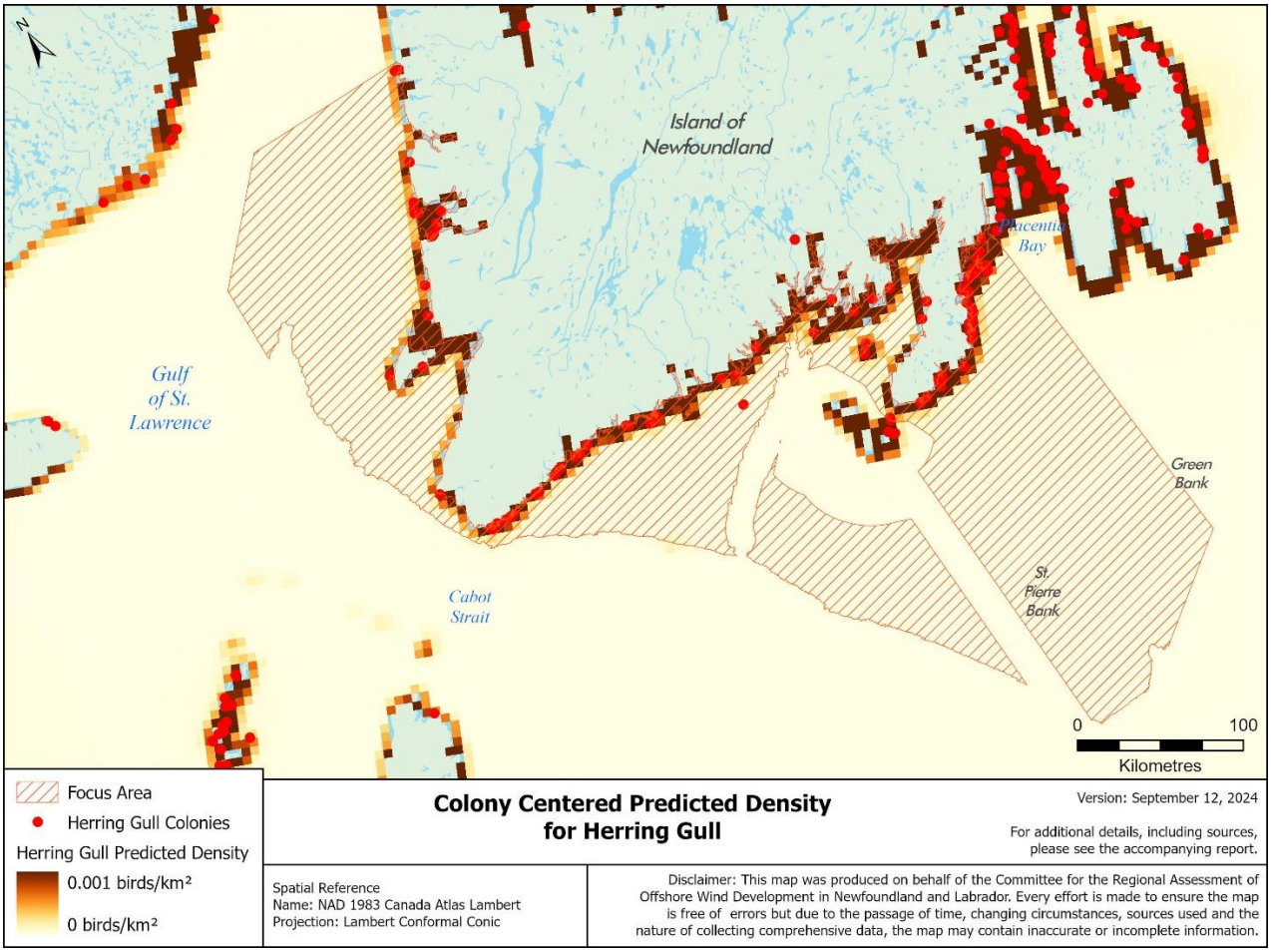
This map shows predicted density for Northern Gannet around bird colonies. Predictions are based on modelling completed by Ronconi et al., (2022). Models were built based on tacking data from individuals around select colonies; environmental variables expected to predict species' presence (based on the 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) to 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) to high (3) 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. Sources: IAAC, 2023; NRCan, 2023; Ronconi et al., 2022.

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



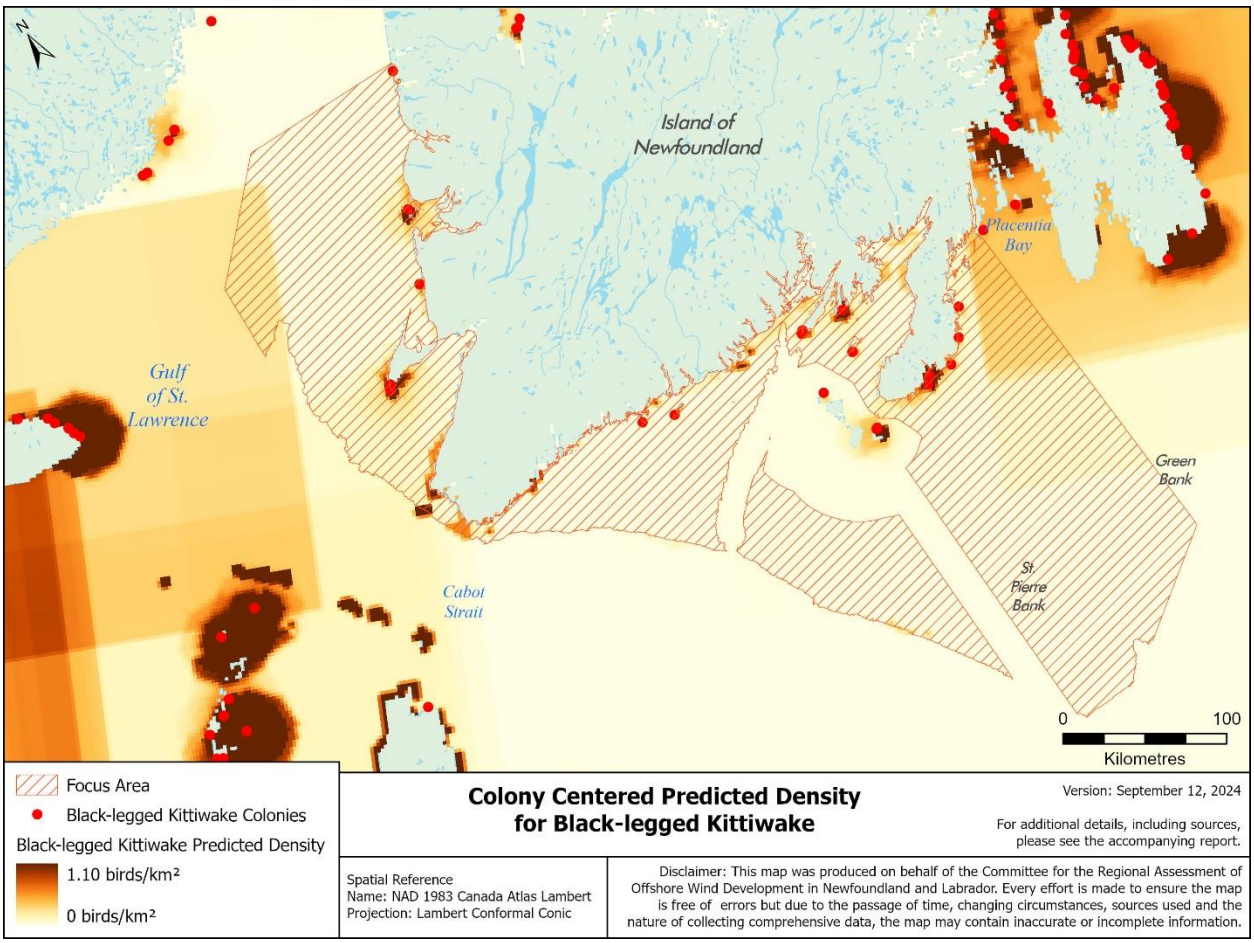
This map shows predicted density for Great Black-backed Gull around bird colonies. Predictions are based on modelling completed by Ronconi et al., (2022). Models were built based on tacking data from individuals around select colonies; environmental variables expected to predict species' presence (based 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) to 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) to high (3) 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 Source: IAAC, 2023; NRCan, 2023; Ronconi et al., 2022.

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



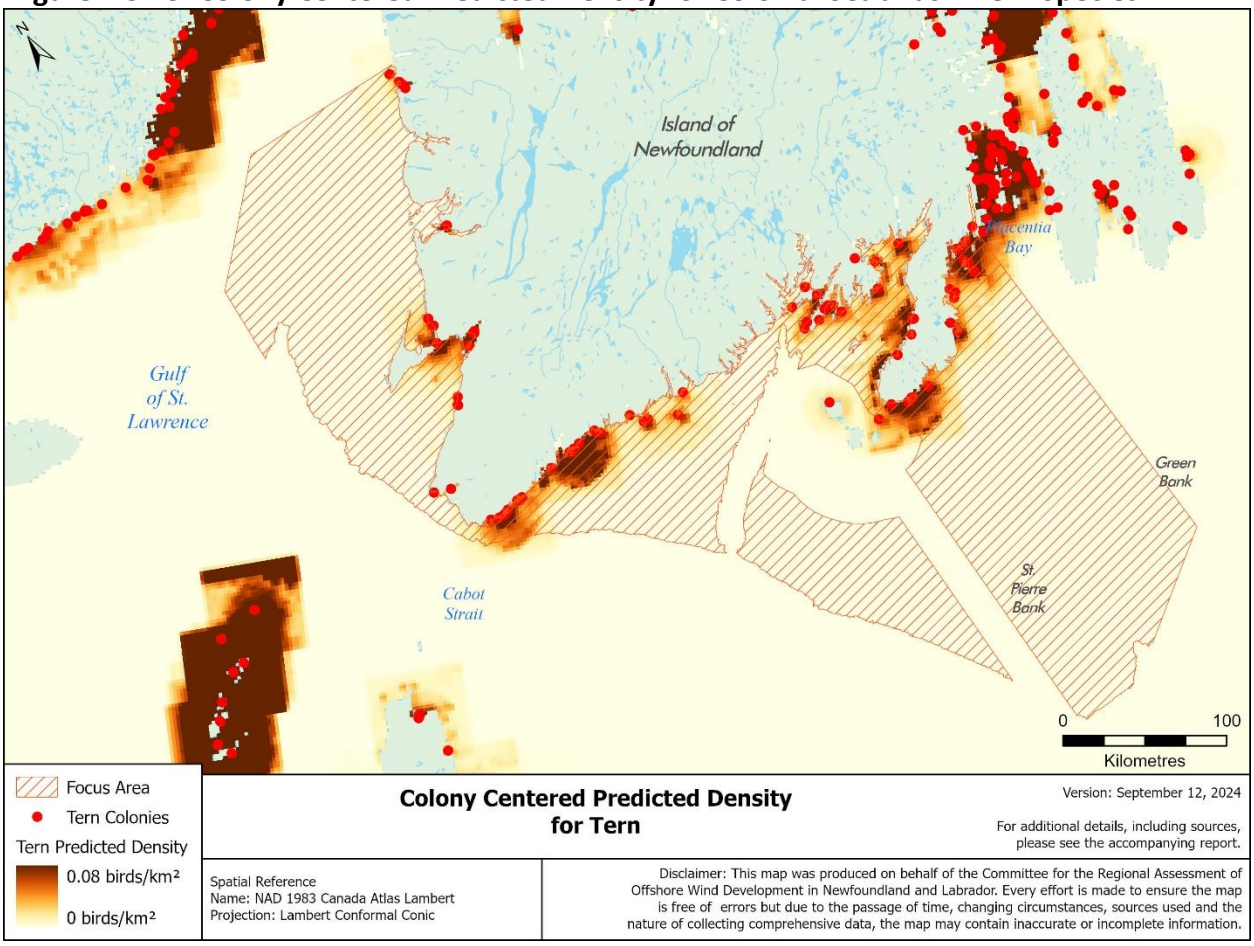
This map shows predicted density for Herring Gull around bird colonies. Predictions are based on modelling completed by Ronconi et al., (2022). Models were built based on tacking data from individuals around select colonies; environmental variables expected to predict species' presence (based on the 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) to 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) to high (3) 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.
Sources: IAAC, 2023; NRCan, 2023; Ronconi et al., 2022

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



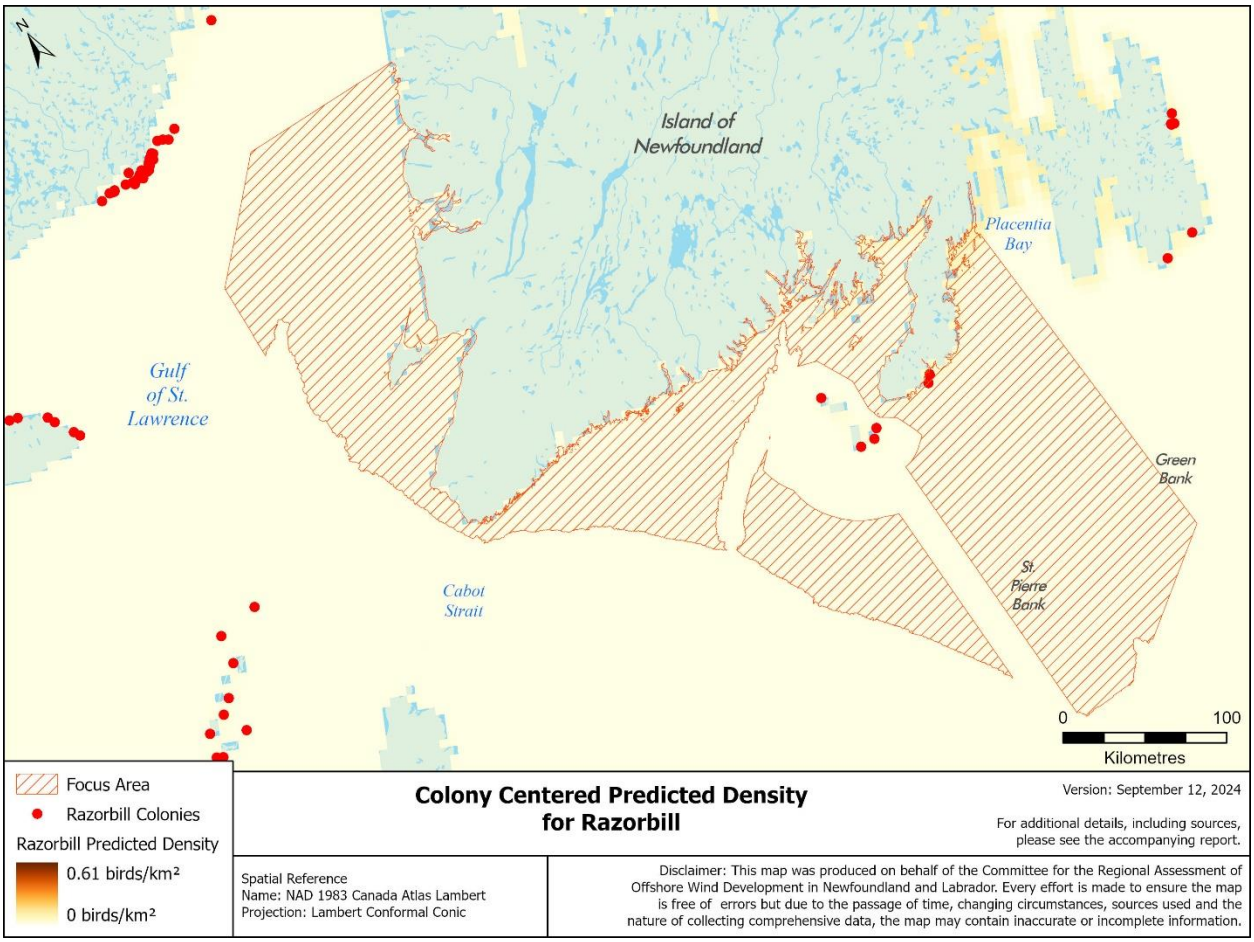
This map shows predicted density for Black-legged Kittiwake around bird colonies. Predictions are based on modelling completed by Ronconi et al., (2022). Models were built based on tacking data from individuals around select colonies; environmental variables expected to predict species' presence (based 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) to 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) to high (3) 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. Sources: IAAC, 2023; NRCan, 2023; Ronconi et al., 2022.

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



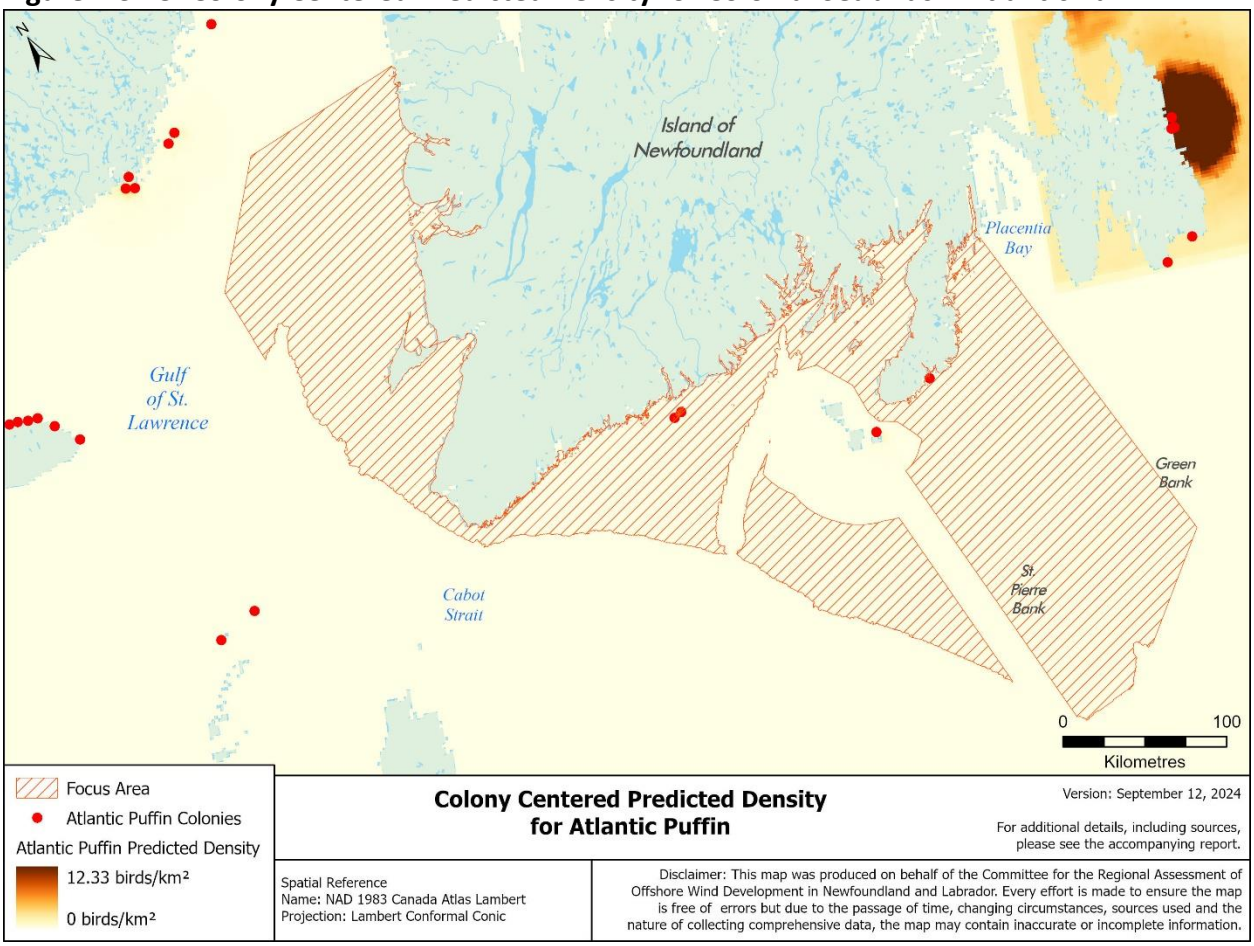
This map shows predicted density for Tern species around bird colonies. Predictions are based on modelling completed by Ronconi et al., (2022). Models were built based on tacking data from individuals around select colonies; environmental variables expected to predict species' presence (based on the 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) to 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) to high (3) 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.
Sources: IAAC, 2023; NRCan, 2023; Ronconi et al., 2022.

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



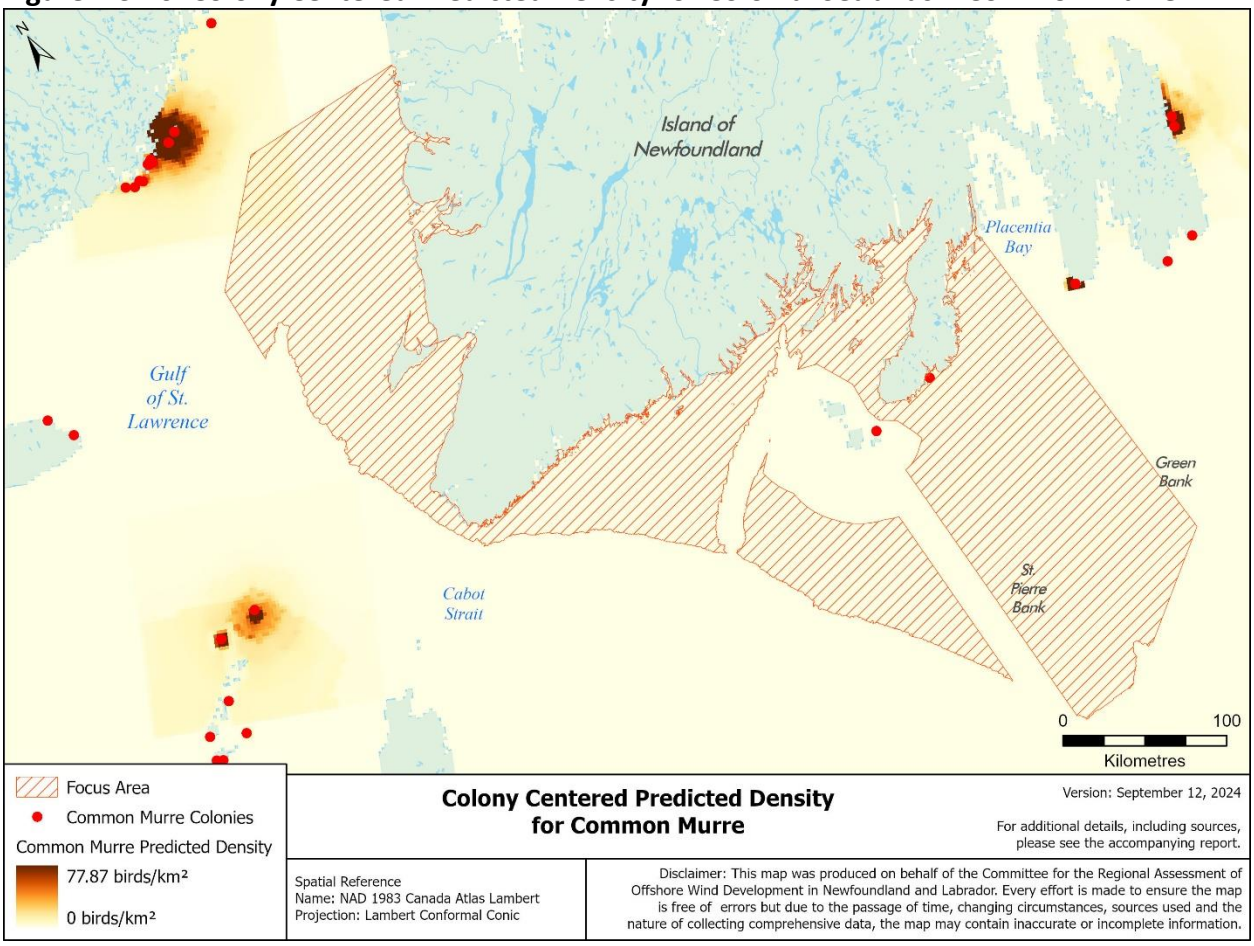
This map shows predicted density for Razorbill around bird colonies. Predictions are based on modelling completed by Ronconi et al., (2022). Models were built based on tacking data from individuals around select colonies; environmental variables expected to predict species' presence (based on the tracking 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) to 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) to high (3) 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.
Sources: IAAC, 2023; NRCan, 2023; Ronconi et al., 2022.

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



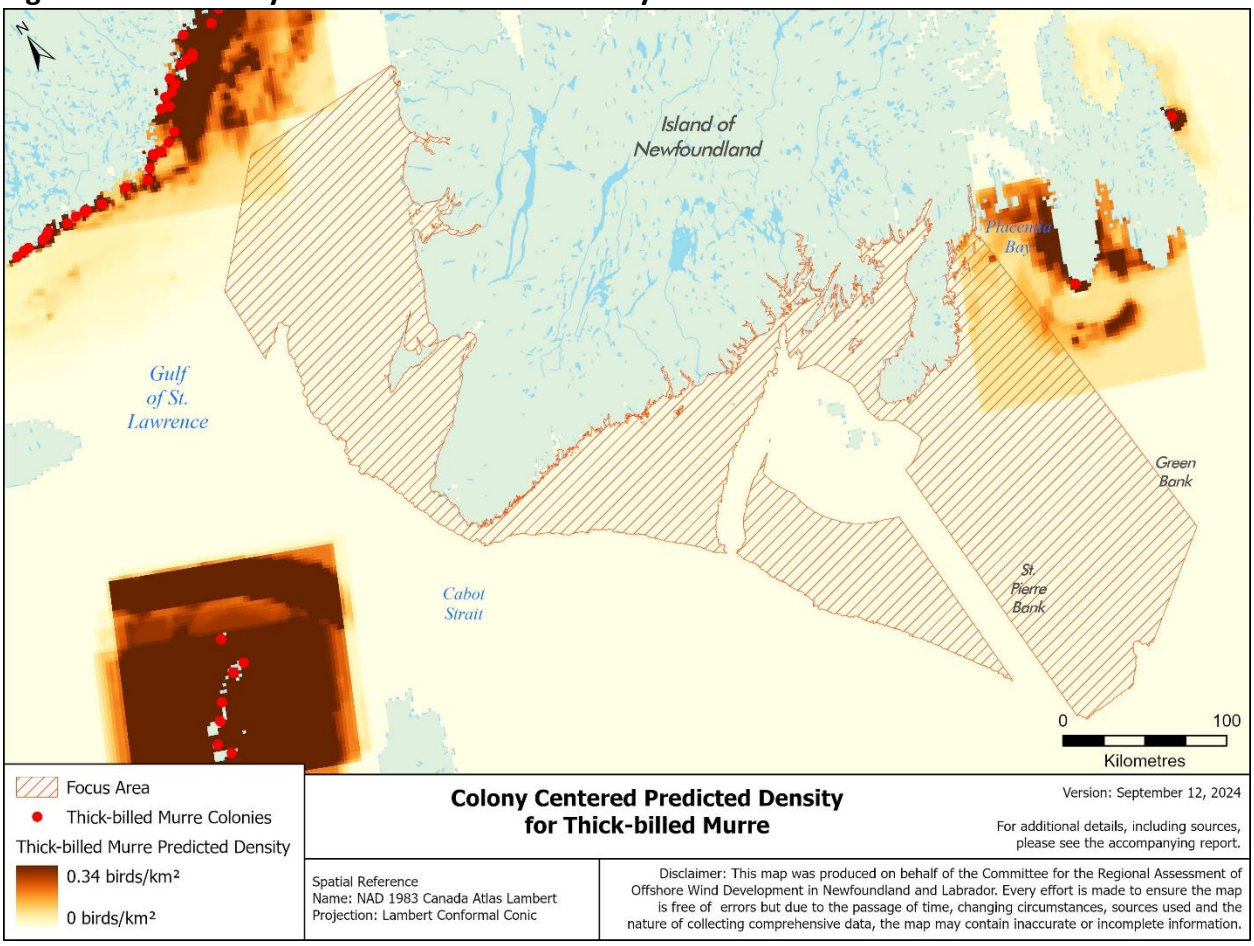
This map shows predicted density for Atlantic Puffin around bird colonies. Predictions are based on modelling completed by Ronconi et al., (2022). Models were built based on tacking data from individuals around select colonies; environmental variables expected to predict species' presence (based on the 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) to 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) to high (3) 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.
Sources: IAAC, 2023; NRCan, 2023; Ronconi et al., 2022.

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



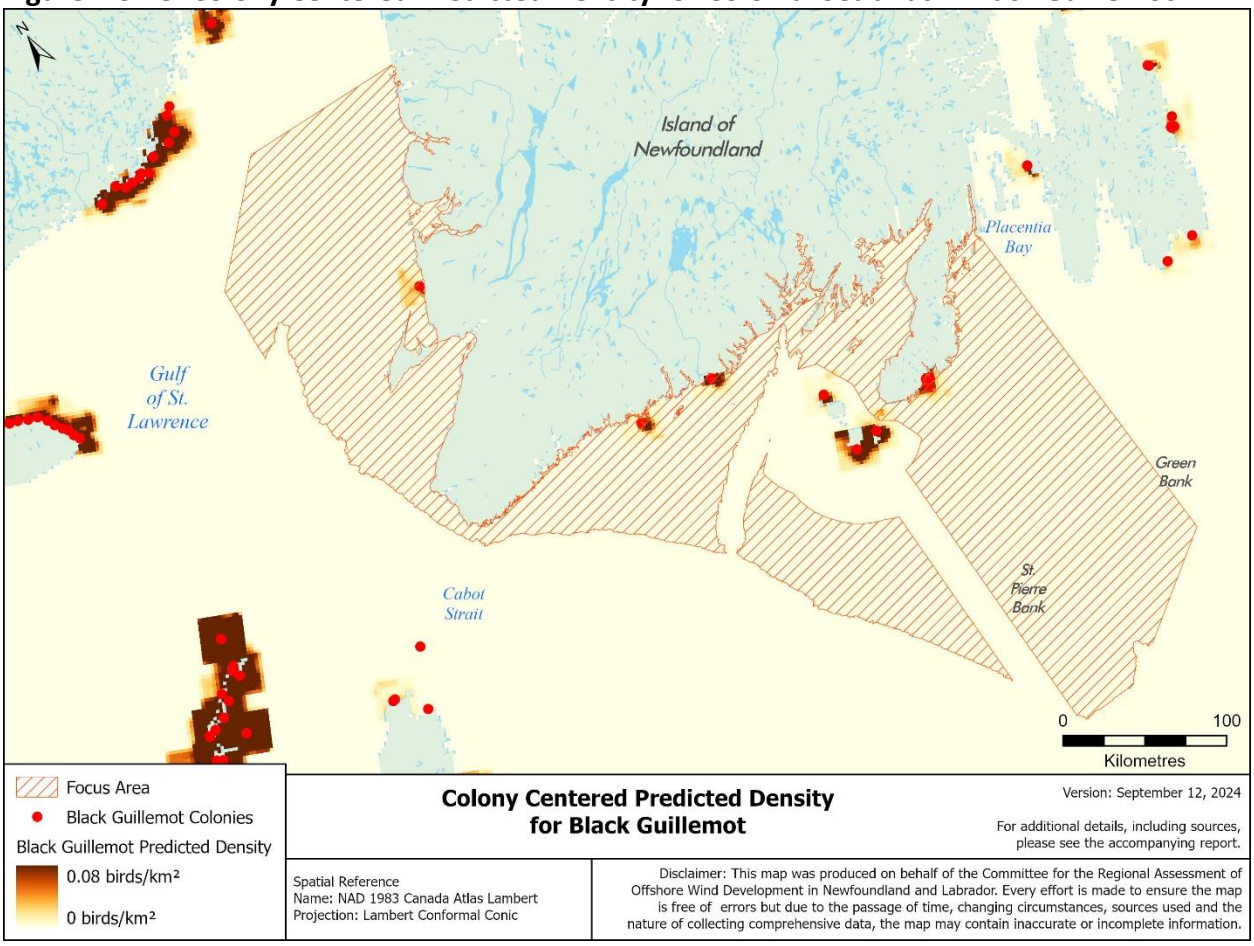
This map shows predicted density for Common Murre around bird colonies. Predictions are based on modelling completed by Ronconi et al., (2022). Models were built based on tacking data from individuals around select colonies; environmental variables expected to predict species' presence (based on the 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) to 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) to high (3) 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.
Sources: IAAC, 2023; NRCan, 2023; Ronconi et al., 2022

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



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 tacking 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) to 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) to high (3) 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.
Sources: IAAC, 2023; NRCan, 2023; Ronconi et al., 2022

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



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 tacking 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) to 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) to high (3) 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.
Sources: IAAC, 2023; 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 7.3.1). 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 (BIOMQ; ECCC 2023c) and the Maine Seabird Database (USFWS, 2023). Th largest known colony size for each site and species between 1974 to 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 under Registry Document 275.

Table 7.3.1. 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	2.4*	1.2	3.6		O	USA	Mosher 1986
Black-crowned Night Heron	4*		4		O	Maine, USA	Maine Department of Inland Fisheries and Wildlife
Black-legged Kittiwake	129.9		129.9	1	D	Atlantic Canada	Ronconi et al. 2022
Caspian Tern	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	10.7*	5.73	16.43		O	Ontario, Canada	Stapanian et al. 2002
Glaucous Gull	35*		35			Alaska, USA	Troy (unpublished)
Great Black-backed Gull	55.3	36.4	91.7	2	D	Atlantic Canada	Ronconi et al. 2022
Great Blue Heron	2.7**		2.7	63 ind.	O	Minnesota, USA	Custer and Galli, 2002
Great Cormorant	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	16.6*		16.6		D	New Jersey, USA	Dosch 2003
Manx Shearwater	1346.8	1018.7	2365.5	6	D	UK; Ireland	Woodward et al. 2024
Northern Fulmar	542.3	657.9	1200.2	16	D	Greenland; Norway; UK; USA	Woodward et al., 2024

Species	Mean max (km)	Mean max SD (km)	Buffer Radii (km)	Sample size	Source	Study location	Reference
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	10.8*		10.8	1029 ind.	O	Montana, USA	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

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, 2024.

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. Once completed, these will be posted on the Registry. The Final Report will be updated to include a clear reference. In the interim, the following provides a description of ongoing work. Information on vulnerability of marine birds to offshore wind, such as a species' vulnerability to collision and displacement risk and population vulnerability, was provided by ECCC (ECCC, 2024). ECCC, with input from BRI, developed offshore wind vulnerability models for marine birds known to occur in the offshore environment of Canada's Atlantic Region. 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 and 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. The completed models will help inform recommendations related to setback distances from specific bird colonies during project-level impact assessments and should be used in conjunction with other parameters that project proponents would be reasonably expected to provide.

Table 7.3.2 summarizes some general characteristics of marine birds that could influence vulnerability.

Table 7.3.2. 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 rarely fly above 20 m • Relatively high macro avoidance rate • Moderate to high habitat flexibility, wide prey, or habitat-specific ranges
Aythyinae – Diving Ducks Examples: Greater Scaup and Lesser Scaup	• Primarily nocturnal foragers • Flight heights estimates vary considerably across the literature, with high uncertainty • High avoidance and moderate habitat flexibility
Gaviidae – Loons Examples: Common Loon and the Red-throated Loon	• Primarily diurnal and provide their young with biparental care • High macro avoidance rate • Minimal habitat flexibility
Hydrobatidae – Storm-petrels Examples: Band-rumped storm-petrels, 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 • Long-distance migrators, returning to their colonies only during the breeding season
Laridae – Gulls Examples: Little Gull, Black-legged Kittiwake, Black-headed Gull, Bonaparte's Gull, Laughing Gull, Glaucous Gull, Great Black-backed Gull, Herring Gull, Iceland Gull, Lesser Black-backed Gull, 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
Merginae – Sea Ducks Examples: Barrow's Goldeneye, Bufflehead, Common Goldeneye, Black Scoter, Surf Scoter, White-winged Scoter, Common Eider, King Eider, Common Merganser, Hooded Merganser, Red-breasted Merganser, Harlequin Duck, 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
Phaethontidae – Tropicbirds Example: White-tailed Tropicbird	• Limited literature on White-tailed Tropicbird behaviour overall

Species Group	Characteristics
	• 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
Phalacrocoracidae – Cormorants Examples: Double-crested Cormorant and Great Cormorant	• Primarily diurnal • Moderate maneuverability. • Double-crested Cormorant forages in marine and freshwater
Podicipedidae – Grebes Examples: Horned Grebe and Red-necked Grebe	• Nocturnal migrant, primarily forages and rests during daytime • May have good maneuverability, however, literature varies • Require specific resources and habitats for nesting and foraging
Procellariidae – Petrels and Shearwaters Examples: Bermuda Petrel, Black-capped Petrel, Desertas Petrel, Fea's Petrel, Zino's Petrel, Audubon's Shearwater, Cory's Shearwater, Great Shearwater, Manx Shearwater, Sooty Shearwater, and Northern Fulmar	• Data on the individual species often lacking • Spend most of their flight time close to the water in search of food • Fulmars fly relatively low in search of food • Shearwaters and fulmars have wide prey/habitat ranges and high macro avoidance.
Scolopacidae – Sandpipers, Snipes, and Relatives Examples: Red Phalarope, Red-necked Phalarope, and Wilson's Phalarope	• 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.
Stercorariidae – Jaegers and Skuas Examples: Long-tailed Jaeger, Parasitic Jaeger, and Pomarine Jaeger, and two skuas: Great Skua and South Polar Skua	• 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
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 unclear • Moderate prey/habitat range due to their piscivorous diet

Species Group	Characteristics
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

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 (2024) in confidential drafts of their work regarding marine bird vulnerability models.

Sources: Bradbury et al., 2014; Cramp, 1985; Cramp and 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; Wade et al., 2016; Willmott et al., 2013; Winkler et al., 2020a; 2020b; 2020c; 2020d; 2020e; 2020f; 2020gj.

7.3.2.1.2 Shorebirds and Coastal Waterbirds

Shorebirds refer to avian species that live along the coast and use 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, 2023). Maps showed shorebird coastal density based on ECCC internal data (ECCC, 2012; 2014; 2015c; 2023g) 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 to October). Except for Purple Sandpiper, which shows moderate relative abundance over winter with peak abundance in April, most species have low abundance or are absent in winter months (ECCC, 2023f).

Through ECCC, the Shorebird Science and Conservation Collective also provided input to the Regional Assessment. Their report to the Canadian Wildlife Service (and provided to the Committee) is available on the Registry Page (ECCC, 2024):

Importantly, their report 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.

Some key findings are summarized here and in Table 7.3.3 below:

- **Total number of individuals and tracks:** Between 2006-2023, 1678 individuals of 21 species contributed to the Shorebird Collective. Of these, 41 individuals (8 species) were tagged 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 (*Scolopax minor*), Black-bellied Plover (*Pluvialis squatarola*), Hudsonian Godwit (*Limosa haemastica*), Lesser Yellowlegs (*Tringa flavipes*), Pectoral Sandpiper (*Calidris melanotos*), Red Phalarope (*Phalaropus fulicarius*), and Whimbrel (*Numenius phaeopus*).
- **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 tagged 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.
- **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 as is sometimes done for bats) may not be an effective approach for all shorebird 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 species2 (n = 594) in the U.S. Atlantic Outer Continental Shelf Region found modeled-estimated flight heights to vary between 28 m - 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).

Table 7.3.3. Post-Breeding (Fall) Migration – Proportion of Shorebirds with Tracklines Intersecting the AOI and Description of Tags in the Regional Assessment Focus Area

Species	Shorebird Collective Dataset Overall (n Individuals)	Relevant Sample (n individuals)	Trackline intersected AOI (n individuals)	Tags in Focus Area*
American golden plover				
Breeding Areas	Eastern Canadian Arctic	6	6 (100%)	1 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 tags or estimated tracklines. One pre-breeding (spring) migration GPS location near Cape St. Mary's.
	Eastern USA	149	0 (0%)	
	Central Canada	8	0 (0%)	
	Central USA	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 tags or estimated tracklines.
	Western Canadian Arctic	3	3 (100%)	
	Alaska	8	0 (0%)	

Species	Shorebird Collective Dataset Overall (n Individuals)	Relevant Sample (n individuals)	Trackline intersected AOI (n individuals)	Tags in Focus Area*
Totals	42	12	4 (33%)	
Lesser yellowlegs				
Breeding Areas	Eastern Canada	9	9 (100%)	No tags. 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 tags or tracklines in Focus Area.
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%)	

Species	Shorebird Collective Dataset Overall (n Individuals)	Relevant Sample (n individuals)	Trackline intersected AOI (n individuals)	Tags in Focus Area*
Additional Tagging Locations	Cape Cod, MA	5	0 (0%)	near Connaigre Peninsula and Burin Peninsula.
Total	66	56	15 (27%)	

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, 2024. Data comes from 74 organizations, collected from 2006 to 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 Page under Document Reference number: 275
*Tag 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 and 1500 m.
Sources: ECCC, 2024; Shorebird Collective Data Version 2023- 10-10.

Limited conclusions can be drawn from the available movement data (see Section 7.3.6 of this Report below, Data Gaps and Limitations). 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.

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, Areas Important for Aerofauna).

7.3.2.1.3 Waterfowl

Waterfowl refers to swimming game birds. They inhabit fresh- and saltwater and spend most of their life on the water's surface. They may use portions of the Focus Area for foraging, migrating or staging.

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, 2018; 2023d), 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.[42] 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 (*Anas rubripes*), Black Scoter (*Melanitta americana*), Common Eider (*Somateria mollissima*), Common Goldeneye (*Bucephala clangula*), Common Merganser (*Mergus merganser*) and an unknown merganser species, Long-tailed Duck (*Clangula hyemalis*), Red-breasted Merganser (*Mergus serrator*) and an unknown loon species. All coastal blocks with waterfowl observations recorded in the Focus Area had a low relative importance. ECCC advised that this information 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 rotor swept zone of offshore wind turbines.

[42] 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.

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 BurinPeninsula, in Fortune Bay and surrounding St. Pierre Miquelon. Relatively high densities of White-winged Scoter (*Melanitta deglandi*) may occur near St. Pierre Miquelon. Other species observed in the Focus Area include Common Eider, Long-tailed Duck, Red-breasted Merganser, and Surf Scoter (*Melanitta perspicillata*).

Maps based on the U.S. Geological Survey Gamebird dataset show relative densities of gamebird harvest around coastal areas in Atlantic Canada. These data also show 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 (*Branta canadensis*), Common Eider, Common Merganser, Green-winged Teal *(Anas crecca),* Lesser Scaup (*Aythya affinis),* Mallard (*Anas platyrhynchos*), and Ring-necked Duck (*Aythya collaris*). This dataset also shows hotspots for common murres (*Uria aalg*e) 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 may be more 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 species and considering an area's similarity to the average niche space.[43] 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 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

[43] 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.

GMNP, was identified as suitable breeding habitat for long-tailed duck. No suitable breeding habitat was identified for other species.[44]

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

7.3.2.1.4 Landbirds and Non-Avian Species

Landbirds predominately inhabit terrestrial areas but may be migratory or partially migratory across coastal and offshore routes. 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.

ECCC provided the Committee with maps showing monarch butterfly and common and swamp milkweed observations (ECCC, 2023f). 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 to 2023 and use various methods (ECCC, 2024). Horay 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 late-August to early-September. ECCC cautioned this may not be directly comparable to this region (ECCC, 2024).

[44] 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.

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.

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 7.3.4 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, 2024).

Table 7.3.4. 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
Ivory Gull	*Pagophila eburnea*	EN	Partial ID				Y	Y
Olive-sided Flycatcher	*Contopus cooperi*	SC					N	P

Common Name	Scientific Name	Current SARA	Critical Habitat	Recent COSEWIC Updates	IUCN Status Updates	IUCN Trend	Marine Habitat Exposure	Marine Movement Exposure
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	*Calidris canutus rufa*	EN	Partial ID	EN/TH/ SC			N	Y
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			N	Y
Leach's Storm-Petrel	*Oceanodroma leucorhoa*			TH			Y	Y
Lesser Yellowlegs	*Tringa flavipes*			TH			N	Y
American Tree Sparrow	*Spizella arborea*						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*						Y	Y
Blackpoll Warbler	*Setophaga striata*						N	Y
Common Tern	*Sterna hirundo*						Y	Y
Horned Lark	*Eremophila alpestris*						N	P
Short-billed Dowitcher	*Limnodromus griseus*			Under assessment			N	Y
Snowy Owl	*Bubo scandiacus*			Under re-assessment			Y	Y
Black Scoter	*Melanitta americana*				NT	Decreasing	Y	Y
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

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

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 the 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).
COSEWIC categories include NAR (not at risk), SC (special concern), TH (threatened), and EN (endangered). Only potential SARA updates are included.
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 in 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.,).
Source: ECCC, 2024.

Based on current data, only Bank Swallow,[45] Bobolink, and Piping Plover (*C. m. melodus*) have critical habitat in or adjacent to the Focus Area (ECCC, 2022c).[46]

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, 2015a). Results from the Breeding Bird Survey also demonstrate persistent decrease in numbers (Smith et al., 2023b). 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, 2013). Little is known about threats during migration 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 to 127.4 m above sea level (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 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, 2015b). Declines are most likely caused by various changes to agricultural management and habitat fragmentation (COSEWIC, 2010; Herkert, 1997; Murphy, 2003).

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 several regions including the Gulf of St. Lawrence (GSL) (Atlantic NL), Boreal Softwood

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

[46]Critical habitat is defined under the SARA 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 7.6.6 of this Report, Protected and Conserved Areas of this Report for more information on critical habitats in the Focus Area.

Shield (Atlantic NL), NLS (Atlantic, NL) (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, 2015d). 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, 2015d). 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 extant and quality, and loss of beach habitat on its wintering grounds (COSEWIC, 2013b; 2015; Elliott-Smith and Haig, 2004; Gratto-Trevor and 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 Saint 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, 2023f). ECCC provided the Committee confidential maps showing areas important for Piping Plover, based on their critical habitat, ACCDC database, and nternal data on nesting records between 2017-2022 (ACCDC, 2023; ECCC, 2021; 2022b). 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 Saint Pierre and Miquelon.

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

- 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 (*Sterna dougallii*).
- Locations of shorelines identified as Red Knot (*Calidris canutus*) priority stopover sites.
- Migration areas for Lesser Yellowlegs (*Tringa flavipes)* travelling through Atlantic Canada during fall migration.
- Locations of bat observations including Myotis (*Myotis lucifugus* and *Myotis Septentrionalis*), Eastern Red Bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), and Silver Haired Bat (*Lasionycteris noctivagans)*.
- Locations of monarch (*Danaus plexippus*) observations obtained from the Atlantic Canada Conservation Data Centre.

Based on these, important stopover areas for Red Knot and important areas for Piping Plover overlap the Focus Area.

Red knot is a long-distance migrant shorebird listed as endangered under Schedule 1 of SARA. 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.

The global Red Knot population is declining, and the *rufa* subspecies has shown a large decrease (>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, 2015e). 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 and Wiebe, 2004;Meltofte et al., 2007; Smol and Douglas, 2007; Stow et al., 2004; Tape and Racine, 2006; Tulp and Schekkerman, 2006; 2008) Other existing threats include decline in shellfish populations and hunting red knot at key wintering and staging sites (COSEWIC, 2007; ECCC, 2017). 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, 2023f). 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; ECCC, 2023f). 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, 2023f). Stopover sites are used for refuelling and resting during migration and high-quality stopover sites are critical for migratory shorebirds.

Additionally, while maps showing migration tracks for Lesser Yellowlegs and locations of bat and monarch observations did not overlap the Focus Area, data on these species is currently lacking (ECCC, 2023f).

Northern Gannet (*Morus bassanus*) 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).

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, Marine Birds.

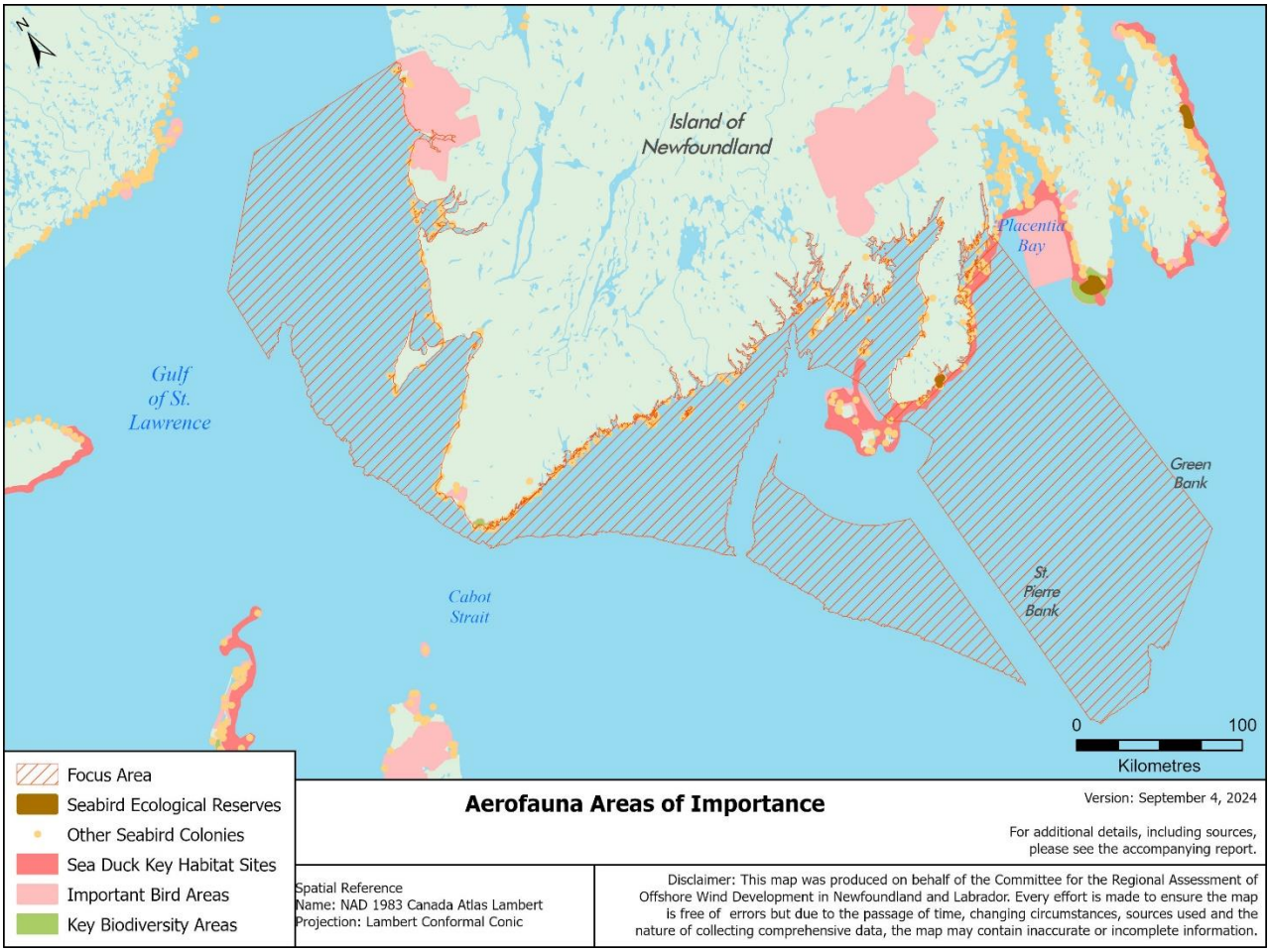
7.3.2.2.2 Areas Important for Aerofauna

Figure 7.3.20 shows areas important for aerofauna near the Focus Area. The figure only shows areas for which verified, public geospatial data was available to the Committee. 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 (see Section 7.6.1.14 of this Report, Important Bird Areas (IBAs)).
- 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.

- Possible migration routes for Northern Gannet, Whimbrel, American Golden Plover, Black-bellied Plover, American Woodcock, and Lesser Yellowlegs (see Sections 7.3.2.1.1 and 7.3.2.1.2 of this Report).

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



This map shows some of the areas important for Aerofauna adjacent to the Focus Area.
Sources: ECCC, 2016a; FFA, 2020; IAAC, 2023; IBA Canada, 2024; KBA, 2024; NRCan, 2023; Sea Duck Joint Venture, n.d.

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 Key Habitat Sites Atlas, n.d.). Most sites occur outside of the Focus Area, with some along the coast of the island of Newfoundland. Part of the St. Pierre and Miquelon to Cape St. Mary's Sea Duck Key Habitat Site occurs within the Focus Area southwest of Bird Island.

Important Shorebird Sites relate to the Western Hemisphere Shorebird Reserve Network (WHSRN) sites.[47] 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 (Newfoundland and Labrador Department of Environment and Climate Change, n.d.). The Committee is not aware of any specific requirements or guidance related to the development of offshore wind 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 gulls, black guillemots, black-legged kittiwakes, common murres and occasionally, Arctic and common terns (Newfoundland and Labrador Department of Environment and Climate Change, n.d.). 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.).

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

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, 2024). 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.[48] 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 7.3.5 summarizes sources of artificial light during different stages of offshore wind development. Once completed, decommissioning can remove some or all sources of artificial lighting and remove attraction and avoidance effects (ECCC, 2024). 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.

[48] 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.

Table7.3.5. 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

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.

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 7.3.3.3.2.2 of this Report Physical Injury or Mortality due to Collisions.

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; Huppop 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 also affect fitness. Displacement from movement pathways can occur due to attraction or avoidance responses (or through other effect pathways). 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).
>
> (ECCC, 2024)

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., 2020).

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). Regarding light characteristics, continuous blue, green or white light tends to increase avifauna attraction (Rebke et al., 2019), and some migratory bat species can be more attracted to red LED light compared to warm-white LED light (Voigt et al., 2018). Contrasting bright light and the surrounding dark marine environment could also heighten attraction (Solick & Newman, 2021).

7.3.3.2 Artificial Structures

Artificial structures are another stressor eliciting effects. Table 7.3.7 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. Similar effects could be expected due to vessel presence.

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 7.3.6 Artificial Structures Associated with Different Stages of Offshore Wind Development

Project Phase	Stressor Sources
Pre-construction	• Vessels, aircraft 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

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.

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, aircrafts 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 in this Report below). Attraction due to these structures can have sub-effects and consequence like those described above under Section 7.3.3.1 of this Report, Artificial Lighting (e.g., heightened collisions risk, increased incidents of stranding, higher energy expenditure, decreased fitness).

Artificial structures (including vessels) 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, redistribution of birds within a windfarm due to turbines, and/or redistribution of birds outside the perimeter of wind farms (SEER, 2022; Skov et al., 2018; Cook et al., 2018; May, 2015). 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 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, 2024). 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 and 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 (Huppop 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 and 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 and Langston, 2006; SEER 2022). 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.[49] For example, project location and design (Drewitt and Langston, 2006; Everaert and Stienen, 2006; Hill et al., 2014; Kerlinger and Curry, 2002; Petterson 2005), species type and abundance (AWWI, 2020; Degraer et al., 2021; Erickson et al. 2014; Everaert and Stienen, 2006; Goodale et al., 2019;Hill et al., 2014; Huppop et al., 2016; SEER, 2022; Watson, 2022), individual characteristics (e.g., age, health, behaviour such as foraging, breeding and migration) (Hill et al., 2014 Huppop et al., 2016), and weather conditions (Willmott et al., 2013) could influence collision rate. While

[49] 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. (Hill et al. 2014).

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 ert 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, 2002). They may similarly risk collision with underwater mooring systems. This risk is expected to be low as many marine birds favor shallow water for foraging, or dive to relatively shallow depths while pursuing underwater prey, and mooring systems are typically associated with deeper 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., 2017). 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 and Barclay, 2009; Hayes, 2019; Martin et al., 2017; Pettit and O'Keefe, 2017; Smallwood, 2013). 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 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, 2016b),[50] 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, 2016a;b). Furthermore, bats have been recorded as occurring up to 130 km off the Atlantic Coast in the U.S. (Stantec, 2016 b), and bats have

[50] See Section 7.3.6 of this Report, Data Gaps and Limitations.

been observed at offshore wind farms in Europe during seasonal migration (Guest et al., 2022; Rydell et al., 2010).

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, 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 and 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 and Brown, 2007).

7.3.3.2.3 Habitat Enhancement

Aerofauna habitat enhancement is one potentially positive aspect of offshore wind development. At the same time, consequences of habitat enhancement like attraction, and subsequently, increased collision risk, can also result in an adverse outcome.

Habitats may be enhanced for aerofauna through the artificial reef effect, due to increase prey availability, and/or perching opportunities.

Several studies have found offshore wind farms serve as artificial reefs, contributing to the creation of enhanced habitats for birds and marine life (Bergstrom et al., 2014; Degraer et al., 2020; Glarou et al., 2020). The artificial reef effect is described under Section 7.4.2 of this Report. For marine birds, 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).

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 2022,). 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 and Wickman; 2015).

Finally, elevated structures associated with wind turbines may also have positive effects. Certain species find these structures suitable for roosting or nesting (Dierschke et al., 2016; Lewis, 2023). Height and isolation from ground predators can create safer environments for breeding colonies, particularly for seabirds that nest on cliffs or rocky outcrops (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, 2020), and cormorant and gull species have been observed roosting on turbines, with a preference for locations along the perimeter of wind farms in (Kahlert et al., 2004; SEER, 2022). 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).

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 7.3.7 summarizes sources of aerofauna habitat loss during different phases of offshore wind development.

Table 7.3.7. 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

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.

7.3.3.3.1 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., 2011a).[51] 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 positive effects. For example, nest destruction related to vessel wake has been document in freshwater system (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. ECCC (August 2024) indicated the following species maybe highly sensitive or vulnerable to disturbance by vessels Dehnhard

[51] Displacement occurs when habitats frequently used by birds (e.g., for transiting, resting, roosting, or foraging) are less frequently used or abandoned.

et al., 2019; Goodship & Furness, 2022; Jarrett et al., 2018; Larsen & Laubek, 2005; Mendel et al., 2019):

- Long-tailed Duck,
- Red-breasted Merganser,
- Red-throated Loons,
- Common Scoter,
- Greater scaup,
- Common Eider,
- Common Goldeneye,
- Sandwich Tern,
- Roseate Tern

Alcids may also be sensitive to vessel disturbance based on observations of Black guillemot behaviour (Ronconi & Clair, 2002).

7.3.3.3.2 Displacement and Fragmentation During Operation

During operation, both adaptation to ongoing activity, and avoidance of effected areas or displacement has been noted in birds (Reid et al., 2022; 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 of 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 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 in bats. Loud and disruptive noises associated with offshore wind can lead to temporary displacement as bats seek to avoid the 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 and 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 and 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 further than 26 km from shore would have minimal impact on bat movements. It was also concluded that offshore wind closer than this could have the same impact on bat mortality as onshore wind farms. Lagerveld and Mostert (2023) found similar movements offshore 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 (2016) 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.

During operation, avoidance responses to turbines can also cause barriers to movement (ECCC, 2024). 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 and 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 (august 2024) 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).

7.3.3.3.3 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 overtime (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).

7.3.3.3.4 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 and may limit access to essential resources such as feeding areas, suitable nesting sites, and stopover locations during migration (Drewitt and 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 et al. 2020a; 2020b). 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 and 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 and Pullan, 2003). Less efficient foraging can further cause nutritional stress (Reid et al. 2022) 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, August 2024).

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 et al., 2020; Watson et al., 2021). 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-CWS-ATL indicated this can hinder reproduction by causing extinction and loss of genetic diversity (Cristofari et al., 2019).

7.3.3.3.5 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 the 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 7.3.8). Noise changes the quality of aerofauna habitat and can cause displacement, increase stress or disrupt auditory cues.

Table 7.3.8. 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

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.

ECCC relayed to the Committee: 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 C.W., 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 C.W., 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 and 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 and 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 and Barclay, 2009). Infrasound, which is below the threshold of human hearing, may still be detectable by bats, given their heightened sensitivity to sound (Surlykke and 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 (tStress responses, which can manifest as altered reproductive patterns, changes in feeding behavior, and overall compromised health (Frick et al., 2020). tBarotrauma 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 (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 and 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 (*Uria aalge*) and great cormorant (Phalacrocorax carbo sinensis) also consistently respond to underwater noise (Hansen et al., 2016). In their 2017 study, Hensen 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 (Hensen 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 (*Gavia stellata*) and northern gannet (*Morus bassanus*) exhibited the highest sound sensitivity thresholds while the lowest thresholds belonged to the duck species, specifically the lesser scaup (*Aythya affinis*) 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, African Penguins 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; Stemp, 1985; Danil and St Leger, 2011; 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 August 2024 submission to the Committee, ECCC 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 (Anderson 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 7.3.9 below.

Table 7.3.9. 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

This table summarizes the potential indirect effects to other components (i.e. Fish and fish habitat, Fisheries and Other Ocean Users etc.) if aerofauna are affected by offshore wind development.

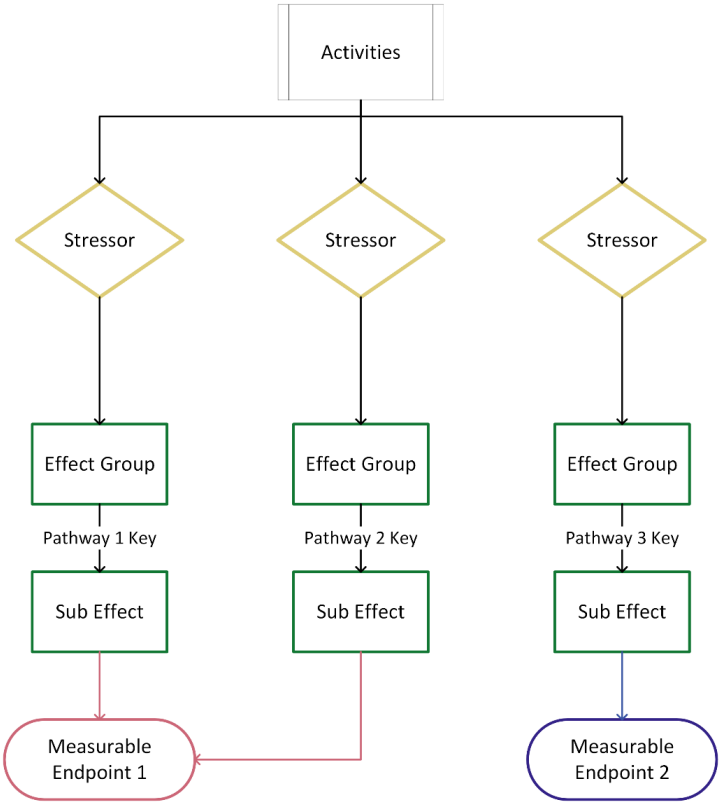
7.3.3.6 Pathways of Effects Models

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 page under document reference 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):

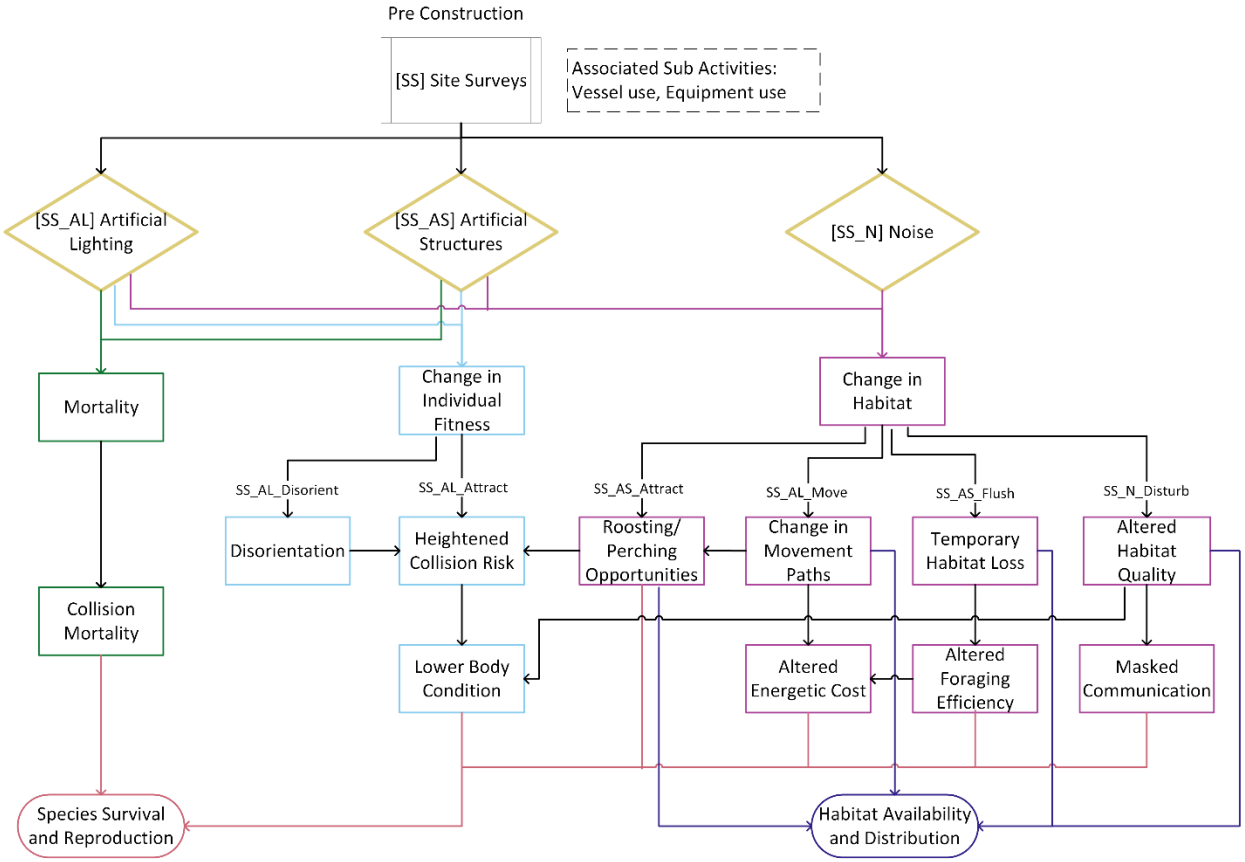
- These are simplified, conceptual models that do not consider cumulative effects.
- Models outline effects, not impacts. An impact implies magnitude and significance, while an effect does not (Boehlert and Gill, 2010).
- PoEs are generic sector-based pathways and do not consider site- and species- specific variable.

Figure 7.3.21. Generic Pathway of Effects Diagram



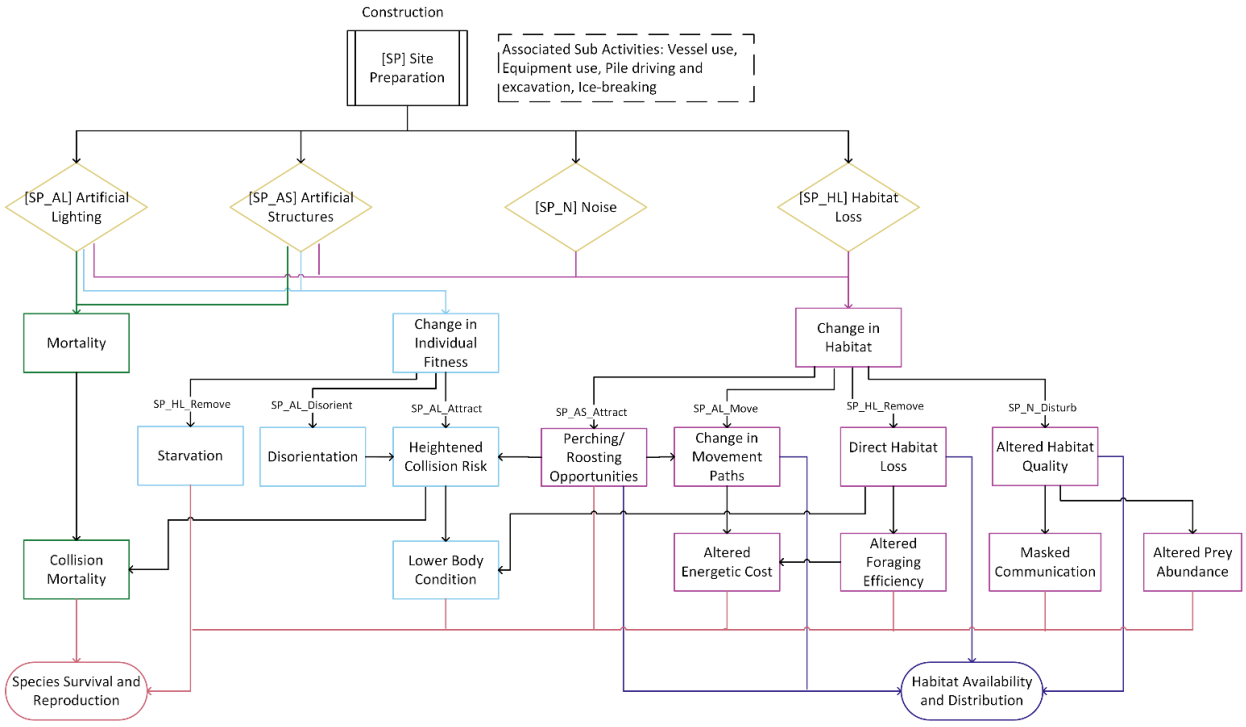
Adopted from ECCC submission to the Committee, August 15, 2024. This diagram may help readers interpret the models below. Model components were defined as follow.
Activities and sub-activities are human-induced undertakings that may result in impacts to the environment (Government of Canada, 2012).
Stressors 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) (EPA, 1998; Government of Canada, 2012; Orr et al., 2020).
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 (EPA, 1998).
Pathways are lines used to represent a cause-effect relationship between an activity, a stressor, and an effect (DFO, 2006).

Figure 7.3.22. Potential Effects of Pre-Construction Site Surveys on Aerofauna



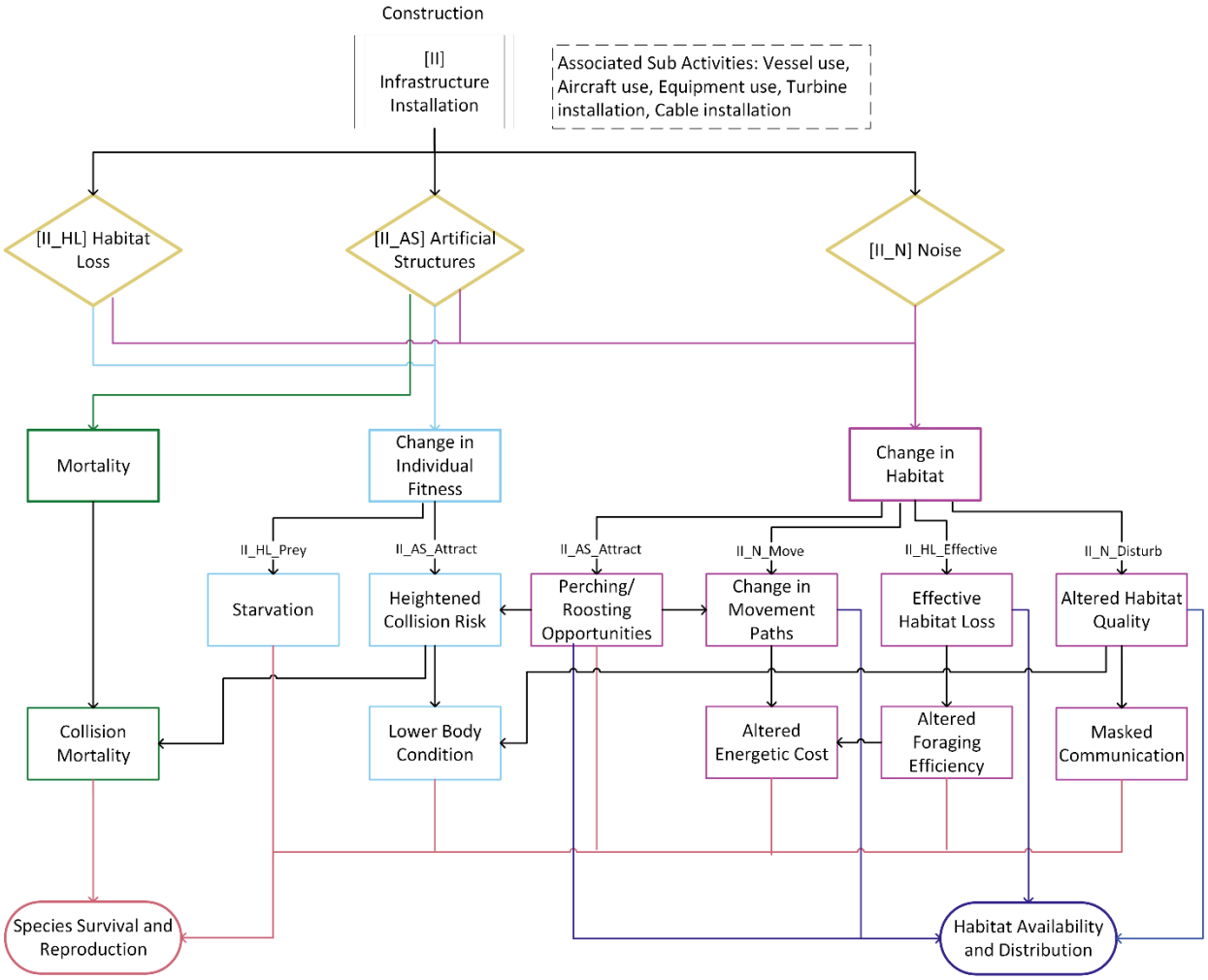
Model adopted from ECCC submission to the Committee, August 15, 2024. This model shows how site preparation during the pre-construction phase of offshore wind development can result in effects to aerofauna.

Figure 7.3.23. Potential Effects of Site Preparation During Construction on Aerofauna



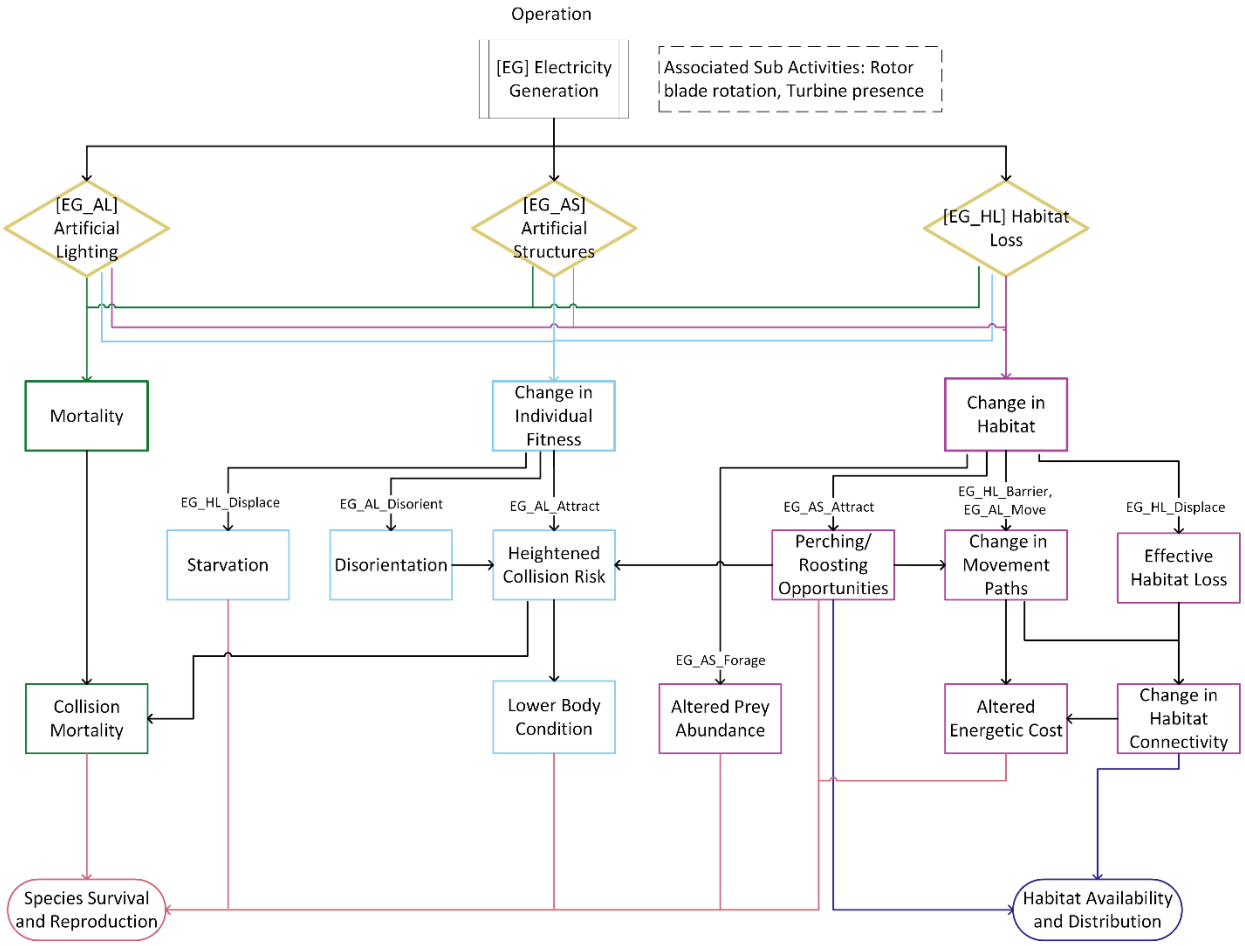
Model adopted from ECCC submission to the Committee, August 15, 2024. This model shows how site preparation during the construction phase of offshore wind development can result in effects to aerofauna.

Figure 7.3.24. Potential Effects of Infrastructure Installation During Construction on Aerofauna



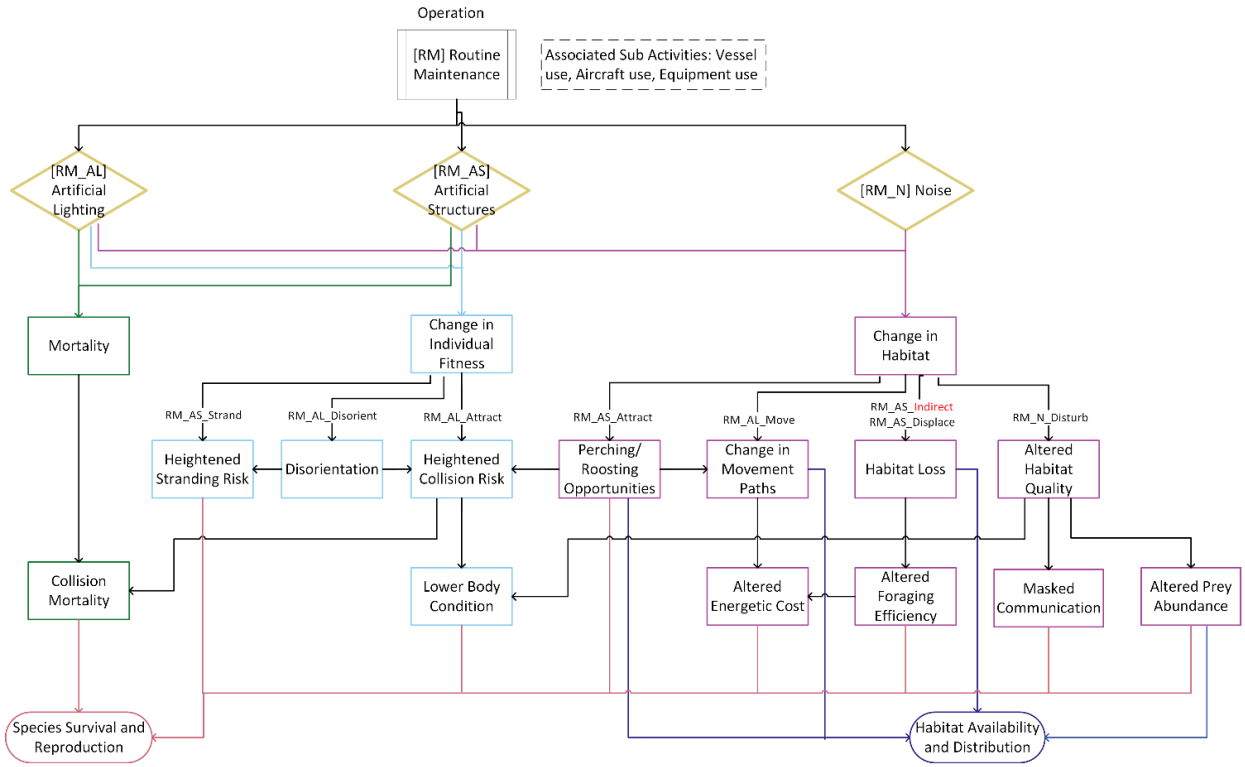
Model adopted from ECCC submission to the Committee, August 15, 2024. This model shows how infrastructure installation during the construction phase of offshore wind development can result in effects to aerofauna.

Figure 7.3.25. Potential Effects of Electricity Generation During Operations on Aerofauna



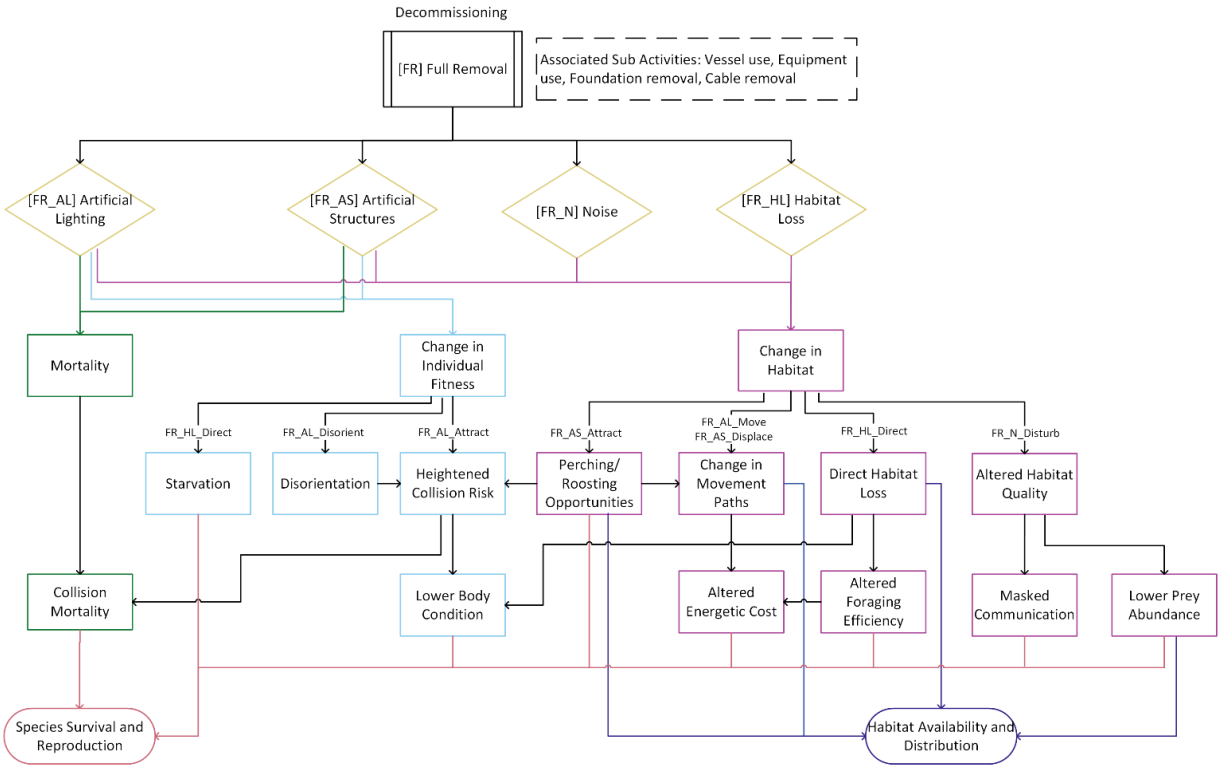
Model adopted from ECCC submission to the Committee, August 15, 2024. This model shows how electricity generation during the operations phase of offshore wind development can result in effects to aerofauna.

Figure 7.3.26. Potential Effects of Routine Maintenance During Operations on Aerofauna



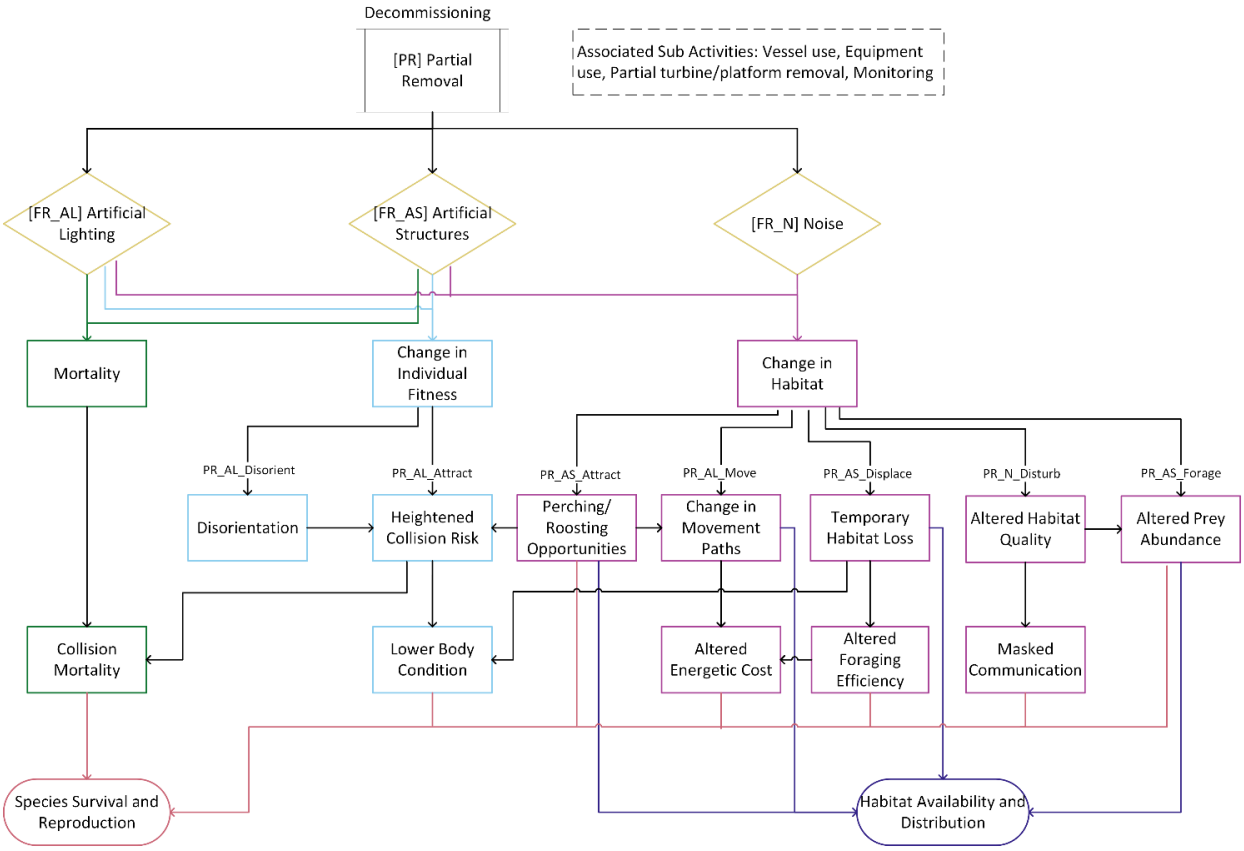
Model adopted from ECCC submission to the Committee, August 15, 2024. This model shows how routine maintenance during the operations phase of offshore wind development can result in effects to aerofauna.

Figure 7.3.28. Potential Effects of Full Removal During Decommissioning on Aerofauna



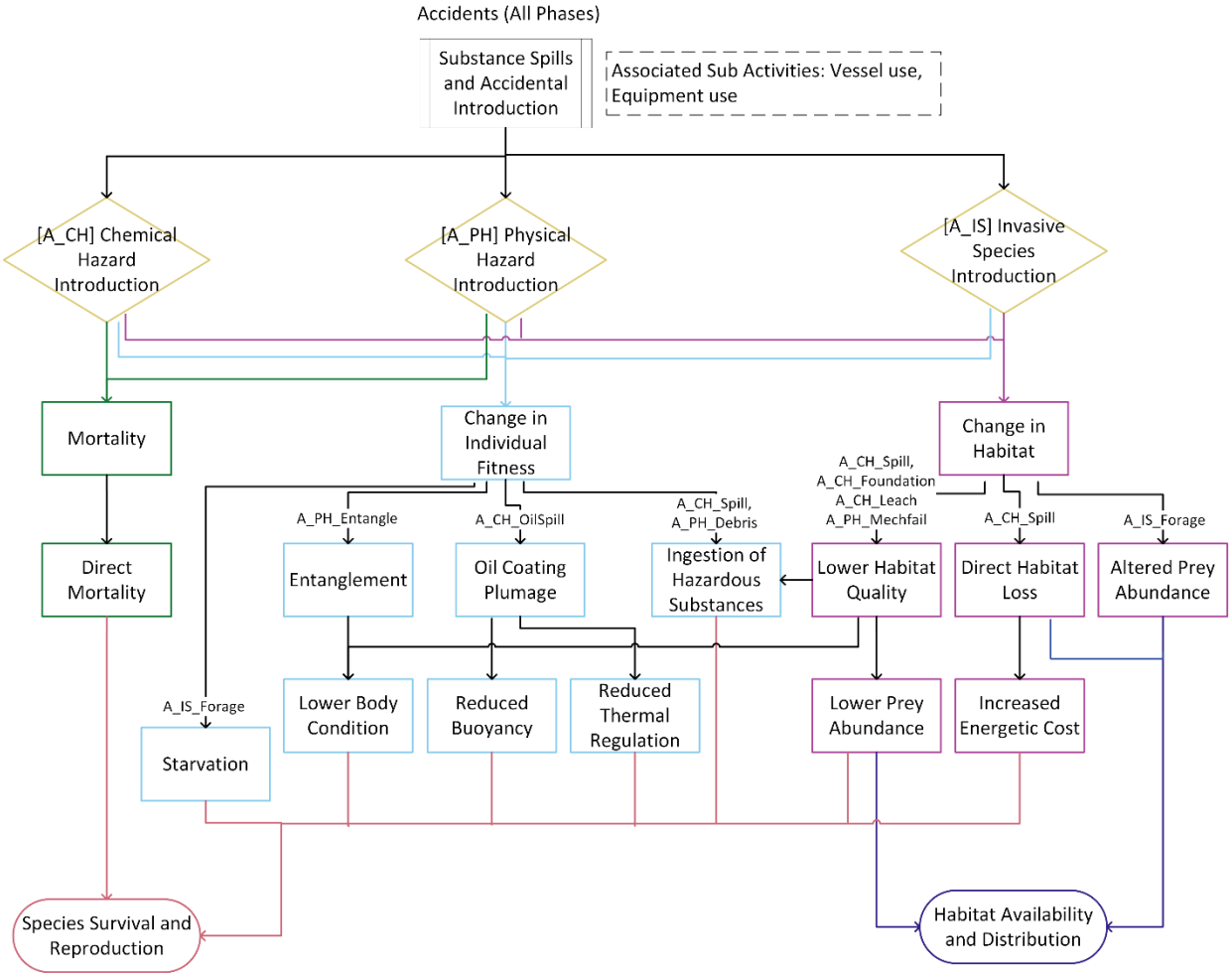
Model adopted from ECCC submission to the Committee, August 15, 2024. This model shows how full turbine removal during the decommissioning phase of offshore wind development can result in effects to aerofauna.

Figure 7.3.29. Potential Effects of Partial Removal During Decommissioning on Aerofauna



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 7.3.30. Effects of Accidents During Any Development Stage on Aerofauna



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

During this Regional Assessment, the BRI in collaboration with ECCC completed a structured literature review of strategies for mitigating offshore wind development. Their work was submitted for peer review in August 2024.[52]

Table 7.3.10 below outlines some common measures used to mitigate adverse effects (or enhance positive effects) of offshore wind development on aerofauna in other jurisdictions. These should be reviewed in the context of key findings from BRI and ECCC.

BRI and ECCC identified 212 mitigation approaches from 233 source documents and 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).

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.

Table 7.3.10. 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.

[52] A pre-print version is publicly available at: Gulka, J., S. Knapp, A. Soccorsi, S. Avery-Gomm, P. Knaga, and K. A. Williams. 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

Mitigation Measure	Description
	• 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. • oise 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. • 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. • 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.

Mitigation Measure	Description
	• 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).
	• 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.

Mitigation Measure	Description
	• 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. • 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.

Mitigation Measure	Description
	• Use of bubble curtains (e.g. big bubble curtains, double curtains) for noise abatement for piling noise.

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 and 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 and 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 and Langston, 2006; Edwards-Jones et al., 2024; European Commission, 2020; Fox et al., 2006; Furness et al., 2013; Garcia-Rosa and 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 and Furness, 2022; Gorresen et al., 2015a; 2015b; 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; 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; Ludeke, 2017; Marques et al., 2014; Martin, 2022; Martin and Banks, 2023; Martin et al., 2017; Masden et al., 2009; Månsson et al., 2022; May et al., 2015; 2017; NatureScot, 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., 2022; Rodrigues et al., 2015; Rogers, 2020; Rosa and Tande, 2023; Rowse et al., 2016; Roy and Traiteur, 2010; Schirmacher et al., 2018; SEER, 2022; Smallwood and Bell, 2020; Solick and Newman, 2021; Sordello et al., 2020; Spyridonidou and Vagiona 2020; Squires et al., 2021; Stone at al., 2012; Thess and Lengsfeld, 2022; Tomé et al., 2017; van Erp et al., 2021; Vagiona and Kamilakis, 2018; Voigt, 2021; Voigt et al., 2012; 2024; Wang and Smith, 2015; Weaver et al., 2020; Wieringa et al., 2021; Wilson and Elliott, 2009; Young et al., 2003.

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 offshore wind 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.
  - Flat Bay Band Inc. raised 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 Port aux Port 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 they 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 would affect birds and bats. They indicated puffin populations are attracted to lights and get disoriented, and 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 to all species at risk such as (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 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, Humback 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'd 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 have been seen in the river.
    - Flocks of Gannets near Cape Ray, always lots of gannets in this area.
- In Fortune participants indicate 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 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 out 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

The following summarizes key data and information gaps related to this section. Regarding data gaps on effects and mitigation, ECCC identified several limitations in currently available research in the PoEs models submitted to the Committee (See above Section 7.3.2 of this Report, Effects). These are summarized below.

Marine Bird Density and Distribution: Data on marine bird density and distribution comes from ECSAS survey data. ECSAS survey use ships of opportunity surveys to collect data, resulting in low survey effort and high variation in some areas. ECCC advised. 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. Ongoing work by ECCC such as forthcoming predictive density models and, especially vulnerability models, will be important for filling this gap. ECCC has indicated that the completed models will help inform recommendations related to setback distances from specific bird colonies during project-level impact assessments. and should be used in conjunction with other parameters that project proponents would be reasonably expected to provide (See Recommendations below).

Habitat Use Around Colonies: Habitat use around colonies varies based on several factors, for example, species-, individual- and environmental- specific characteristics. Predictive foraging models by Ronconi et al., (2022) provides good insight but only covers some species. ECCC provided the Committee with best available estimates for theoretical foraging radii for other species. Understanding actual foraging behaviour around specific colonies remains a limitation.

Shorebird Distribution: Spatial distribution of shorebirds in the Focus Area cannot be inferred from available information. Coastal hotspots such as near Flat Bay Peninsula, Sandy Point, Stephenville Crossing, Western Brook Pond Beach, and St Paul's Salt Marsh could be areas of higher risk Birds may interact with nearshore turbines while travelling between roosting locations, during stopovers, or when initiating migration.

Avifauna Movement in the Focus Area: Information on avifauna movement in the Focus Area is a key limitation. Movement data is only available for some species and, where it is available, it is often based on datasets with small sample sizes and/or movement tracks are interpolated from fixed point data. This information can provide some insights on species that may move through the Focus Area, but it estimates individual tracks and is, therefore, not representative of movement patterns for overall populations. This gap may be problematic because impacts are often mitigated by selecting sites and/or designing offshore wind farm layouts in a way that can preserve movement corridors.

Waterfowl: Available data on waterfowl does not provide a good indication of their occurrence offshore. Most data in the area comes from coastal block surveys, or triennial common eider surveys, which target common eider and record incidental observations. ECCC advised the available coastal data should be used this information 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 rotor swept zone of offshore wind turbines. As under Section 7.3.2.1.3 of this Report, Waterfowl, ECCC provided habitat suitability models for five species of sea ducks, which helps to identify potentially important areas, however habitat suitability was only assessed within areas used by individuals tracked in the study Lamb et al., (2020). Most portions of the Focus Area were not included in the assessment during most periods.

Bats and Insects in the Focus Area: Information on bats and insects offshore is generally lacking. For example, there are few bat or insect observations in the marine environment, therefore it is difficult to infer spatial distribution, important movement areas or key habitats which may be important to consider in the context of offshore wind development. Information on the effects of offshore wind development for these taxa is also limited when compared to avifauna species. However, available evidence related to onshore wind development suggests offshore wind development could have adverse impacts on these types of species (see Section 7.3.3 of this Report, Potential Effects).

Effects on Terrestrial and Shorebird Species: Research tends to focus on marine birds, migratory bats and passerine species. Information gaps remain for terrestrial and shorebird bird species, although emerging evidence indicates that terrestrial birds might be at risk of effects from offshore wind artificial structures (Robinson Willmott et al., 2023).

Effects of Noise, Vessel Activity and Light from offshore wind energy specifically: Regarding stressors, there is limited information on linkages between offshore wind energy development and effects to aerofauna because of noise, vessel related activities, and artificial lighting. The understanding of these effects pathways is mostly based on other offshore industries (Isaacman & Daborn, 2011)

Effects of Underwater Noise and Electromagnetic Fields on Birds and Bats: This subject is not currently well studied. Research is beginning to investigate underwater hearing in marine birds (e.g., Anderson Hansen et al., 2020).

Variability: Effects are highly variable and may be dependent on species' behavior, site characteristics, environmental conditions, and other factors. This emphasizes the critical need for studies throughout the entire duration of development (e.g., baseline studies during project planning, continuous monitoring during operation, studies on effects after decommissioning).

Mitigation efficacy: Data and information gaps related to mitigation are discussed above under Section 7.3.4 of this Report, Mitigation. Overall, there is very limited evidence suggesting the efficacy of mitigation measures for effects of offshore wind development on aerofauna.

7.3.7 Committee Conclusions and Recommendations

To address data and information gaps related to aerofauna:

- The Committee recommends more robust movement studies of aerofauna likely to intersect the Focus Area. Project proponents in collaboration with ECCC should optimize project to avoid any major migration corridors.

- The Committee recommends colony-specific set-back distances should be set on a case-by-case basis during project-level impact assessment. ECCC is compiling a list of parameters that can be used to assist in determining the appropriate set-back distances of offshore wind infrastructure and support vessels from marine bird colonies in Atlantic Canada. Proponents would be reasonably expected to provide information on these parameters, and ECCC would, in turn, provide project-specific recommendations on setback distances. Project proponents should consult ECCC.[53]
- The Committee recommends that offshore wind project proponents consult ECCC and 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 a long-term evaluation of proposed development areas must be initiated that is designed to identify species that occupy the area, their key breeding, migration, foraging, staging, and wintering areas. Upon completion of the evaluation the proponent must work with the appropriate federal or provincial agency on the development of species-specific avoidance, setback, buffer, or mitigation protocols.
- The Committee recommends site assessments and / or project-level impact assessments set appropriate buffer/setback distances that adequately protect Migratory Bird Sanctuaries (MBS) and National Wildlife Areas (NWA).
- The Committee recommends proponents of offshore wind projects consult ECCC and 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 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 carcass was found, as soon as possible after discovery.

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[54] Excerpts from this submission are posted on the Registry Page under Document 275. The Regional Assessment Secretariat, on behalf of the Committee, received permission from ECCC to post specific materials in September 2024. Some sections are redacted or not posted due to the inclusion of unpublished, confidential data.
ECCC is continuing to provide updated and additional material to the Committee. Report content is up to date as of information provided by August 23, 2024. Additional submissions maybe posted on the Registry. Any discrepancies in this Report will be resolved in the Final Report.

[55] See footnote above.

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7.4 Marine Fish and Fish Habitat

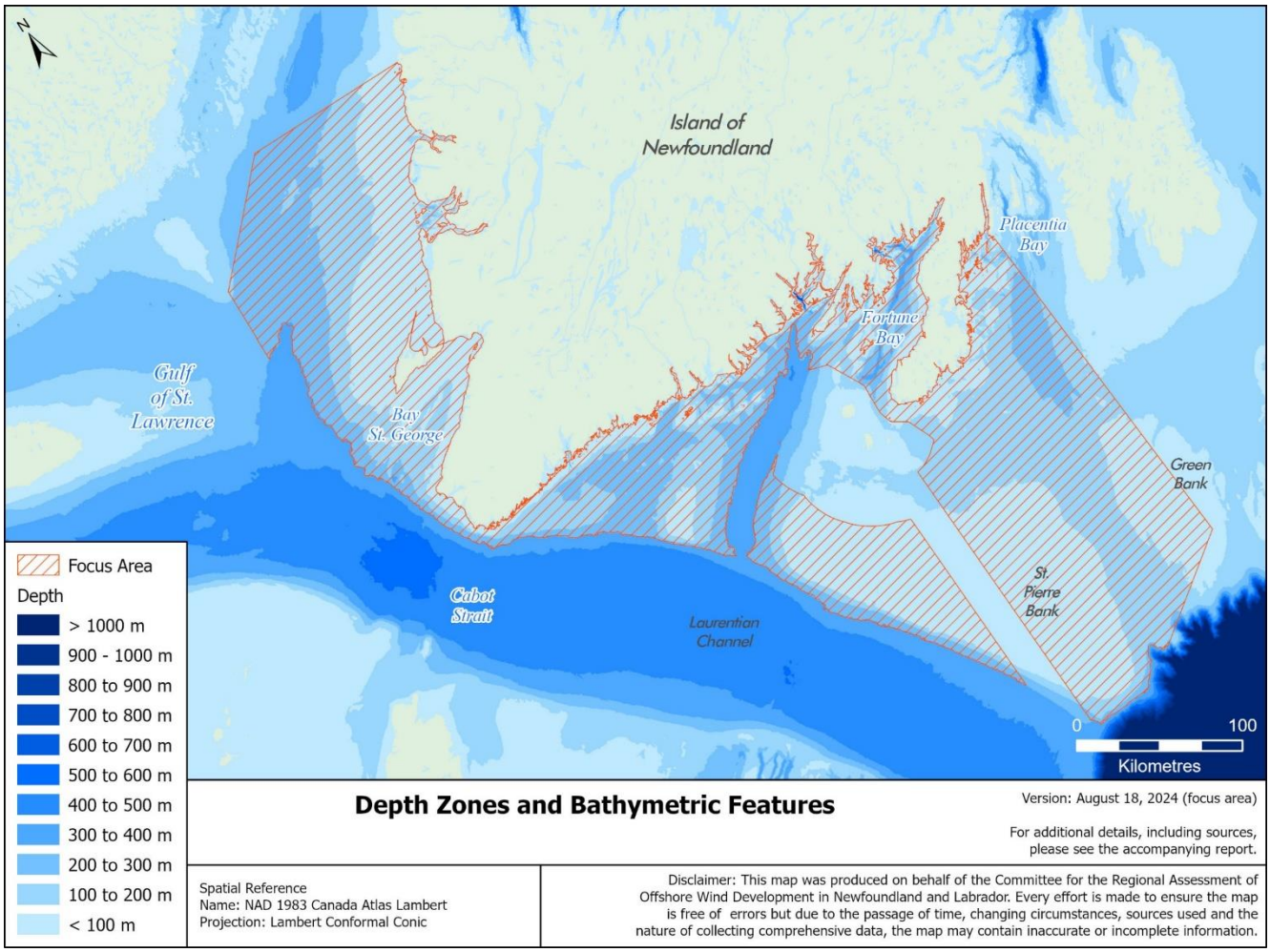
The ocean environment around Newfoundland and Labrador is changing. Evidence is in the scientific literature, and in observations from Indigenous peoples, fish harvesters, tourism operators, and community residents.

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 bioregions and the Focus Area in Section 7.7.1.2. 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. Some species in the Focus Area are considered ecologically, economically, culturally, and /or recreationally important to various groups, including government departments and agencies, Indigenous groups, and other interested parties. Several of the species that occur within the Focus Area are of conservation concern, they are described in Section 7.4.1 of this Report.

Figure 7.4.1 Primary Depth Zones and Bathymetric Features in the Focus Area.



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 100m). Data Source: (GEBCO Compilation Group, 2023).

7.4.1 Existing Conditions

7.4.1.1 Existing Data and Monitoring Programs

NAFO was established in 1979 as the 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, 2024; 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, 2024; NAFO Secretariat, 2020). NAFO Regulatory Areas (NRA) that overlap with the Focus Area include 4R, 3Pn, and 3Ps (DFO, 2009a). NAFO is also discussed in the section on Commercial Fisheries (see Sections 7.7 and 7.8 of this Report).

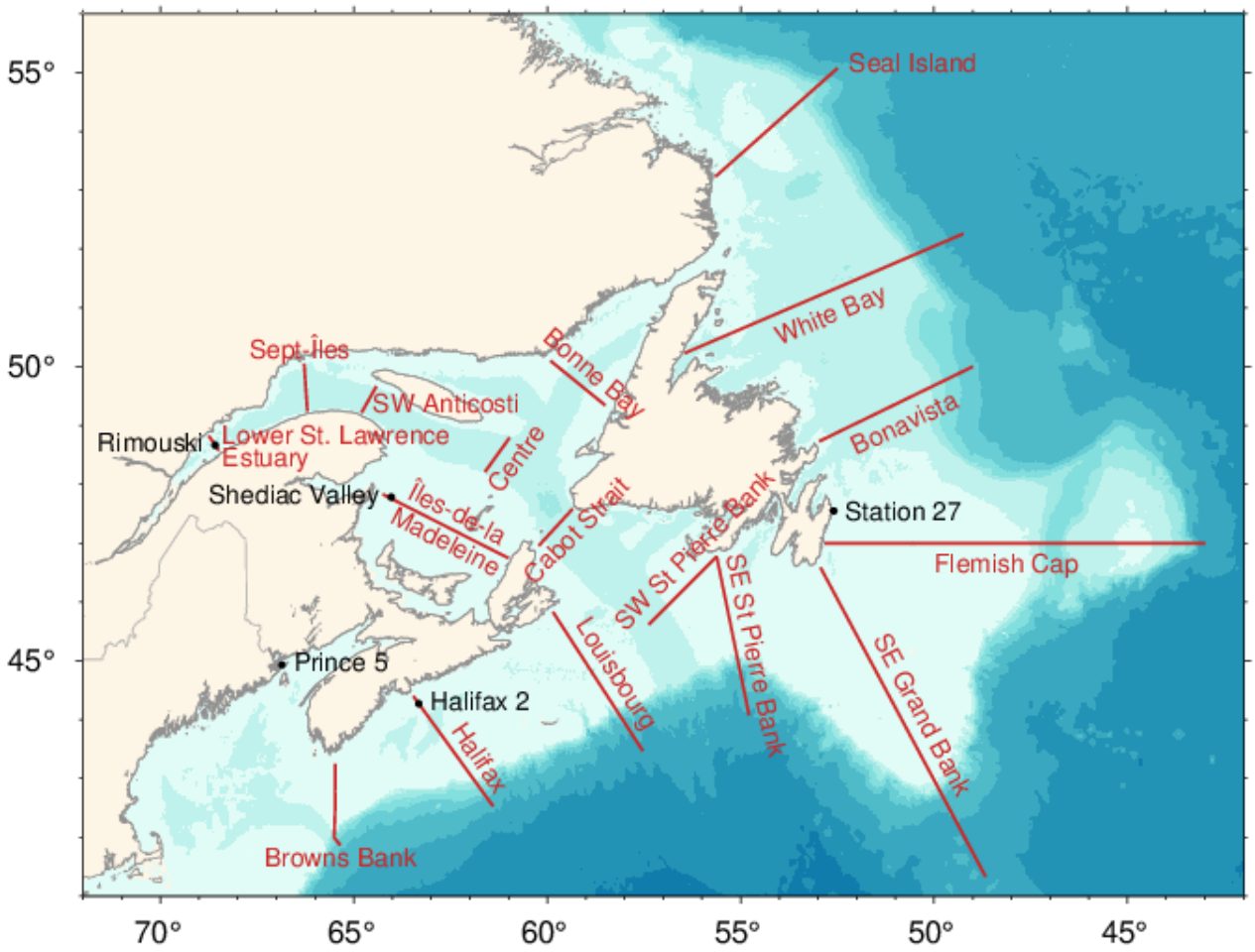
Since the 1970's, DFO has performed regular multi-species trawl surveys to gain a better understanding of the marine ecosystems and species distribution within the bioregions. These surveys are primarily used for stock assessments and resource management, but more recently, the data has been revisited to support various conservation and protection efforts (Bourdages et al., 2023; N. J. 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, 2023k). Through this program, regular surveys are conducted with data typically focusing on foundational trophic levels (e.g., physical oceanography, data on phytoplankton and zooplankton populations). The sampling strategy is based on seasonal and opportunistic sampling along sections 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 there are six locations within the Focus Area, i.e., Bonne Bay, Northeast Gulf, Centre Gulf, Cabot Strait, SW St. Pierre Bank, and SE St. Pierre Bank (DFO, 2023k).

DFO 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, 2024). 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, 2009a).

Figure 7.4.2: AZMP section lines within the Focus Area.



This figure displays the DFO AZMP section lines in the Focus Area including Bonne Bay, Northeast Gulf, Centre Gulf, Cabot Strait, SW St. Pierre Bank, and SE St. Pierre Bank. 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.

7.4.1.2 Oceanographic Characteristics and Marine Ecosystems

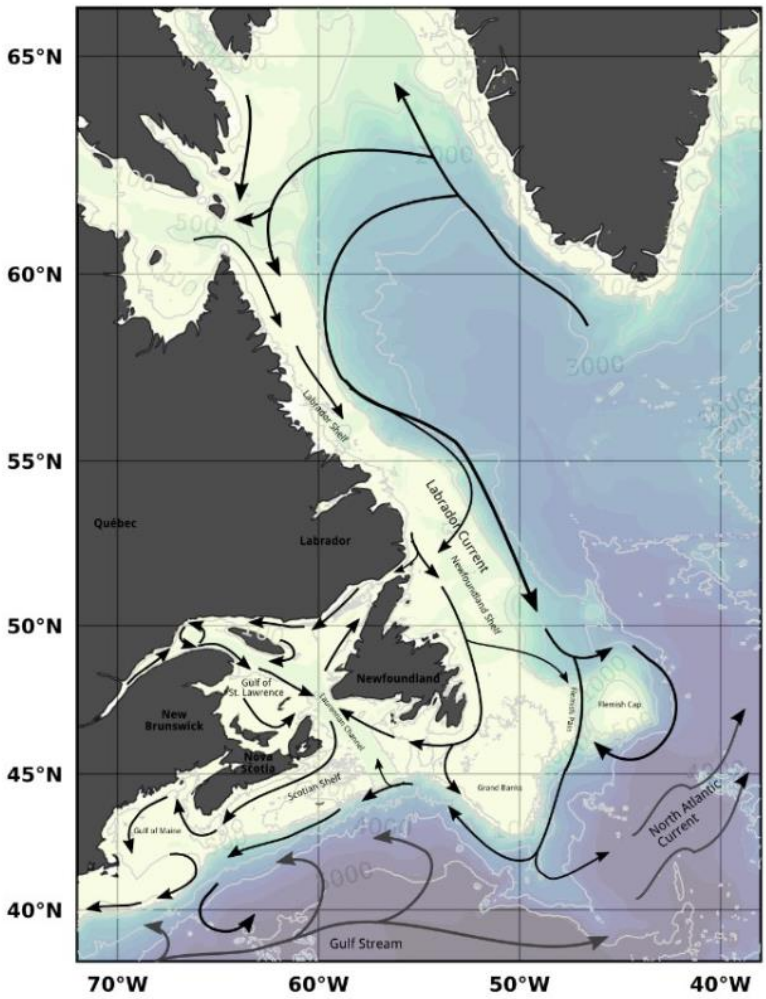
7.4.1.2.1 Oceanographic conditions

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, 2023k). Recent observations (2021) reported warming surface and bottom waters; reductions in sea ice duration, arial coverage, and/or volume; declining thickness, 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 7.4.1.1 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.[56] It summarizes anomalies for ten different variables including the winter North Atlantic Oscillation, 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. Some variables are site specific (i.e., consistently measures 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 NCLI findings for 1950-2023 are displayed in Figure 7.4.4.

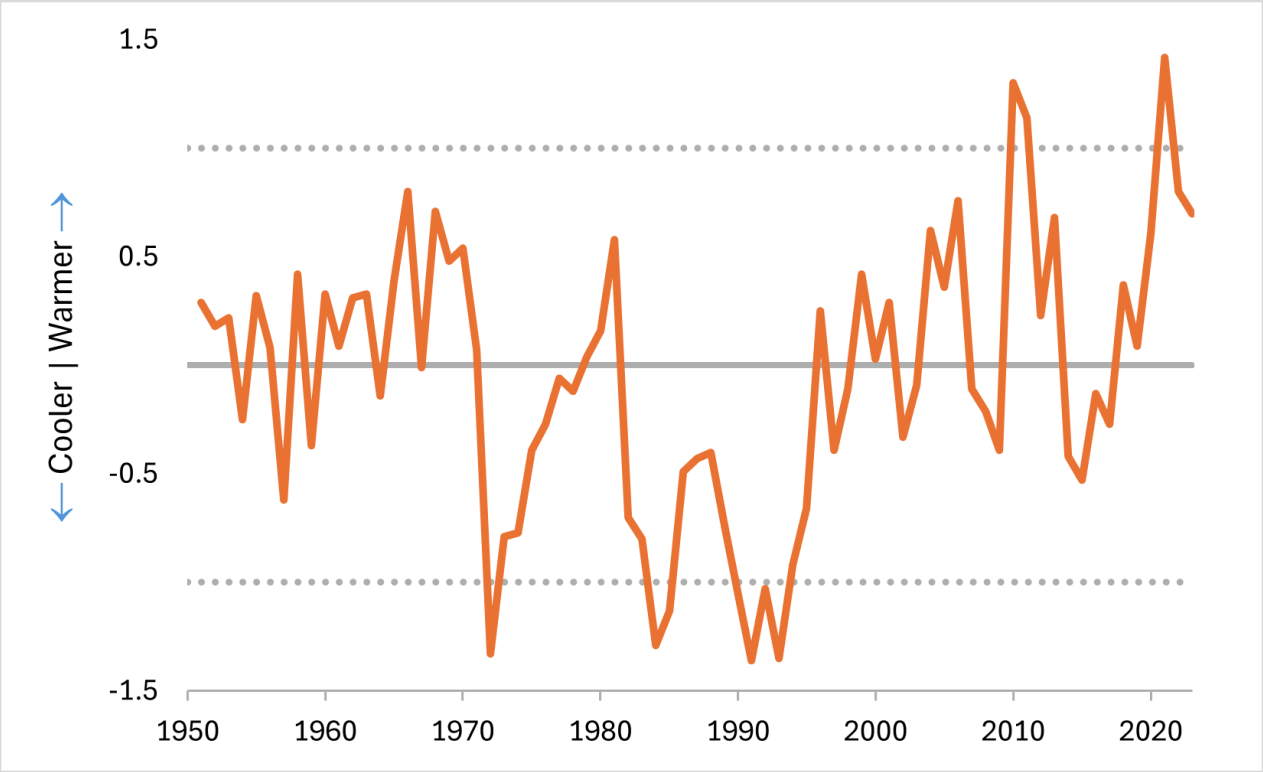
[56] The NLI was developed for the NLS (Cyr & Galbraith, 2021). They describe it as "a simple way to relate average environmental conditions to the state of the ecosystem" (Cyr & Galbraith, 2021). It is also relevant for the Northwest Atlantic Ocean.

Figure 7.4.3 Oceanographic currents in the Focus Area.



This map shows the oceanographic currents in and around the Focus Area including the Gulf Stream, the Labrador Current, and the North Atlantic Current. 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.



This figure displays the Index of climate conditions on the Newfoundland Shelf from 1950 to 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 1991 and 1993. Since the latest cold period in 1993 the index highlights a warming trend with warmest year on record for the entire period (1950-2023) occurring in 2021. Adapted from Canada's Oceans Now: Atlantic Ecosystems (p9), by DFO, 2022. Copyright 2023 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[1].

Environmental Variable/ Common Name	Description
Physical Oceanography	

Ocean Temperature (sea surface)	• Sea temperature varies vertically through the ocean year-round and are 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 at around 1°C 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 with only 4/75 annual averages recorded 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 (IS), and damage to the living environment, amoung 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 T<0°C on the NLS and T<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 with the nGSL experiencing a record low in the series in 2021. • Weakening of the CIL can impact fish and fish habitat through changing nutrient and oxygen concentrations, affecting the North Atlantic Oscillation, 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 correlated heavily 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. • Weakening of the CIL can impact fish and fish habitat through changing prey availability (plankton), nutrient, and oxygen concentrations as well as potentially affect the North Atlantic Oscillation.

Mean Sea Level	• Observed local relative sea levels (RSLs) are rising around the world due to melting ice 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.

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 nGSL with pH units decreasing 0.04 pH units/decade. 2020 represents record acidity in series.

Environmental Variable/ Common Name	**Description**
	○ The pH of the NLS is measuring around 7.8 to 8 pH units (neutral). • 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 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.
Dissolved oxygen	• Dissolved oxygen has been reduced in the top 1000m 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 through wind-driven mixing of water in late fall and winter. This carries nitrates from deep layers to surface depths.

Environmental Variable/ Common Name		**Description**
		• Deep nitrate levels can impact fish and fish habitat as levels of nitrate in the deeper waters (50-150m) are a measure of future availability for phytoplankton (the deep-nitrate inventory). o The deep nitrate inventory has shown considerable inter-annual variability. o After record lows in 2017 and 2018, nutrients have increased to near normal in 2019–2020 in the Atlantic. o In the nGSL records show a shift in nutrients from below normal to above normal. o 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. o 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 such as salps (filter-feeding gelatinous macrozooplankton). o In the Atlantic abundance is near normal. o 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 (chaetognaths), 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.

Environmental Variable/ Common Name		Description

	Pseudocalanus spp.	• *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.

This table describes the oceanographic variables and planktonic organisms within the bioregions that overlap with the Focus Area as well as any relevant trends.

[1]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.

[2]ATL: Atlantic; NLS: Newfoundland and Labrador Shelves; nGSL: northern Gulf of St. Lawrence.

Sources: (Aarbakke et al., 2014; Bernier et al., 2023; Cyr et al., 2022; Cyr & Galbraith, 2021; DFO, 2012a, 2023k, 2023f; Dzierzbicka-Głowacka, 2004; Galbraith et al., 2023; Herbert et al., 2021; IPCC, 2019; Jiang et al., 2019; Pepin et al., 2005).

7.4.1.2.2 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 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 (G. 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 IS, especially bryozoans harmful to kelp (Carman et al., 2019; K. Wilson & Lotze, 2019).

Table 7.4.2 Status and trend information for macrophytes in the Focus Area[1].

Common/ Species Name		Description	Bioregion[2]	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, Atlantic tomcod, white hake, American lobster, rock crab, and Jonah crab.	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/ Species Name		Description	Bioregion[2]	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, 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 (ECCC, 2020). • The reduction or disappearance of eelgrass has been shown to cause declines in species who depend on it as a food source such as geese, clams, lobsters, scallops, and flounder (ECCC, 2020).	nGSL/ NLS	Majority of beds are stable or expanding in NLS; half the beds are decreasing in the nGSL and in Placentia Bay.

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.

[1]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.

[2]NLS: Newfoundland and Labrador Shelves; nGSL: Northern Gulf of St. Lawrence.

Sources: (Barrell et al., 2015; Bernier et al., 2023; Britannica, The Editors of Encyclopaedia, 2024; Carman et al., 2019; DFO, 2009b, 2009a, 2023f; ECCC, 2020; Gorman et al., 2009; J. 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; K. Wilson & Lotze, 2019; Wong & Dowd, 2015).

7.4.1.3 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 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; R. G. 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 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 (small shrimps, amphipods etc.) decreasing (Bourdages et al., 2023). However, no clear trend has been observed for piscivorous, filter feeding, limnivorous, and detritivorous invertebrates (Bourdages et al., 2023).

7.4.1.3.1 Cnidaria and Porifera

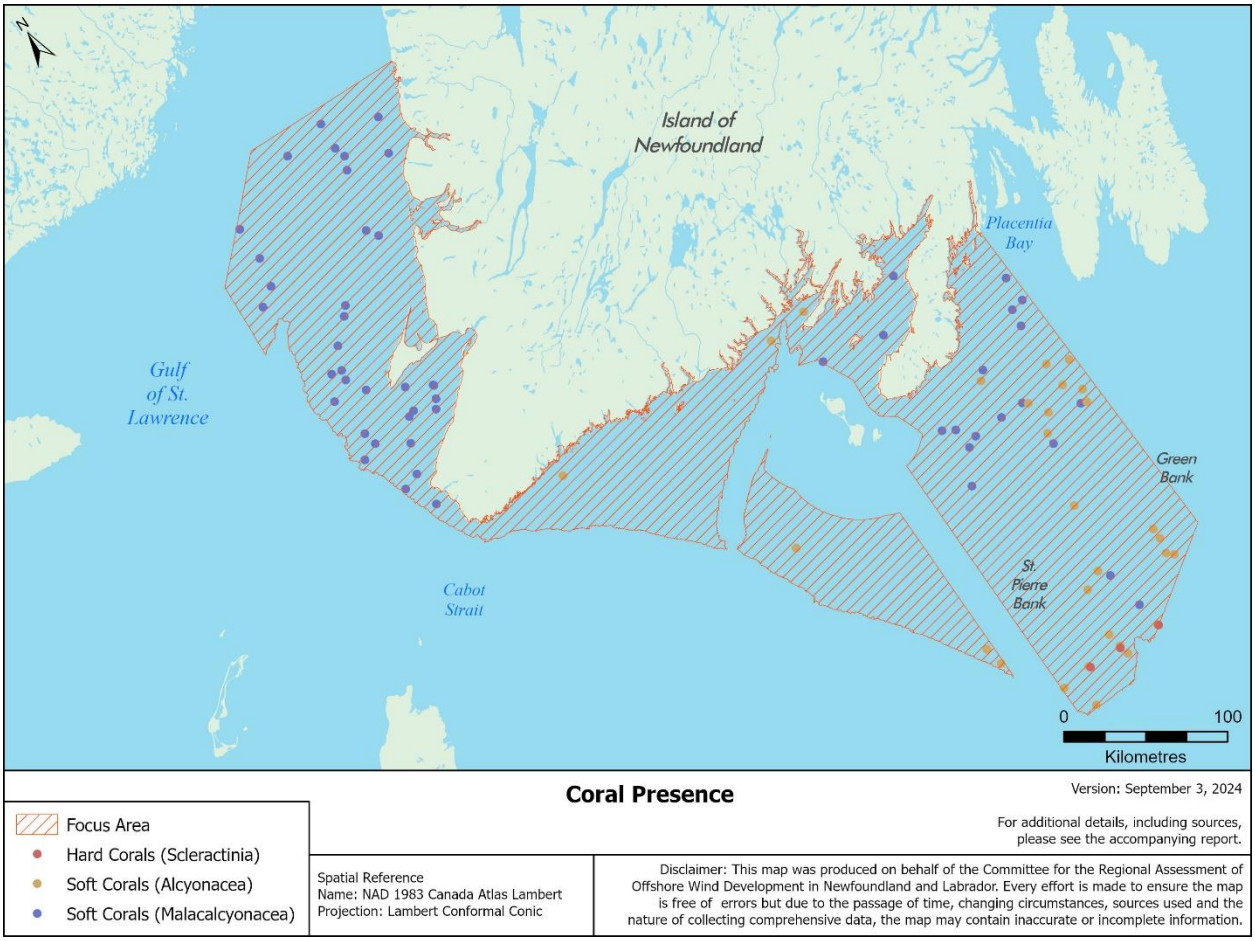
Corals, sea anemones, and jellyfish are from phylum cnidaria which are characterized by the stinging cells they possess while sponges of phylum porifera are often characterized by their pores (Beckmann & Özbek, 2012; Christian et al., 2010; Hand & Fautin, 2024; J. Hooper & van Soest, 2002; Sarà, 2024). There are 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 representative species for sea anemones and jelly fish 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 such as corals and sponges which act as ecosystem engineers by creating, destroying, or modifying habitat in their environment and regulating the availability of resources within it (Bernier et al., 2023; Gullage et al., 2022). Coral and sponge distribution within the Focus Area is shown in Figure 7.4.5 and Figure 7.4.6. Other 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). Data on sea anemones, Lion's Mane and Moon jellyfish abundance 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, 2015a; Morley et al., 2014; NOAA, 2024a; Purcell et al., 2007; The Coral Reef Alliance, 2003; Vad et al., 2021). There are several protection measures in place for corals and sponges in the Focus Area, including protected and special areas such as EBSAs, Vulnerable Marine Ecosystems , and SiBAs. Protected and Special Areas are described in Section 7.6 of this Report.

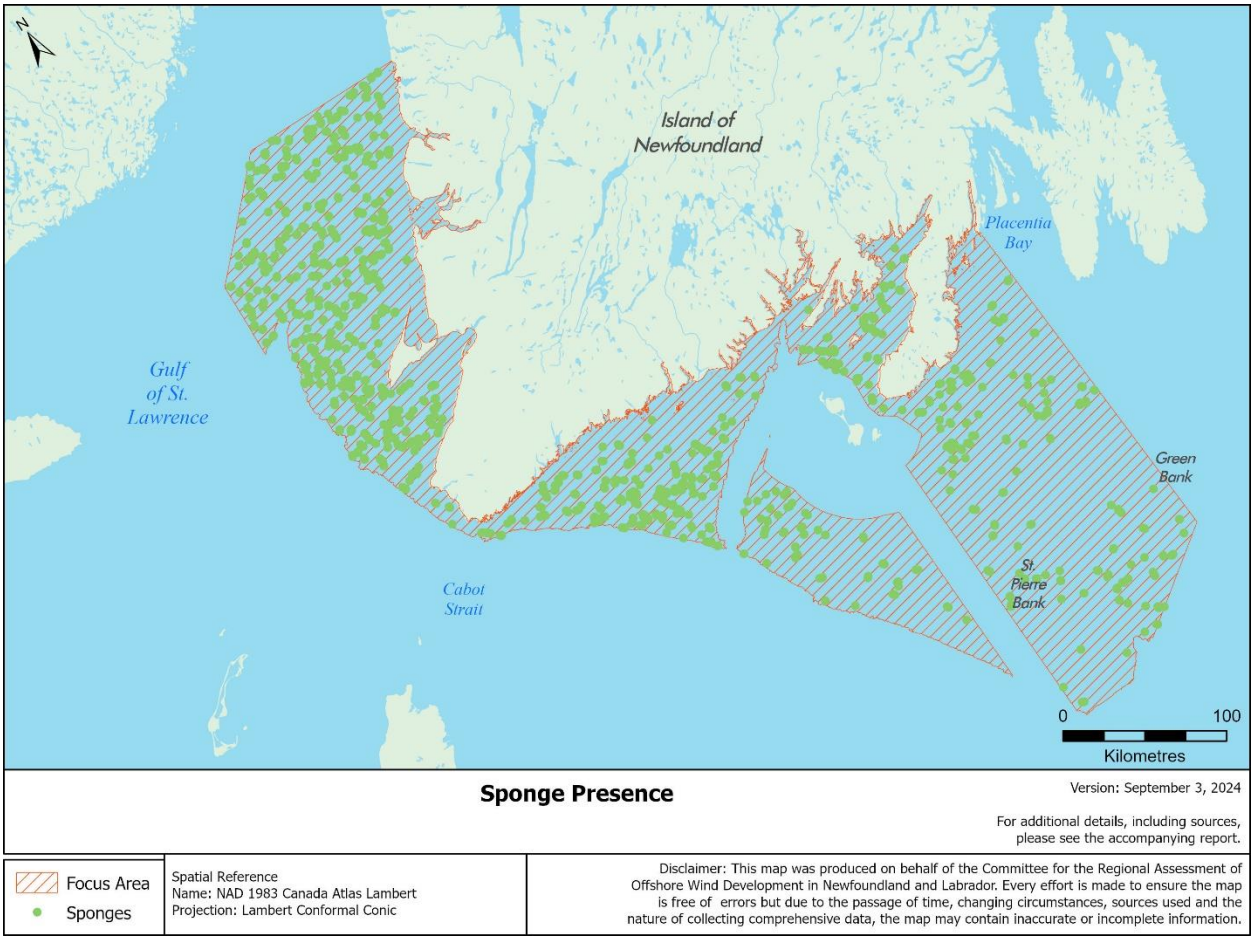
Climate change is affecting corals through a number of mechanisms including ocean acidification, warming ocean temperatures, sea level rise, and damage from storms (DFO, 2015a; Morley et al., 2014; NOAA, 2024a; The Coral Reef Alliance, 2003). The effects of climate change on sponges and sea anemones is poorly understood but they are anticipated to be impacted through similar mechanisms to corals (DFO, 2015a; Vad et al., 2021). Jellyfish may benefit from the effects of climate change on ocean ecosystems (Nagelkerken et al., 2016; Purcell et al., 2007).

Figure 7.4.5 Distribution of Corals in the Focus Area



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 occur 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.
Data Sources: OBIS, 2024

Figure 7.4.6 Distribution of Sponges in the Focus Area



This map displays presence data points for sponges in the Focus Area. Sponges occur in relatively high densities throughout the Focus Area.
Data Sources: OBIS, 2024.

Table 7.4.3 Description and status information for corals, sponges, sea anemones, and jellyfish in the Focus Area[1].

Common/ Species Name	Description	Bioregion[2]	Status

Cnidaria (Corals)	• Occurs 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 <100–2900m but most frequently found 600-1470m.
	• 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, 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

Porifera (Sponges)	• Occurs in the Focus area year-round. ○ Highest densities occur off the west and south western coasts of Newfoundland. • Found across the continental shelf, in valleys, troughs, canyons, and across the shelf edge.	nGSL/ NLS	Abundant

Common/ Species Name		Description	Bioregion[2]	Status

		• 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 <105‑8000m but most frequently found 950-1470m.
		• 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.		

Cnidaria (Sea anemones)	Frilled Anemone (*Metridium senile*)	• Distribution ranges from the Arctic to Delaware Bay in the northwest Atlantic. • Benthic, found in intertidal waters up to 150m 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
Cnidaria (Jellyfish)	Lion's Mane Jellyfish	• Occurs from Labrador to mid-U.S. (Cape Hatteras).	nGSL/ NLS	Abundant

Common/ Species Name		Description	Bioregion[2]	Status
	(*Cyanea capillata*)	○ Swarms in its northern range in late spring/summer. ○ More commonly found inshore in fall, due to currents. • Prefers warm water (6-25°C), high salinity (24-33ppt), and deep-water environments. ○ Typically found near sea surface (<20m) in late spring/summer. • The largest species of jellyfish, with bell diameters up to 2m. • Feed on zooplankton (small fish, shrimp, copepods). ○ Feed near the surface at night and travel into deeper water during the day (pelagic). • Predators include Leatherback Sea Turtles.		
	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 (20-40m) but has been recorded as deep as 200m (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.	nGSL/ NLS	Abundant

Common/ Species Name		Description	Bioregion[2]	Status
		• Predators include leatherback sea turtles, sunfish (*Mola mola*), and occasionally seabirds.		

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.

[1]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.

[2]NLS: Newfoundland and Labrador Shelves; Northern Gulf of St. Lawrence.

Sources: (Bernier et al., 2023; Burke da Silva & Nedosyko, 2016; Catto et al., 1999; Christian et al., 2010; DFO, 2015a, 2017b, 2023g; Francis, 1979; Gilkinson & Edinger, 2002; Gosner, 1999; Guijarro et al., 2016; Gullage et al., 2017, 2022; J. Hooper & van Soest, 2002; R. G. Hooper, 1997; E. Kenchington et al., 2016; E. L. Kenchington et al., 2014; 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; W. H. Wilson & Ruff, 1988).

7.4.1.3.2 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 representative 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 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, Jonah Crab, Toad Crab, 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 and Agriculture, n.d.-b; DFO, 2008a, 2017c, 2018f, 2021a, 2022h).

It has been mentioned frequently in Regional Assessment public engagement sessions, especially those in 2024, that American Lobster landings and abundance have been increasing over the past several years which is also reflected in the literature (DFO, 2021). 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). Whereas, 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 7.341.2 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, 2021; Perkins', 1972).

Table 7.4.4 Large Crustaceans that Occur in or adjacent to the Focus Area[1]

Common Name (Scientific name)	Description	Bioregion[2]	Status/ Trend Information

American Lobster (*Homarus americanus*)	• Distribution range spans from Southern Labrador to Cape Hatters, 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 on 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.
	  ○ Water temperature influence the rate of development with colder temperatures causing longer development times.
		nGSL/ NLS	Healthy/ Increasing

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 60-400m.
	• Spawning occurs April-May in shallow waters (10-40m) with larvae presence peaking mid-June/July.
	• Adult diet consists of on polychaetes, clams, sea stars, and brittle stars.
	  ○ Diet changes throughout life stages.
	• Predators include various groundfish, Thorny Skate, other Snow Crab, and seals.
	• Participants noted that 3Ps is an important area for Snow Crab fisheries.
		nGSL/ NLS	Healthy/ declining

Common Name (Scientific name)	Description	Bioregion[2]	Status/ Trend Information
Jonah Crab (*Cancer borealis*)	• Distribution range spans from southern Labrador to Florida in the west Atlantic, with some presence in Newfoundland and Labrador. • Prefer inter-tidal to deep water, occur at depths of 5-450m but most often found in shallow waters <20m in the northern part of its range. • Spawning occurs Apr-May in shallow waters (10-40m) with larvae presence peaking mid-June/July. • Found in habitats with rocky to silt/clay bottoms.	nGSL/ NLS	Recent decline
Toad Crab (*Hyas spp*.)	• Distribution range spans both sides of the Atlantic Ocean, abundant off Newfoundland coast. • Prefer shallow sub-tidal habitat up to >700m in depth. • 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 in the west Atlantic, with some presence in Newfoundland and Labrador. • Prefer inter-tidal to deep water, occur at depths of 5-450m but most often found in shallow waters <20m in the northern part of its range. • Common in inshore waters along all coastlines. • Spawning occurs Apr-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)

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.

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[2]NLS: Newfoundland and Labrador Shelves; nGSL: Northern Gulf of St. Lawrence.

Sources: (Bernier et al., 2023; Carroll et al., 2017; Carter & Steele, 1981; Chabot et al., 2013; Christian et al., 2010; Department of Fisheries and Agriculture, n.d.-b; DFO, 2007a, 2008a, 2017c, 2018f, 2021a, 2022h; 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).

7.4.1.3.3 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 representative species will be discussed and their key characteristics will be described in Table 7.4.5 (Bernier et al., 2023; Chabot et al., 2013; Christian et al., 2010; DFO, 2023h, 2023g).

Stock assessments for all the representative molluscs and marine annelids 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; W. H. Wilson & Ruff, 1988). However, Northern Shortfin and Longfin squid prefer warmer water temperatures and may 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[1].

Common Name (Scientific name)	Description	Bioregion[2]	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, wolffish, sculpins and Winter Flounder 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 Apr-May in Newfoundland and Jul-Aug in the nGSL. • Larval hatch occurs hours after egg fertilization. • 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.	nGSL/ NLS	Unknown/ Healthy
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.	nGSL	Stable

Common Name (Scientific name)	Description	Bioregion[2]	Status/ Trend Information
	• Predators include snails, crabs, and fish (cod, Haddock).		
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 100m. ○ 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
Waved Whelks (*Buccinum undatum*)	• Distribution range spans throughout Newfoundland, GSL, and into New Jersey U.S. • Found in intertidal areas to depths of 100m with greatest densities at 15-30 m on soft bottoms. • Prefers cold water environments 5°C and <0°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 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 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[2]	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- 20m.
	• 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 Apr – Jun.
	• 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

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 eel grass 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

Common Name (Scientific name)	Description	Bioregion[2]	Status/ Trend Information

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-Sep.
	  ○ 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 1-20m but can occur as deep as 500m. • Prefer temperate waters (8-10°C). • Attaches to wharves, pilings, rocks, and buoys. Often found with other sessile animals. • 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 Jul- Feb.	nGSL/ NLS	Unknown

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, 2007b, 2010b, 2011d, 2013b, 2020c, 2021c, 2023h, 2023g; Gosner, 1979, 1999; R. G. Hooper, 1997; E. L. Kenchington et al., 2014; Morley et al., 2014; Naidu et al., 1999; Ollerhead et al., 2004; Rogers et al., 2023; Rowell, 1986; W. H. Wilson & Ruff, 1988).

7.4.1.3.4 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, representative 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 are part of a commercial fishery in Newfoundland and Labrador and experienced a decline in abundance from 2004-2008 (DFO, 2020d). The cause of this decline is associated with fishing effort rather than species abundance (DFO, 2020d; 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, is anticipated to have a number of potential negative impacts on echinoderms who 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[1].

Common Name (Scientific name)	Description	Bioregion[2]	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 300m. • 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.	nGSL/ NLS	Unknown
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- 60m.) • Prefer stable rocky grounds (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, and seabirds.	nGSL/ NLS	Decline in nGSL

Common Name (Scientific name)	Description	Bioregion[2]	Status/ Trend information
Sand Dollars (*Echinarachnius parma*)	• Circumpolar occurrence, distribution range spans from Labrador to Cape Hatteras, U.S. in the northwest Atlantic. • Prefers shallower depths at northern range (intertidal) but can be found as deep as 800m 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. • Prefers 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. • Adult diet consists of molluscs, brittle stars, and sea urchins. • Predators include crustaceans, fish, other sea stars, and birds.	nGSL/ NLS	Unknown
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 1500m. • Breeds during late spring/summer. • Adult diet consists of detritus, polychaetes, and small crustaceans. • Predators include lobsters, sea stars, and fish.	nGSL/ NLS	Unknown

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.

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Sources: (Bernier et al., 2023; Catto et al., 1999; Chabot et al., 2013; Christian et al., 2010; DFO, 1996, 2001, 2007b, 2010b, 2013b, 2019a, 2023g, 2023h, 2020d; 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).

7.4.1.4 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, herring, mackerel, tuna, some sharks, and swordfish, 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 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, sea lamprey. Catadromous fish migrate from freshwater to salt water to spawn, e.g. eels.

The main fish, shark, and skate species that are known or likely to occur 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 representative fish species that have habitats within 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 that fish stocks have not recovered from to date (DFO, 2023h, 2023l). Some biomass returned between 2020 – 2021, but was not consistent year to year, although there has been some improvement in 2019 – 2021 (DFO, 2023h, 2023l).

Changes in the ocean climate (see Section 7.4.1.2 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, Witch Flounder) increasing between 2006 and 2022 (Bourdages et al., 2023). The biomass of fish species that prefer warm water (i.e. silver hake) have also increased between 1990 – 2021 while species that prefer cold water habitats (i.e. Arctic Cod, Lumpsucker, Greenland Halibut) 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 (DFO, 2023).

7.4.1.4.1 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 and Agriculture, n.d.-a; DFO, 2016b, 2023j). 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. Some species may migrate through the Focus Area, but it is outside their known distribution range such as Bigeye Thresher Shark, Tiger Shark,

Oceanic Whitetip, Atlantic Sharpnose Shark, and Dusky Shark - these species will not be considered further due to lack of data and their sporadic presence in the Focus Area.

Distribution of sharks within the Focus Area is largely related to feeding – following prey such as fish and squid and, for larger sharks, marine mammals. Trends show that both Great White Sharks and Porbeagle Sharks are increasing in abundance (Buren et al.2014: Bernier et al. 2023) and, during Regional Assessment public consultations, there was anecdotal evidence of sightings of other species observed off the coast of the Island.

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 Atlantic Region and the Focus Area (DFO, 2023j, 2023h).

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, 2023j). 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, 2023j; Erauskin-Extramiana et al., 2023). The level of impact is contested due to the long evolutionary history and high adaptive capacity of sharks (Hazen et al., 2019).

Table 7.4.7 Large Pelagic Species that Occur in or adjacent to the Focus Area[1].

Common Name (Scientific name)	Description	Bioregion[2]	Trend Information[3]
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 with 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 >1000. • 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–Nov. • 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[2]	Trend Information[3]

Porbeagle Shark (*Lamna nasus)*	• Distribution range spans from Newfoundland and Labrador to Cape Hatteras U.S.
	  ○ Present in the Focus Area year-round.
	• Performs long-distance seasonal migrations.
	  ○ Move into GSL and NLS in summer/fall.
	• Prefer cold, temperate waters from the coast to open ocean.
	• Often Found in deep basins and along the shelf edge at depths of <200m.
	• Found at up to 1360m depth in water temperatures of –2-15°C.
	• Bear live young (females at age 13 years plus); 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.
		nGSL/ NLS	Abundance is increasing; Endangered (COSEWIC)

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 >1000m but typically at <50–500.
	• Long lived (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.
		nGSL/ NLS	Abundance is increasing; Endangered (SARA/COSEWIC)

Basking Shark (*Cetorhinus maximus)*	• Coastal, pelagic shark with circumpolar occurrence. ○ Present in the Focus Area year-round.	nGSL/ NLS	Special Concern (COSEWIC)

Common Name (Scientific name)	Description	Bioregion[2]	Trend Information[3]
	• Migratory, moving north in summer and south in spring winter occurrence is unknown). • Huge, filter feeding shark: can be more than 15m in length. • Swims in near surface waters for feeding and basking. • Prefers water temperatures between 6–16°C. • Slow swimmer, either individually or in a school. • Feeds on plankton, using gill rakers to strain prey.		

Shortfin Mako Shark (*Isurus oxyrinchus)*	• Distribution ranges from Newfoundland and Labrador to Argentina in the Atlantic.
	  ○ Present in the Focus Area year-round.
	• Highly migratory, associated with warm water from the Gulf.
	  ○ In Newfoundland and Labrador waters in summer and fall.
	• Mainly a tropic species but also found in temperate waters 17-22°C.
	• Found in surface waters up to 500m 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.
	  ○ Present in the Focus Area year-round.
	• Highly migratory.
	  ○ Seasonal migrant to Newfoundland and Labrador waters in summer and fall.
	• Use surface waters to depths of 600m.
	• 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 Raven, butterfish, tuna, and swordfish. Opportunistic scavengers of dead whales.
		nGSL/ NLS	Not at Risk (COSEWIC)

Common Name (Scientific name)	Description	Bioregion[2]	Trend Information[3]

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 Jul-Nov.
	• Prefer temperate to tropical waters.
	• Swims at the surface in coastal waters but can be found at depths of 350m.
	  ○ 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 180-730m 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 (seals, sea lions, whales). • Sometimes mistakenly identified as Basking Shark.	nGSL/ NLS	COSEWIC (not assessed)
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 730m 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

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.

[1]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.
[2]NLS: Newfoundland and Labrador Shelves; nGSL: Northern Gulf of St. Lawrence.
[3]The protection status of species at risk are described further in Section 7.4.1.6.
Sources: (Bernier et al., 2023; Campana et al., 2012; COSEWIC, 2009b, 2010d, 2011a, 2014b, 2016, 2019d, 2021b; Dell'Apa et al., 2018, 2023; Department of Fisheries and Agriculture, n.d.-a; DFO, 2006, 2008c, 2015b, 2016b, 2023h, 2023j; Erauskin-Extramiana et al., 2023; ICCAT, 2009; Kulka et al., 2020; Morgan & Sulikowski, 2015; Young et al., n.d.).

7.4.1.4.2 Small Pelagics – Forage Species

Small pelagic species (also called forage species) live throughout the water column and are important sources of food for larger fish as well as sharks, seabirds, and marine mammals (Bernier et al., 2023; N. J. Wells et al., 2021). While there are a variety of small pelagics that are an integral part of the ecosystem in the Focus Area, representative species for each 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 and the stock is still at low levels, affecting the abundance of larger fish without this food supply (DFO, 2023h; H. M. 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 are currently undergoing significant declines caused by overfishing, changes in environmental conditions, and predation (Calder et al., 2023; DFO, 2023e, 2023d).

Current anthropogenic threats to small pelagic fish continue to include overexploitation, changing oceanographic conditions, pollution, and habitat destruction (Calder et al., 2023; DFO, 2023h; H. M. 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; H. M. Murphy et al., 2021; Nissar et al., 2022).

Table 7.4.8 Small Pelagic Species (Forage species) that Occur in or adjacent to the Focus Area[1].

Common Name (Scientific name)	Fishery Management Unit	Description	Bioregion[2]	Stock Status

Capelin (*Mallotus villosus*)	3Ps	• Distribution range spans western Greenland to Maine, U.S. in the northwest Atlantic with the highest distribution around Newfoundland.
		  ○ Relatively low density along the south coast of Newfoundland.
		• Small forage fish; participates in schooling.
		• Sensitive to changes in oceanographic conditions 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, <40m).
		  ○ Spawning often results in high mortality rates of the participating adults.
			nGSL/ NLS	Unknown

	4RST	• Highest abundance thought to be in 4R. • Spend most of their lives offshore. ○ Spawning occurs (Apr-Aug) both at the beach or in deep-water (demersal, <40m).		Healthy

Common Name (Scientific name)	Fishery Management Unit	Description	Bioregion[2]	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.
		• Small forage fish; participates in schooling.
		• 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 stocks complexes in 3Ps (south coast ofNewfoundland): 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; fall dominant at Fortune Bay.
			nGSL/ NLS	Unknown

	4R	• Two stocks 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[2]	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 (Aug-Nov).
		• Small forage fish; participates in schooling.
		• 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

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.

[1]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.

[2]NLS: Newfoundland Shelves and Labrador; nGSL: northern Gulf of St. Lawrence.

Sources: (Bernier et al., 2023; Bourne et al., 2023; Calder et al., 2023; Canadian Science Advisory Secretariat, Rice, et al., 2007; Canadian Science Advisory Secretariat, Templeman, et al., 2007; DFO, 2022a, 2022d, 2023d, 2023o, 2023a, 2023h; Émond et al., 2024; Fisheries, 2024; H. M. Murphy et al., 2021; Nissar et al., 2022; OCEANA, n.d.-b, n.d.-a; N. J. Wells et al., 2021).

7.4.1.4.3 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. While there are a variety of demersal fish and skates that are an integral part of the ecosystem in the Focus Area, representative species for each will be described in this section and in Table 7.4.9 (Bernier et al., 2023; Bourdages et al., 2023; Canadian Science Advisory Secretariat, Rice, et al., 2007; Canadian Science Advisory Secretariat, Templeman, et al., 2007; DFO, 2023h; E. F. Murphy, 1995; Templeman, 2007; N. J. 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 7.4.1.6. The stock increases for some species are occurring in the southern part of the NLS bioregion (DFO, 2022f). 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 have a preference for warmer waters including Silver Hake, Cusk, Haddock, and Sand Lance. White Hake, and Atlantic Wolffish 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 a wider water temperature ranges 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[1].

Common Name (Scientific name)	Description/Trend Information	Bioregion[2]	Stock Status[3]

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 10-155m.
	• 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 50–150m 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:
	  ○ 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 Mar-Jun.
	  ○ 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[2]	Stock Status[3]
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 (200-500m) 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 Whales, and the Greenland Shark. • 3Ps: o Stock is increasing but spawning stock biomass is low. o Spawning time/location unknown, but anecdotal information from harvesters suggests it occurs in deep water Dec-Mar. o Historically overfished; stocks increasing since 1990's, considered 'Healthy' as of 2022. • 4R: o Avoid cold intermediate depth layer (50-100m). ▪ Seasonally migratory; summer in shallow waters (<50m) and travel to deeper waters in winter. o 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. o Wide distribution around Newfoundland and Labrador. • Often found on continental shelves >300m but can live in deep water >1000m deep. • Prefer cold water but have a wide temperature tolerance (-0.5-5°C) • Inhabit areas with soft sediment suitable for burrowing. • 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: o Stock is critically low with little to no growth, expected to remain below limit reference point. o Spring spawning, no specific grounds. o Recovery potentially limited by warming water, and increased presence of warm water fishes contributing to structural changes in the habitat.	NLS	Critical Threatened (COSEWIC)

Common Name (Scientific name)	Description/Trend Information	Bioregion[2]	Stock Status[3]

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 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

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 20-1000m.
	• Prefer deeper colder water as juveniles and adults (-1.9-12°C).
	• Migrate during late spring and summer 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 (Herring, Sand Lance).
	• Preyed on by seals, Sperm Whales, and Greenland Shark.
	• 3P and 4R:
	  ○ Inshore fishery established in 1976.
	  ○ Commercial landings in sharp decline since 2005 across its Canadian range, but abundance is stable in the nGSL.
		nGSL/ NLS	Threatened (COSEWIC)

Common Name (Scientific name)	Description/Trend Information	Bioregion[2]	Stock Status[3]

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 <100m but can be found in areas deeper than 270m.
	• Prefer temperature waters from 1-11°C. Spawn during winter in sand.
	• Burrow during night in sand or gravel bottoms.
	  ○ Leave burrows in schools during the day to feed.
	• Replace capelin as primary forage fish for cod, Haddock, American Plaice in southern areas
	• Juvenile and adult diet consists primarily of copepod *Calanus finmarchicus*, though they also consume other planktonic organisms.
	• Predators include seabirds, shore birds, fish, and marine mammals.
		nGSL/ NLS	Healthy

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[2]	Stock Status[3]

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).
	  ○ Stock assessment has not been completed. 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 (50-400m). • 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 (Jul-Aug) 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

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 (100-400m) and can be found as deep as 1600m.
	• Often found in soft substrate habitats with water temperatures of 3-6°C.
	• Not know to migrate seasonally but may travel for spawning (Jan-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

Common Name (Scientific name)	Description/Trend Information	Bioregion[2]	Stock Status[3]
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 (200-400m) with softer substrates. • Spawning occurs annually in early spring (Jan-Mar) 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, Beluga Whales, and Greenland Shark. • 4R: ○ Stock expected to remain stable, stock status listed as "cautious" as a precautionary measure.	nGSL	Cautious

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 150-300m (*S. fasciatus*) and 350-500m (*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, 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[2]	Stock Status[3]
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*). • Found in depths of 200-750m (*A. minor*) and 500-1000m (*A. denticulatus)* on the continental shelf and in deep trenches. • Water temperature plays a significant role in habitat selection with prefer 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 (*A. minor*), jellyfish, crustaceans, molluscs and sometimes 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.	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 – 375m and recorded as deep as 1185m, seldom found closer to shore.
	• 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, and Grey Seals.
	• Population declined from the 1970's – 2000's.
	  ○ Population abundance has low but been stable since 1999.
	• By-catch in longline and lobster fisheries.
		NLS	Endangered (COSEWIC)

Common Name (Scientific name)	Description/Trend Information	Bioregion[2]	Stock Status[3]

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 – 1000 m.
	• Long lived (60yr), 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 – 1500 m depths on continental slope.
	• 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.
		NLS	Not at Risk (COSEWIC)

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 150-550m but found as shallow as 25m and as deep as 1436m.
	• 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
	• 3P and 4R:
	  ○ Stock declined in the 1980/90's and have 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[2]	Stock Status[3]

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 (18-1200m), 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.
	• Catches have declined since the 1990's, particularly in their southern range.
	• 3Ps:
	  ○ Stock is stable at low biomass.
	  ○ Low biomass in GSL but increasing in areas within the NLS.
		nGSL/ NLS	Cautious;
			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 (110-370m), prefer water temps 5-16°C. • Adult diet consists of crustaceans, squid, polychaetes, other invertebrates, small fish, and other skates. • Predators include other skates, sharks, and seals, particularly Grey Seals. • Abundance has declined since the 1970's and remains low. ○ Appears in bycatch.	nGSL/ NLS	Endangered (COSEWIC)

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.

[1]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.

[2]NLS: Newfoundland and Labrador Shelves; nGSL: Northern Gulf of St. Lawrence.

[3]The protection status of species at risk are described further in Section 7.4.1.6.

Sources: (Bernier et al., 2023; Brodziak, 2005; Canadian Science Advisory Secretariat, Rice, et al., 2007; Canadian Science Advisory Secretariat, Templeman, et al., 2007; COSEWIC, 2009a, 2010c, 2010a, 2012i, 2012f, 2013a, 2017b; Department of Fisheries & Aquaculture, n.d.; DFO, 2010c, 2013d, 2014, 2015c, 2016a, 2017d, 2018d, 2018a, 2019c, 2019b, 2020b, 2021b, 2022b, 2022f, 2022g, 2022c, 2022f, 2023c, 2023n, 2023m, 2023h, 2023j; E. F. Murphy, 1995; Pitt, 1984; Robards et al., 1999; J. S. Scott, 1985).

7.4.1.5 Diadromous Fish

Diadromous fish regularly migrate between the salt water of the sea and freshwater (DFO, 2023l). These fish include the anadromous species that spawn in freshwater but spend much of their lives in the sea and the catadromous species that spawn at sea but spend most of their lives in freshwater (DFO, 2023l). Species that are known or considered likely to occur in the region with some degree of regularity 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, 2023l). 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, 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 and are currently in decline, have low population abundance, or are in recovery (COSEWIC, 2010b, 2011b; ECCC, 2021). Current threats to anadromous species are similar to the historical ones. There are conservation concerns about several diadromous fish species that are known or considered likely to occur in the Focus Area described in Section 7.4.1.6 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 (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 however, the effects of climate induced changes in ocean waters on anadromous species is understudied (DFO, 2023l; NOAA, 2024b, 2024d). American Eels are also suspected to be affected by the changing oceanographic conditions caused by climate change but they 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[1].

Common Name (Scientific name)	Description	Bioregion[2]	Stock Status/ Trend Information[3]
Anadromous			

Atlantic Sturgeon (*Acipenser oxyrinchus*)	• Distribution ranges from Ungava Bay Labrador to the Gulf of Mexico in the Atlantic.
	• Found up to 50m 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 (1-3m) in deep pools and areas with moving water (strong currents/waterfalls).
	• Spawning occurs in Jun-Jul 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 southwestern 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. • Spawning occurs in their natal rivers (river in which they were hatched) in spring and summer; salmon rivers are found throughout most of Newfoundland and Labrador. • Juveniles spend 3-4 years in freshwater before migrating to the ocean as smolts. • Prefer shallow water (<10m) 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.	nGSL/ NLS	Special Concern (nGSL)/ Threatened (NLS) (COSEWIC)

Common Name (Scientific name)	Description	Bioregion[2]	Stock Status/ Trend Information[3]

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)

Catadromous			

American Eel (Anguilla rostrata)	• Distribution range spans from Greenland to northern South America in the Western Atlantic.
	•
	• Juveniles may travel on currents through the Focus Area.
	• Highly migratory species
	  ○ Adults may migrate through the Focus Area enroute 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)

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.

[1]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.

[2]NLS: Newfoundland and Labrador Shelves; nGSL: northern Gulf of St. Lawrence.
[3]The protection status of species at risk are described further in Section 7.4.1.6.
Sources: (Andrews et al., 2019; Bernier et al., 2023; COSEWIC, 2010b, 2011b, 2012a, 2012h; DFO, 2011e, 2013c, 2022e, 2023l; NOAA, 2024b, 2024d; Porter, 1975; Waldman & Quinn, 2022).

7.4.1.6 Invasive Species in the Focus Area

DFO describes IS as "plants, animals, aquatic life and microorganisms that can out-compete native species when introduced outside of their natural environment." (DFO, 2012a). IS 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 environments, and have high rates of reproduction (DFO, 2012a). IS can negatively affect native plants and animals and cause ecosystem and economic damage (DFO, 2012a). There are seven confirmed IS in the Focus Area, including European Green Crab, Vase Tunicate, Golden Star Tunicate, Violet Tunicate, Coffin Box Bryozoan, Skeleton Shrimp, and Oyster Thief Seaweed, they are described below (DFO, 2023b).

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. 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 (DFO, 2023b). It has since spread extensively in Placentia Bay, along the south coast, including Fortune Bay, and on the west coast in Sai Bay St George.

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, 2019f, 2019d). The Vase Tunicate (*Ciona intestinalis*) can attach to any hard surface, creating significant biofouling on wharves, vessels, buoys (DFO, 2013a, 2023b). Vase Tunicate were first observed in Marystown in 2012 and containment measures were effective until 2020 when it began to spread (DFO, 2023b). This tunicate is easily spread through the movements of fishing gear, boats, vessels, shellfish (DFO, 2013a, 2023b).

The Violet Tunicate (*Botrylloides violaceus*) lives on hard surfaces. It grows quickly and can cover nearby plants and small organisms, smothering them (DFO, 2019f, 2023b). Individual tunicates are erect on a gelatinous mat, closely packed together in random arrangements of rows (DFO, 2019f, 2023b). 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, 2019f, 2023b). 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, 2019f, 2023b). It can be spread by fishing gear, shellfish and recreational or commercial vessels (DFO, 2019f, 2023b).

The Golden Star Tunicate (*Botryllus schlosseri*) is a biofouling organism that forms colonies on hard surfaces such as buoys, ropes, floating docks (DFO, 2019d, 2023b). 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 the Island. It can be

spread by fishing gear, vessels and shellfish (DFO, 2019d, 2023b). It is not known if the warming of the ocean will increase the spread of this species (DFO, 2019d, 2023b).

The Coffin Box Bryozoan (*Membranipora membranacea*) is a tiny, filter feeding invertebrate, typically found living in sedentary colonies that secretes a calcium carbonate outer coat (DFO, 2011a). They were originally from Pacific Ocean kelp beds and was first observed in Newfoundland and Labrador in 2002 (DFO, 2023b). It is now common throughout the coastal areas of the Island 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 (*Caprella mutica*) are hairy shrimp native to the subarctic regions of the Sea of Japan (DFO, 2023b). 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, 2023b). They were likely carried in ballast water of vessels and can form dense infestations, up to 100 000/m (DFO, 2023b). They are opportunistic, adaptable feeders, and can be a nuisance on gear but have no known ecosystem effect (DFO, 2019e, 2023b).

Oyster Thief Seaweed (*Codium fragile*) also known as Dead Man's Fingers is a sedentary algae that grows in shallow subtidal waters (Government of Canada, 2019). Oyster Thief 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, 2023b; Government of Canada, 2019). With its rapid growth rate, it can replace native species of eel grass and kelp. As well, it can foul shellfish beds and aquaculture equipment (Government of Canada, 2019). Oyster Thief 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, 2023b; Government of Canada, 2019). 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 in only a very few locations in Fortune Bay and Placentia Bay (Government of Canada, 2019).

Many of the IS 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 IS to spread further north or new IS colonize the area (DFO, 2023b).

7.4.1.7 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

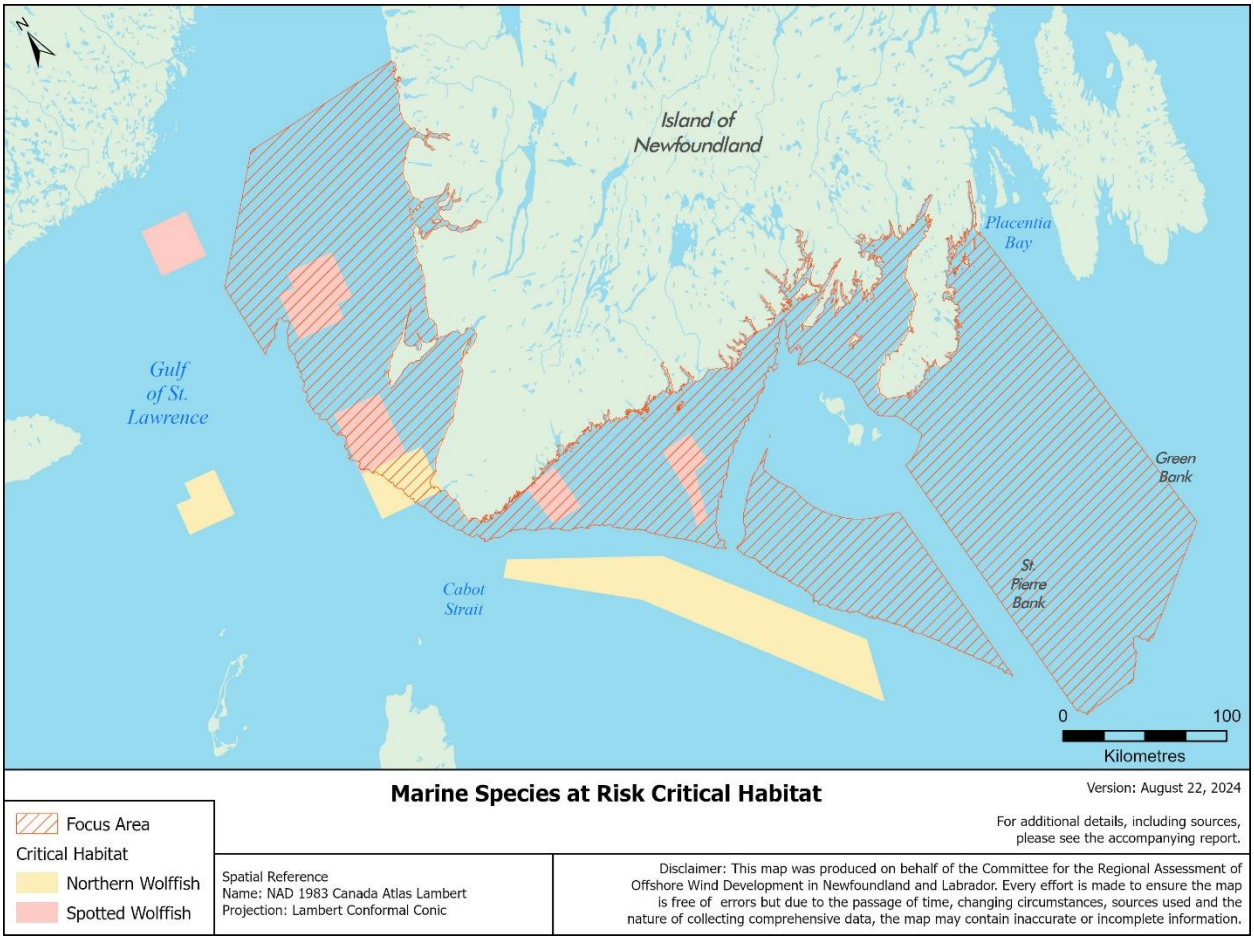
legislation or initiatives. The primary mechanisms for identifying and protecting fish in Canada are *SARA* and COSEWIC. Every species at risk (Schedule 1) under *SARA* has a recovery strategy and a corresponding action plan which identifies threats and describes how to address and mitigate them to ensure 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, 2022). Critical habitats are protected under *SARA* (SARA, 2022). COSEWIC also provides an assessment report detailing the 'at risk' status and detailed information on the species at its population. Other international (e.g. IUCN Red List, Northwest Atlantic Fisheries Organization), federal (e.g. *Fisheries Act* (1985), *SARA* (2002), *Oceans Act* (1996)), and provincial (e.g. *NL Endangered Species Act* (2004), *NL Wildlife Act* (2013)) policies contribute to "at-risk" designations and conservation efforts. Fish habitats that are of conservation concern are protected through protected and conservation areas that are covered in Section 7.6 of this Report. Impacts directly related to offshore wind development in the Focus Area is described in further detail in Section 7.4.2 of this Report.

One species of large pelagic fish and four species of pelagic sharks found in the Focus Area are species at risk. Critical habitat has not been defined for any shark species in Canadian water. However, 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 species at risk. 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, 2012d, f). 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, 2010c, 2012i, 2012f, 2012c, 2012b, 2012e, 2012g, 2013a, 2015, 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, 2012i, 2012f, 2013a, 2015).

Three species of diadromous fish found in the Focus are species at risk. The greatest existing anthropogenic threats to diadromous fish 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, 2012g; DFO, 2022f; Waldman and Quinn, 2022).

Figure 7.4.7 Critical Habitat for Northern and Spotted Wolffish within the Focus Area



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 3 separate polygons identified for Northern Wolffish and 5 for Spotted wolffish.
Source: (DFO, 2024)

Table 7.4.11 Marine Fish Species at Risk in or adjacent to the Focus Area and their Federal 'At Risk' Status[1].

Common Name (Species Name)	Population	Population Trend	NL Region Status	*SARA* Schedule 1 Listing	COSEWIC Status	Anthropogenic threats
Large Pelagic Species						
Atlantic Bluefin Tuna (*Thunnus thynnus*)	-	Decline	No Status	No Status	Endangered	Overfishing (direct and indirect), pollution (oil spills), underwater noise, threats to habitat.
Porbeagle Shark (*Lamna nasus*)	Northwest Atlantic	Low but stable	Not at Risk	No Status	Endangered	Overfishing (direct and indirect).
White Shark (*Carcharodon carcharias)*	-	Stable	At Risk	Endangered	Endangered	Fishing and capture (direct and incidental), and pollution (bioaccumulation).
Basking Shark (*Cetorhinus maximus*)	Atlantic	Unknown/ Declining	Not at Risk	No Status	Special concern	Fishing (direct and incidental) vessel collisions.
Shortfin Mako Shark (*Isurus oxyrinchus*)	North Atlantic	Declining	Not at Risk	No Status	Endangered	Overfishing (direct and incidental).
Blue Shark (*Prionace glauca)*	North Atlantic	No Trend[2]	At Risk	No Status	Not at Risk	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	No Status	Endangered	Overfishing, disease, pollution, changes in habitat, and climate variation.
American Plaice (*Hippoglossoides platessoides)*	Maritime/ Newfoundland and Labrador	Critically low but stable	At Risk	No Status	Threatened	Overfishing and climate variation.
Lumpfish (*Cyclopterus lumpus*)	-	Stable but Low/ Declining	-	Under Consideration/ No Status	Threatened	Fishing, change in habitat, seismic exploration, and climate variation.
White Hake (*Urophycis renuis)*	Atlantic and nGSL	Increasing	At Risk	No Status	Threatened	Overfishing.

Common Name (Species Name)	**Population**	**Population Trend**	**NL Region Status**	***SARA* Schedule 1 Listing**	**COSEWIC Status**	**Anthropogenic threats**
Acadian Redfish (*Sebastes fasciatus*)	Atlantic	Increasing	At Risk	No Status	Threatened	Fishing (direct and incidental) and climate variation.
Deepwater Redfish (*Sebastes mentella)*	GSL and Laurentian Channel	Increasing	At Risk	No Status	Endangered/ Threatened	Fishing (direct and incidental) and climate variation.
Atlantic Wolffish (*Anarhichas lupus)*	-	Stable/ Increasing	At Risk	Special Concern	Special Concern	Commercial fishing (direct and indirect) and climate variation.
Northern Wolffish (*Anathichas denticulatus)*	-	Stable/ Increasing	At Risk	Threatened	Threatened	Bycatch, habitat degradation, and climate variation.
Spotted Wolffish (*Anarhichas minor)*	-	Stable/ Increasing	At Risk	Threatened	Threatened	Commercial fishing (direct and indirect), habitat degradation, and climate variation.
Cusk (*Brosme brosme*)	-	Stable	At Risk	No Status	Endangered	Overfishing (direct and indirect).
Roundnose Grenadier (*Coryphaenoides rupestris*)	-	Stable	At Risk	No Status	Endangered	Overfishing (direct and indirect).
Roughhead Grenadier (*Macrourus berglax*)	-	Increasing/ stable	At Risk	No Status	Not at Risk	Overfishing (direct and indirect).
Smooth Skate (*Malacoraja senta*)	Laurentian-Scotian/ Nose of the Grand Bank	Unknown	At Risk	No Status	Special Concern/ Data deficient	Climate variation and fishing (indirect).
Thorny Skate (*Amblyraja radiata*)	-	Increasing	At Risk	No Status	Special Concern	Fishing.
Winter Skate (*Leucoraja ocellata*)	Eastern Scotian Shelf-Newfoundland/ Southern GSL	Declining	At Risk	Under Consideration/No Status	Endangered	Overfishing (direct and indirect).

Common Name (Species Name)	Population	Population Trend	NL Region Status	*SARA* Schedule 1 Listing	COSEWIC Status	Anthropogenic threats
Diadromous species						
Atlantic Sturgeon (*Acipenser oxyrinchus*)	St. Lawrence	Unknown	At Risk	No Status	Threatened	Fishing, changes to habitat, and pollution.
Atlantic Salmon (*Salmo salar*)	South Newfoundland/ Southwest Newfoundland	Unknown/ Increasing	At Risk	No Status	Threatened/ Not at Risk	Climate change, changes to ocean ecosystems and habitats, and fishing.
Striped Bass (*Morone saxatilis*)	Southern GSL/ Bay of Fundy/ St. Lawrence River	Unknown	-	No Status /Endangered	Endangered/ Special concern	Habitat degradation and change, pollution, climate change, and fishing.
American Eel (*Anguilla rostrata*)	-	Unknown	At Risk	No Status	Threatened	Habitat degradation and change, pollution, climate change, and fishing.

This table lists the threatened and endangered species that occur in or around the Focus Area including the affected population, population trends, *SARA* Schedule 1 listing status, COSEWIC status, and the current anthropogenic threats they face.
[1]Adapted from Environmental Assessment Update: Eastern Newfoundland Offshore Geophysical, Geochemical, Environmental and Geotechnical Programs 2015-2024, by AMEC, 2018, Prepared for ExxonMobil Canada Ltd. Copyright 2018.
[2]Results uncertain due to data availability.
Sources: (AMEC, 2018b; COSEWIC, 2008a, 2009a, 2009b, 2010c, 2010a, 2010b, 2010d, 2011a, 2011b, 2012f, 2012i, 2012c, 2012b, 2012g, 2012e, 2012a, 2012h, 2013a, 2014b, 2015, 2016, 2017b, 2018, 2019d, 2021b; DFO, 2010c, 2011c, 2013d, 2014, 2018c, 2022e).

7.4.1.8 Key Areas and Times

Climate induced changes in the ocean waters themselves are effecting 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, with deeper water, colder (Bernier et al., 2023; Cyr et al., 2022; DFO, 2023k). 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, 2023j). There have been changes in community structure within the marine ecosystem since the decline of fish stocks in the late 1980s and early 1990s and the 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 the large pelagic fish and sharks are highly migratory and tend to be seasonal residents (see Sections 7.4.1.3. and 7.4.1.4 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 7.4.1.4 of this Report). Most invertebrates are found in intertidal or coastal areas along the shores of the Focus Area (see Section 7.4.1.3 of this Report). For both residential and migratory species abundance is highest from spring to summer when prey availability is highest and spawning occurs (see Sections 7.4.1.3 and 7.4.1.4 of this Report). For species with known spawning times within the Focus Area, late spring to fall is most common with some species moving inshore to breed (see Sections 7.4.1.3 and 7.4.1.4 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 7.4.1.3 and 7.4.1.4 of this Report). These areas have been used to inform EBSAs and may be used to inform delineation of future critical habitats (N. 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 White sharks is currently being assessed within the Focus Area.

A number of EBSAs have been identified within or near the Focus Area by DFO or by the United Nations Convention on Biological Diversity (UNCBD) for which the criteria for their identification, evaluation, and selection has included their importance to invertebrates, fish, sharks, and skates in terms of biodiversity, density and 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 of this Report.

7.4.2 Potential Effects

Several fish, shark, and skate species, including species at risk, reside in or pass through the Focus Area within various habitats composed of both biotic and abiotic components (see Section 7.4.1 of this Report). The activities associated with an offshore wind farm that could impact the environment as well as the plants and the animals within it are described in Section 4 of this Report. Effects from an offshore wind farm can occur throughout any of the phases of development. Impacts associated with offshore wind development can have both temporary or permanent, physical, or behavioral effects on the various invertebrate, fish, shark, and skate species found within the Focus Area. The potential effects for the various phases of an offshore wind development are described in Table 7.4.12. Accidental events are also briefly considered.

Any impact on marine fish or fish habitat could have direct or indirect effects on other components (e.g. Fisheries and Other Ocean Users, Aerofauna, Marine Mammals and Sea Turtles etc.,). Cumulative effects are described in Section 8 of this Report.

7.4.2.1 Effects of Planned Offshore Wind Activities

Offshore wind development may potentially 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. While some impacts are present throughout every stage of offshore wind development, other impacts may only occur during specific phases of development (Table 7.4.12).

7.4.2.1.1 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; A. Popper et al., 2014; Stantec, 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., n.d.). Aquatic species such as fish, sharks, and skates vary in their hearing frequency ranges and sensitivity to various sound levels and pressures (A. D. Hawkins et al., 2015; Mickle & Higgs, 2022; Nieder, 2023; A. N. Popper et al., 2019; A. N. Popper & Hawkins, 2018). However, 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). These differences as well as proximity to the source and duration of noise generating activities can result in different responses across species to underwater noise generated by offshore wind development (Carroll et al., 2017; A. D. Hawkins & Popper, 2017; A. Popper et al., 2014; A. Popper & Hawkins, 2012; A. N. Popper et al., 2007; A. N. Popper & Hastings, 2009; A. N. Popper & Hawkins, 2016). Due to the various exposure levels and durations required to impact different species, the physiological effects caused by offshore wind development for fish, sharks, and skates can range in severity from auditory masking of communication and behavioural changes (changes in habitat use, or foraging), to auditory injury, tissue damage, and mortality (Carroll et al., 2017; A. Popper & Hawkins, 2012; A. N. Popper & Hawkins, 2016).

Auditory injury is often associated with a loss of hearing or hearing sensitivity caused by noise exposure over a significant period of time and sound pressure level (A. Popper et al., 2014). If a noise induced threshold shift (NITS) in hearing is temporary and returns to normal the injury is considered a temporary threshold shift (TTS), but if the hearing threshold shift remains elevated it is called a permanent threshold shift (PTS) (A. 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 more resilient to anthropogenic sound exposure (Carroll et al., 2017; A. D. Hawkins & Popper, 2017; Morley et al., 2014). Pelagic species are also expected to have more sensitive hearing than demersal species by demonstrating hearing thresholds at lower frequencies (Carroll et al., 2017). The clupeidae family which includes herrings, 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 sound. The differences in responses for marine species to sound stimulus across sound types, exposure levels, age, sex, environmental conditions, source proximity, and other factors make guidance thresholds for underwater noise levels difficult to quantitatively define and are more suitable for project-level assessments and therefore not included in Table 6.4.2.1.1 (Carroll et al., 2017; A. D. Hawkins & Popper, 2017; A. Popper et al., 2014; A. Popper & Hawkins, 2012; A. N. Popper et al., 2007; A. N. Popper & Hastings, 2009; A. N. Popper & Hawkins, 2016).

The presence and effects of underwater noise throughout offshore varies. Noise associated with marine vessel activity can have a number of impacts on invertebrates, fish, and sharks (A. 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 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, 2004; 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, 2004; 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.

During the pre-construction phase, site surveys are performed to 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, 2004; Payne et al., 2009; A. Popper et al., 2014; Streever et al., 2016). Site survey associated with offshore wind development are not expected to pose a significant biological or physical risk if behavioural responses are brief and outside a critical period due to the generally lower source levels, intermittent short pulse, and direction of some methods (Dalen, 2007; A. D. Hawkins & Popper, 2017; McCauley, Fewtrell, Duncan, Jenner, Jenner, Penrose, Prince, Adhitya, et al., 2000; Mooney et al., 2020; Sivle et al., 2015).

Systems used for penetrating the seafloor for offshore wind are lower energy (quieter) 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 (Dalen, 2007; A. Popper et al., 2014). 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).

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 sound at both high and low frequencies that may cause auditory injury at close range (CSA Ocean Sciences Inc., 2021; A. Popper et al., 2014). The available research on the potential effects of particle motion on invertebrates and fish is limited, but 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 also dependent on the size and material of the piles as well as the hammer type used for driving (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 unlikely to generate underwater noise that would impact marine species, 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).

The operation phase generates both temporary underwater noise through maintenance activities and the continuous low amplitude sounds 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 and are not expected to cause direct physical injury (Kaldellis et al., 2016; SEER, 2022). Some studies suggest that fish may adapt to the low intensity operational turbine noise (Thomsen et al. 2006). Overall, the operation phase of offshore wind development is not expected to have a significant negative effect on invertebrate, fish, shark, and skate abundance or distribution as any effects are likely to be small, especially compared to impacts from other more common anthropogenic and natural noise sources such as vessel traffic (Kaldellis et al., 2016; Verfuss et al., 2019).

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 emissions produced by such activities are anticipated to be similar to those produced during the construction phase (Hinzmann et al., 2017). The noise and sound pressure generated may be significant enough to 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 7.4.2.1.3. of this Report *Presence of Infrastructure* below for information on the effects of artificial reefs) (Kikuchi, 2010; Maxwell et al., 2022; Mooney et al., 2020).

7.4.2.1.2 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, 2022). The installation of gravity foundations, often requires dredging of the sea floor in order to level the area which causes 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; 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.

7.4.2.1.3 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, 2004; 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). Both impacts may cause changes in invertebrate, fish, eggs, and larvae distributions, abundance, and behaviour through a variety of mechanisms (CSA Ocean Sciences Inc., 2021; DFO, 2004; English et al., 2017; Farr et al., 2021; ICF, 2020).

Newly introduced structures may also create hospitable conditions for non-native/IS to colonize and spread by acting as ‘stepping stones’ and allowing non-native/IS access new regions (De Mesel et al., 2015; Degraer et al., 2020; ICF, 2020; NYSERDA, 2017b). The spread of IS through the presence of new infrastructure may be further exacerbated by the increase in vessel traffic, as ships can carry non-native and IS in their ballast and introduce them 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 IS spread than fixed-bottom offshore wind structures (Karlsson et al., 2022).

The introduction or spread of non-indigenous and IS 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 IS can eliminate essential food sources for predators or disrupt existing predator/prey relationships (Watson et al., 2024). IS of particular concern for Newfoundland and Labrador that already exist within the region include the coffin box ectoproct, European

green crab, violet tunicates, and golden star tunicates (DFO, 2012a; Mouland, 2008). They are described further in Section 7.4.1 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 create artificial reef effects by attracting other invertebrates, fish, sharks and skates, and introducing new communities of organisms to an area and increasing biodiversity (Glarou et al., 2020; ICF, 2020; SEER, 2022). The behavioural changes associated with the artificial reef effect are species-specific with some species such as cod showing an increase in abundance on site while others such as herring show no behavioural change (HDR, 2018; SEER, 2022; Svendsen et al., 2022).

Changes in the abundance and biomass of invertebrate and fish species in a given area can affect distribution and behaviour of predators in the area of the structures (Bergström et al., 2013; ICF, 2020; Lindeboom et al., 2011; Reubens et al., 2014; Svendsen et al., 2022). The artificial reef effects have been observed to expand beyond the boundaries of an offshore wind project into the surrounding area (Dannheim et al., 2020a). 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 are expected to have comparative positive 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 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 an artificial reef effect, 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 may have environmental and economic benefits, especially if habitat created on the structures has conservation or commercial value (Smyth et al., 2015).

7.4.2.1.4 Presence of Electromagnetic fields (EMF)

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 during the operation phase (inter-array cables) which are often buried in the seabed (>1m 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 to ensure efficient energy transport (CMACS, 2003; OSPAR Commission, 2012; Vize et al., 2008). Power cables used for floating offshore wind developments can exist throughout the water column and may require additional protection to reduce EMF emissions 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 which in combination can eliminate most of the EMF emissions (CMACS, 2003; CSA Ocean Sciences Inc. and Exponent, 2019). AC cables generally carry lower power levels and generate weaker magnetic fields than DC making the magnetic fields from AC cables less likely to be detected by marine species (Normandeau et al., 2011; NYSERDA, 2017b, 2017c; Taormina et al., 2020). However, the interactions between naturally occurring EMF in the oceans and cable-induced EMF are not well understood. There is little evidence that EMF emissions produced from offshore wind subsea cables impact individual animals or populations (Stantec, 2022; Taormina et al., 2020).

EMF can affect electrosensitive animals such as some bony fishes, and elasmobranchs (sharks, skates, and rays) as well as magnetosensitive animals such as some invertebrates and elasmobranchs (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, 2017b; 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 (K. 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 (≤20m) (K. Scott et al., 2018, 2021; SEER, 2022; Taormina et al., 2020).

7.4.2.1.5 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. owever, secondary entanglement caused by marine debris (e.g. derelict fishing gear) becoming snagged in floating offshore wind farm mooring lines and cable systems pose a threat to marine species (Maxwell et al., 2022; Taormina et al., 2020). This poses a significant risk to large migratory species at risk in Newfoundland and Labrador, such as the endangered basking shark (Maxwell et al., 2022; SEER, 2022). Entanglement can result in acute tissue damage, asphyxiation or respiratory distress, mobility issues, reduced foraging capacity, and population growth problems (SEER, 2022). Predators may also be attracted to entangled marine debris if prey species are caught within it (Maxwell et al., 2022).

7.4.2.1.6 Collisions

The mechanism and nature of vessel collisions are described in Section 7.4.2 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, 2017d; Schoeman et al.,

2020). However, for most marine fish and shark species the risk of vessel collision is very low due to size and lack of time spent at or near the surface.

7.4.2.1.7 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, 2017b; Stantec, 2022). However, it is unlikely that artificial and navigational lighting have a significant effect on fish and invertebrates.

7.4.2.1.8 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 but the effects from the warm water and any associated secondary effects are likely to be minimal (Middleton & Barnhart, 2022). There is also some 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).

Table 7.4.12 Potential Impact Pathways and Effects of Offshore Wind Development on Marine Fish and Fish Habitat.

Project Phase	Effects
Underwater Noise	
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).
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.
Visual and spatial disturbance	
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 IS occurrence. • Temporary or permanent spread of IS.

Project Phase	Effects
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.
Entanglement	
Construction and Operation	• Temporary or permanent entanglement risk. • Temporary changes in foraging efficiency. • Temporary or permanent changes in predator avoidance success.
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.

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.
Sources: (Andrzejaczek et al., 2022; Bailey et al., 2014; Bat et al., 2013; Bergström et al., 2013, 2014; Bray et al., 2016; Carroll et al., 2017; CEF Consultants Ltd., 2011; CMACS, 2003; CSA Ocean Sciences Inc., 2021; CSA Ocean Sciences Inc. and Exponent, 2019; Dalen, 2007; Dannheim et al., 2020a; Day et al., 2016; De Mesel et al., 2015; Defingou et al., 2019; Degraer et al., 2012, 2020; DFO, 2004; 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; A. Hawkins et al., 2020; A. D. Hawkins et al., 2015; A. D. Hawkins & Popper, 2017, 2018; HDR, 2018; Hermans et al., 2022; Hewitt et al., 2009, 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., 2003; McCauley, Fewtrell, Duncan, Jenner, Jenner, Penrose, Prince, Adhitya, et al., 2000; McCauley, Fewtrell, Duncan, Jenner, Jenner, Penrose, Prince, Adhiyta, et al., 2000; Mooney et al., 2020; Morley et al., 2014; Nedwell et al., 2003, 2007; Nedwell & Howell, 2004; Normandeau et al., 2011; NYSERDA, 2017b, 2017d, 2021; Payne et al., 2009; A. Popper et al., 2014; A. Popper & Hawkins, 2012; A. N. Popper et al., 2007; A. N. Popper & Hastings, 2009; Reubens et al., 2013, 2014; Schoeman et al., 2020; K. Scott et al., 2018, 2021; SEER, 2022; Sivle et al., 2015; Slotte et al., 2004; Smith, 2016; Smyth et al., 2015; Souissi et al., 2017; Stantec, 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).

7.4.2.2 Indirect Effects of Planned Offshore Wind Activities

Invertebrates, fish, skate, sharks, and fish habitat that occur within the Focus Area are culturally, economically, and environmentally important for a number 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 activities.

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.	7.4
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 Users	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

This table summarizes the potential indirect effects to other components (i.e. Marine Mammals and Sea Turtles, Fisheries and Other Ocean Users 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., 2020b; DFO, 2005; Lindeboom et al., 2011; MMO, 2013; Veit & Harrison, 2017)

7.4.3 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; MMS, 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. rAvoid 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, seasonal species distributions and efficient monitoring protocols. • Perform Pre-installation 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 pre-construction, construction, and decommissioning activities that produce noise efficiently to use the minimum duration necessary. • Plan seismic surveys to use the minimum energy required. • Use foundation types or installation methods that do not require 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 around pile driving and air source array (500m) 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. • 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. • Pre-fabricate parts onshore when possible to reduce the introduction of noise to the marine environment.

Mitigation Measures	Description
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 of 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.
Visual and Spatial disturbance	• Same as for Project Siting • Repair of 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).

Mitigation Measures	Description
	• If possible, consider leaving infrastructure in place if there is an artificial reef effect associated with foundations/scour protection that provides biodiversity/ecosystem benefits. • Reducing the overall footprint of the turbine matrix and cable array. • Develop guidance for offshore wind developers regarding IS 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 at-risk species 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. • 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.
Subsea Power Cables and Emf Emissions	• Bury cables to a depth of 1.5 to 2 m to mitigate impacts of the magnetic and induced electrical fields by employing sediment as a physical barrier to sensitive species. • 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.

Mitigation Measures	Description
	• Add additional protective layer around cables installed on top of the seafloor.

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.
Sources: (Bennun et al., 2021; BOEM, 2022; Carroll et al., 2017; Causon & Gill, 2018; Copping & Hemery, 2020; CSA Ocean Sciences Inc. and Exponent, 2019; Dannheim et al., 2020a; Degraer et al., 2020; DFO, 2004; Fowler et al., 2020; Hammar et al., 2015; A. D. Hawkins & Popper, 2017; Lüdeke, 2017; Maxwell et al., 2022; NOAA, 2008; NYSERDA, 2017a, 2021, 2021; OSPAR Commission, 2012; Perry & Heyman, 2020; Raoux et al., 2017; SEER, 2022; Stantec, 2022; Svendsen et al., 2022; Taormina et al., 2020; Verfuss et al., 2019; Vize et al., 2008; Watson et al., 2024).

7.4.4 Engagement Outcomes

Participants expressed general concerns about how offshore wind development will affect marine species and their habitats and a need for more longitudinal 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 whereabouts 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, invertebrates, fish, sharks, and skates were expressed frequently through public engagement, advisory group input, and Indigenous consultation. 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.

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 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 23rd, 2024, a member of Port au Port Indian Band indicated they are concerned for the impact of offshore wind 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.

7.4.5 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 there are the cause of the existing data gaps and limitations in regard 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.

7.4.5.1.1 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 but some regions within the Focus Area are not well mapped, particularly regions of great depth or that are very shallow (<30m). With the interest in the potential for offshore wind energy development off the east coast of Canada, the Geological Survey of Canada)has initiated assessment 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.

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.

7.4.5.1.2 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 (1500m 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.

7.4.5.1.3 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 (Druin et al. 2022 in CSAS 2023).

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 energy 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.

7.4.5.1.4 Invasive Species in the Focus Area

Understanding how IS spread is essential to preventing or slowing their spread into new regions. Currently, the information on how IS 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, 2023b). More studies and surveys are also required to assess the current abundance and associated numbers for control for some IS in the Focus Area in order to direct mitigation measures to prevent impacts to fisheries and the environment (DFO, 2023b). The method, manner, and speed of IS 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, 2023b).

7.4.5.1.5 Underwater Noise

There remain considerable gaps in the understanding of anthropogenic sound on fish and invertebrates (Popper and Hastings, 2009; Hawkins et al. 2015; Carroll et al., 2017; Hawkins and Popper, 2017; Weilgart, 2018; Popper and Hawkins, 2019). 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 focuses primarily on structures that require pile driving; additional research on the underwater noise generated by non-pile foundations is required.

7.4.5.1.6 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) is ensured. Information on movement and behaviour would also improve the ability to identify high-risk offshore wind areas and improve monitoring efforts. Existing data on vessel collisions focuses 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 collective quantitative movement and behavioural data (Copping & Hemery, 2020; Fowler et al., 2020; A. D. Hawkins & Popper, 2017).

7.4.5.1.7 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. 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, sharks, and skate species is also not well documented.

7.4.5.1.8 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.

7.4.5.1.9 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 (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).

7.4.5.1.10 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.

7.4.6 Committee Conclusions and Recommendations

The oceans waters around Newfoundland and Labrador are changing rapidly as are some of the historical marine communities (DFO, 2023). 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 energy. As an outcome of preparing the Regional Assessment, several recommendations to address data and information important to considering offshore wind energy 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 of Preliminary Licencing Areas)
- A program of surveys in the Focus Area to collect information on sharks regarding species occurrence and abundance. A range of technologies and data gathering should be considered, including protocols for observations by ocean users; eDNA; autonomous underwater vehicles.
- Research and survey effort should include identification of migratory routes and/or important areas for all species at risk, fish and sharks.

- Project specific environmental impact assessments should be based on a minimum of 2 years of site-specific surveys that should be made part of a long-term monitoring and research program.

7.4.7 References

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7.5 Marine Mammals and Sea Turtles

7.5.1 Existing conditions

A variety of marine mammals and sea turtle species occurs within the Focus Area, including a number of *mysticetes* (baleen whales), *odontocetes* (toothed whales, dolphins and porpoises), *pinnipeds* (seals), and several sea turtle species. The distribution of marine mammals and their prey is affected by oceanographic conditions which are described in further detail in Section 7.4.1.2 of this Report. Polar Bears are occasional visitors to the island of Newfoundland outside the Focus Area (COSEWIC, 2018). However, Polar Bear sightings in the region are considered extra-limital observations occurring when individuals drift south 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. They may be considered in future if technological advancements broaden the potential range for offshore wind along the coast of Labrador and northern Newfoundland.

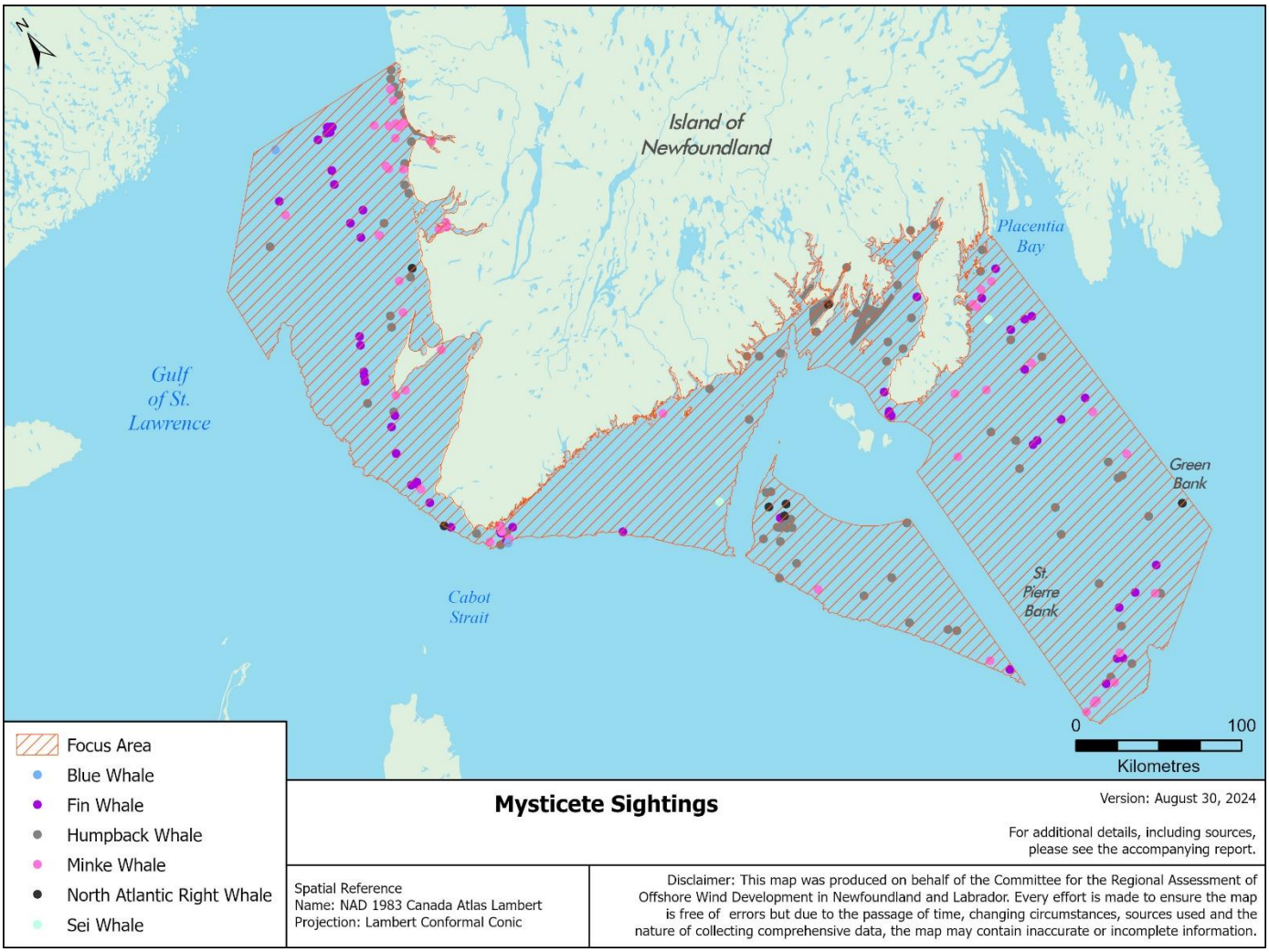
Of the species found in the Focus area, several are of conservation concern. Their protected status is described further in Section 7.5.1.5 of this Report. Marine mammals and sea turtles are considered ecologically, economically, culturally, and recreationally important to various groups, including government departments and agencies, Indigenous groups, and other interested parties.

7.5.1.1 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 (Stantec, 2022). Species that are known or considered likely to occur in the region with some degree of regularity include North Atlantic Right Whales, Common Minke Whales, Sei Whales, Blue Whales, Fin Whales, and Humpback Whales. Baleen whales use acoustic communication to maintain complex social structures (Erbe, 2002).

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, 2013b, 2019a, 2019c, 2022b). More recently, anthropogenic threats include increased vessel traffic (collisions), and fishing gear (entanglement) which are the leading causes of mortality for these species (AMEC, 2014a; COSEWIC, 2002, 2006a, 2013b, 2019a, 2019c, 2022b). Climate change is anticipated to affect baleen whales through causing changes to their prey availability and distribution as well as causing direct harm through increases in ocean temperatures for species that are sensitive to heatwaves (COSEWIC, 2002, 2022b; Lettrich et al., 2023; Tulloch et al., 2019).

Figure 7.5.1: Mysticete Sightings in the Focus Area.



This map displays presence points for locations where various baleen whale species have been observed in the Focus Area. The baleen whales identified include Blue Whales, Fin Whales, Humpback Whales, Common Minke Whales, North Atlantic Right Whales, and Sei Whales. The highest density of whale sightings in the Focus Area occur on St. Pierre Bank and around the west coast.
Data Source: (DFO, 2023a; Government of Canada, DFO, 2024; OBIS, 2024).

Table 7.5.1 Mysticete Species that occur in or around the Focus Area[1].

Type	Species	Habitat and Movement	Presence in Focus Area[2]
Balaenidae – Right whales	North Atlantic Right Whale (*Eubalaena glacialis*)	• Prefers waters 100 – 200 m deep with surface temperatures between 8 and 15°C. Though the species occurs in shallow and deep coastal waters as well as offshore. • Distribution related to presence and abundance of prey species. • In the Atlantic Canada, the highest abundance of the species congregates in the Bay of Fundy, on the Scotian shelf, and in two areas of the GSL. • Found in Atlantic Canada 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 in Focus Area; most likely to be present in the summer to late fall months.
Balaenopteridae – Rorquals	Common Minke Whale (*Balaenoptera acutorostrata*) - Atlantic population	• Prefers shallow (<200m) 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 5000 around Newfoundland and Labrador. • Often alone or in small groups, occasional form large groups for feeding.	Present in the Focus Area; most common in the winter.
	Sei Whale (*Balaenoptera borealis*) - Atlantic population	• In the Northwest Atlantic, often found 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 in the Focus Area but most likely to be present during the summer months.

Type	Species	Habitat and Movement	Presence in Focus Area[2]
	Blue Whale (*Balaenoptera musculus*) - Atlantic population	• Found in coastal and pelagic waters, frequently at shelf edge where food production is high. • Critical habitat in the estuary and Gulf of St. Lawrence is currently being identified for the species. • Found 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 the areas of high concentrations of their primary food item.	Present in the Focus Area in small numbers throughout the year; most common in the winter and early spring (April – December).
	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 the areas of high concentrations of their primary food item. • Often alone or in pairs, occasional form groups as large as 20 individuals for feeding. • Often sighted off the south coast of Newfoundland.	Present year-round in the Focus Area, most common in the summer months.
	Humpback Whale (*Megaptera novaengliae*) - Western North Atlantic population	• Migratory great distances between temperate and arctic feeding areas seasonally. ○ Migrate through the Focus Area into the Gulf. • Often alone or in small groups, occasional form groups as large as 15 individuals for breeding and feeding. • Frequently sighted off the south coast of Newfoundland. • Newfoundland and Labrador and the GSL identified as two of size distinct feeding areas in North Atlantic. • Known for its surface displays and breaching acrobatics.	Present in the Focus Area.

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.

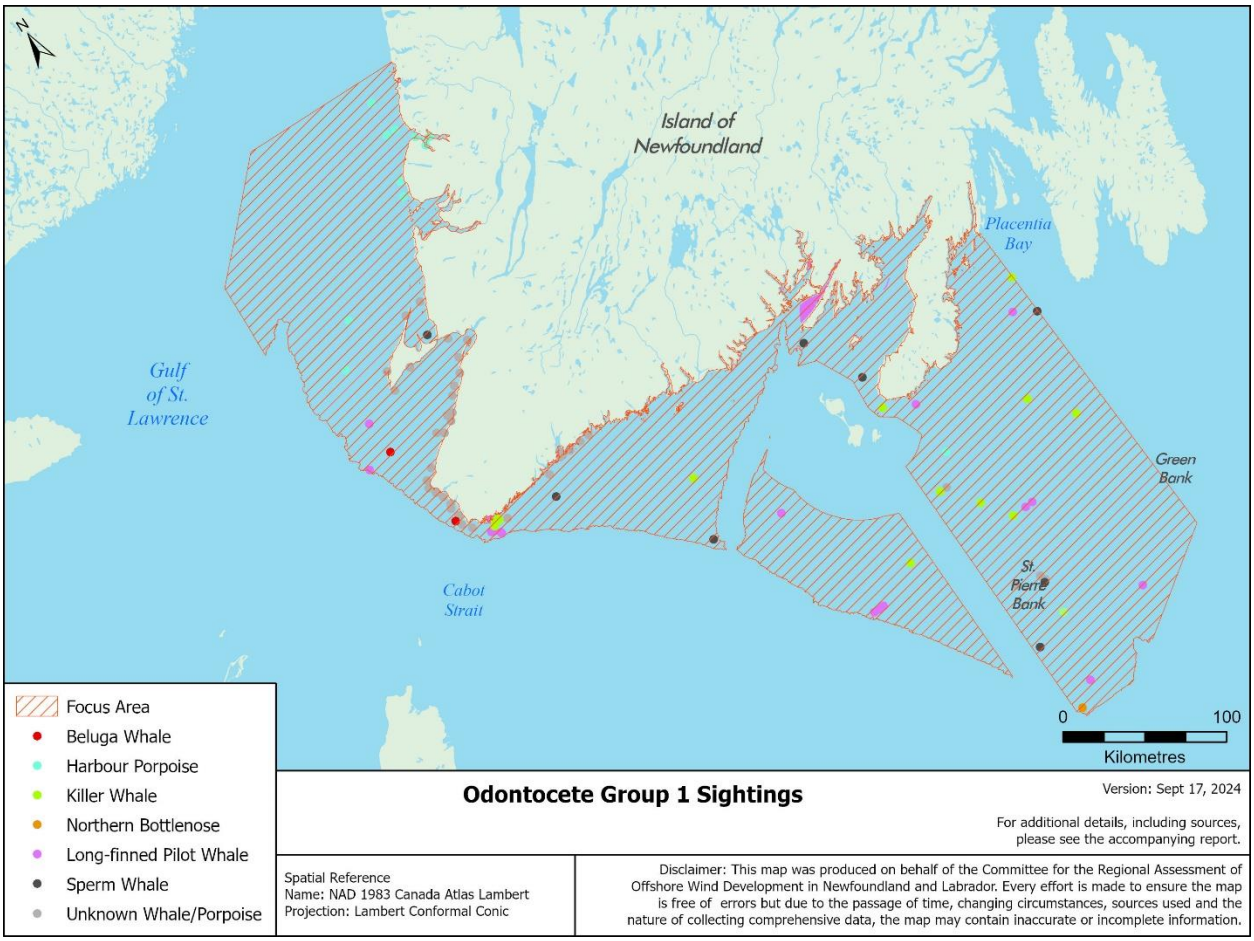
[1]Adapted from Environmental Assessment Update: Eastern Newfoundland Offshore Geophysical, Geochemical, Environmental and Geotechnical Programs 2015-2024, by AMEC, 2018, Prepared for ExxonMobil Canada Ltd. Copyright 2018.
[2]"Present" means the Focus Area is included in the species habitat range; "Uncommon" means the species does not have habitat within the Focus Area but may have habitat nearby causing spillover, the species may only migrate through the Focus Area, or the species may be considered an "accidental visitor".
Sources: (AMEC, 2014a, 2014b; COSEWIC, 2002, 2013b, 2019c, 2019a, 2021c, 2022b; DFO, 2018b, 2023i; IWC, 2002; Kenney, 2001; Lawson & Gosselin, 2009; Leatherwood & Reeves, 1983; Moors-Murphy et al., 2019; NOAA, 2017; Reilly et al., 2008; Stewart & Leatherwood, 1985)

7.5.1.2 Odontocetes

Toothed whales, dolphins, and porpoises (*odontocetes*) are cetaceans that are characterized by teeth that they use to feed on fish and invertebrates (Stantec, 2022). Species that are known or considered likely to occur in the region with some degree of regularity include: Cuvier's Beaked Whales, Sowerby's Beaked Whales, Northern Bottlenose Whales, Sperm Whales, Beluga Whales, Harbour Porpoises, Short-beaked Dolphins, Long-finned Pilot Whales, Risso's Dolphins, Atlantic White-sided Dolphins, White-beaked Dolphins, Killer Whales, Striped Dolphins, and Common Bottlenose Dolphins. Toothed whales, porpoises, and dolphins rely heavily on acoustic vocalizations for social communication and for navigation and feeding via echolocation (Richardson et al., 1995; Stantec, 2022).

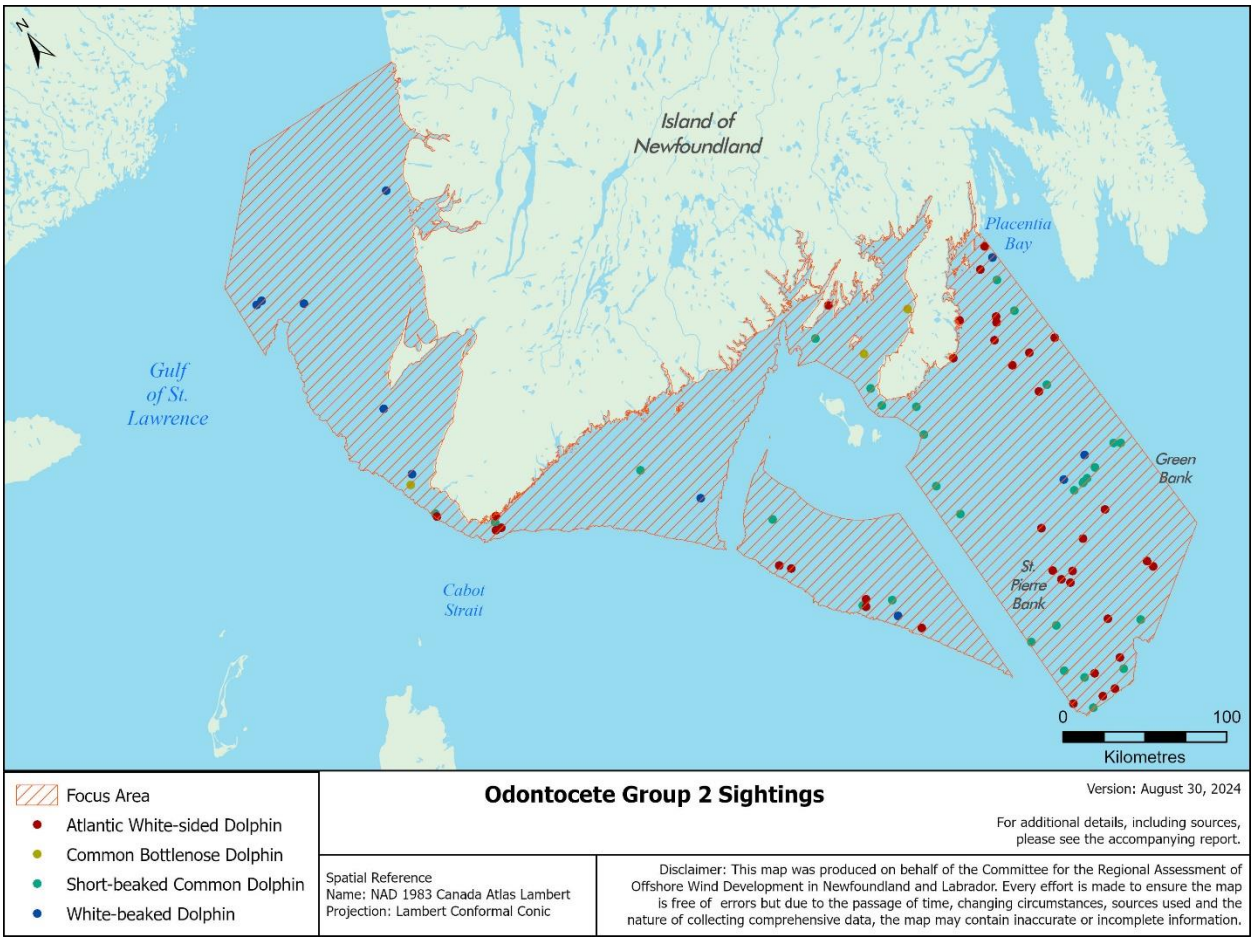
For toothed whale and porpoise species at risk, the historic decline in their population was caused by a number of anthropogenic forces including whaling (COSEWIC, 2011c), hunting (COSEWIC, 2014a, 2020), and declines in prey abundance (COSEWIC, 2008b). The greatest existing anthropogenic threat to toothed whales and porpoises in Newfoundland 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, 2019b, 2019d, 2019a, 2020, 2021e, 2021a; Themelis et al., 2016). Climate change is anticipated to affect toothed whales, dolphins, and porpoises through causing changes to their prey availability and distribution (Lettrich et al., 2023; NOAA, 2019b, 2019d, 2019a, 2020, 2021e, 2021a; van Weelden et al., 2021). In engagement sessions during June 2024, fish harvesters and residents in the Focus Area mention that they are seeing more 'porpoises'; commercial fish harvesters also frequently mention that the water is warmer.

Figure 7.5.2 Odontocete sightings in the Focus Area.



This map displays presence points for locations where various toothed whale, and porpoise species have been observed in the Focus Area. 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). The highest density of toothed whale and porpoise sightings in the Focus Area occur along the coast of the southwest tip of the island of Newfoundland near Port aux Basques, Cape Anguille, and Bay Saint George.
Data Source: (DFO, 2023a; Government of Canada, DFO, 2024; OBIS, 2024).

Figure 7.5.3 Odontocete sightings in the Focus Area.



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 occur on St. Pierre Bank and around Placentia Bay.
Data Source: (DFO, 2023a; Government of Canada, DFO, 2024; OBIS, 2024).

Table 7.5.2 Odontocete Species that Occur in or around the Focus Area[1].

Type	Species	Habitat and Movement	Presence in Focus Area[2]
Ziphiidae – Beaked whales	Cuvier's Beaked Whale (*Ziphius cavirostris*)	• Cosmopolitan distribution; found in temperate, subtropical, and tropical waters. The seasonality and migration patterns of this species are not known. • Deep-diving species that prefer deep pelagic waters (>1000m) of the continental slope and edge. • Newfoundland waters lie outside the edge of their northern range. • Typically found alone or in small groups of 2-10 animals; have been found in groups as large as 25 individuals.	Uncommon in the Focus Area, 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-Aug). • Found in deep (>1000m) 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 in the Focus Area; 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 found in waters 800-1500m 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. • Birthing season occurs from April – June. • Known to approach vessels.	Present in the Focus Area in small numbers year-round; Most likely to be present in the spring and summer.

Type	Species	Habitat and Movement	Presence in Focus Area[2]
Physeteridae – Sperm whales	Sperm Whale (Physester macrocephalus)	• Deep divers that regularly dive >100m and as deep as 3000m on occasion. • Sperm whales have been sighted in shallow water and close to the coastline in Southern Newfoundland. • 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 in the Focus Area; present in surrounding deep-water areas year-round.
Phocoenidae – Porpoises	Harbour Porpoise (*Phocoena phocoena*) - Northwest Atlantic population	• Found on the continental shelves, more likely to be found on the coastal shelf, bays and estuaries in the summer. • Highly mobile species that may remain in the same are 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 found along the south and west coasts of Newfoundland within the Focus Area. • Typically found in small groups of 1-3 individuals, sometimes found in groups of 10. Rarely form large groups for feeding. • Seasonal movements, behaviour and population estimates poorly known.	Present in the Focus Area, possibly present year-round.
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 in the Focus Area.

Type	Species	Habitat and Movement	Presence in Focus Area[2]
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 >200m but can also be found in shallower waters with high productivity. • Most likely to be found in the Focus Area in summer and autumn months.	Present in the Focus Area; 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 found in deep water with steep bottom topography as observed in the GSL. • 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.	Present in the Focus Area, most likely in late summer-autumn. The greatest abundance occurs outside the Focus Area off the continental shelf edge.
	Risso's Dolphin (*Grampus griseus*)	• Prefer deep offshore tropical and temperate waters >300m near the continental shelf edge but have been known to inhabit coastal areas. • Can dive for 30m but very active on the surface (jumping, spy-hopping, 'porpoise' and slapping the water with the flippers or tail). • Seasonal migration patterns for these species are poorly understood. • Typically found in groups of 10-30, occasionally found 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 in the Focus Area, if present, only found in deep water habitats during the summer.

Type	Species	Habitat and Movement	Presence in Focus Area[2]
	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 found in groups of 5-50, often associate and feed with large baleen whales and are known to form mixed dolphin species group. • Frequently sighted off the south coast of Newfoundland in the Focus Area.	Present in the Focus Area
	White-beaked Dolphin (Lagenorhynchus albirostris)	• Prefer shallow colder temperate and subpolar waters <200m. • 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 found 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 in the Focus Area.
	Killer Whale (*Orcinus orca*) - Northwest Atlantic/Eastern Arctic populations	• Prefer nearshore and pelagic environments, also often found 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. • Most often found within 800km of shore. • Sighted nearshore within the Focus Area and along the continental shelf edge.	Present in the Focus Area; small numbers have been observed in the area at all times of year.

Type	Species	Habitat and Movement	Presence in Focus Area[2]
	Striped Dolphin (Stenella coeruleoalba)	• Prefer deep warm temperate to tropical oceanic waters and convergence zones. • Found 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.	Uncommon in the Focus Area; may be present year-round in deep water habitats, most likely to be found in the summer.
	Common Bottlenose Dolphin (*Tursiops truncatus*)	• Prefer temperate and tropical waters around 10°C-32°C, can be found both offshore and in coastal waters. The species found in waters off Newfoundland are more likely to be found 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 in Nova Scotia. • Seasonally migratory, found in the northern range in the summer months and moving southward to warmer waters in the winter. • Typically found alone or in undefined groups, more likely to form groups when resting or feeding.	Uncommon in the Focus Area, if present, only found in the summer.

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.

[1]Adapted from Environmental Assessment Update: Eastern Newfoundland Offshore Geophysical, Geochemical, Environmental and Geotechnical Programs 2015-2024, by AMEC, 2018, Prepared for ExxonMobil Canada Ltd. Copyright 2018.

[2]"Present" means the Focus are 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".

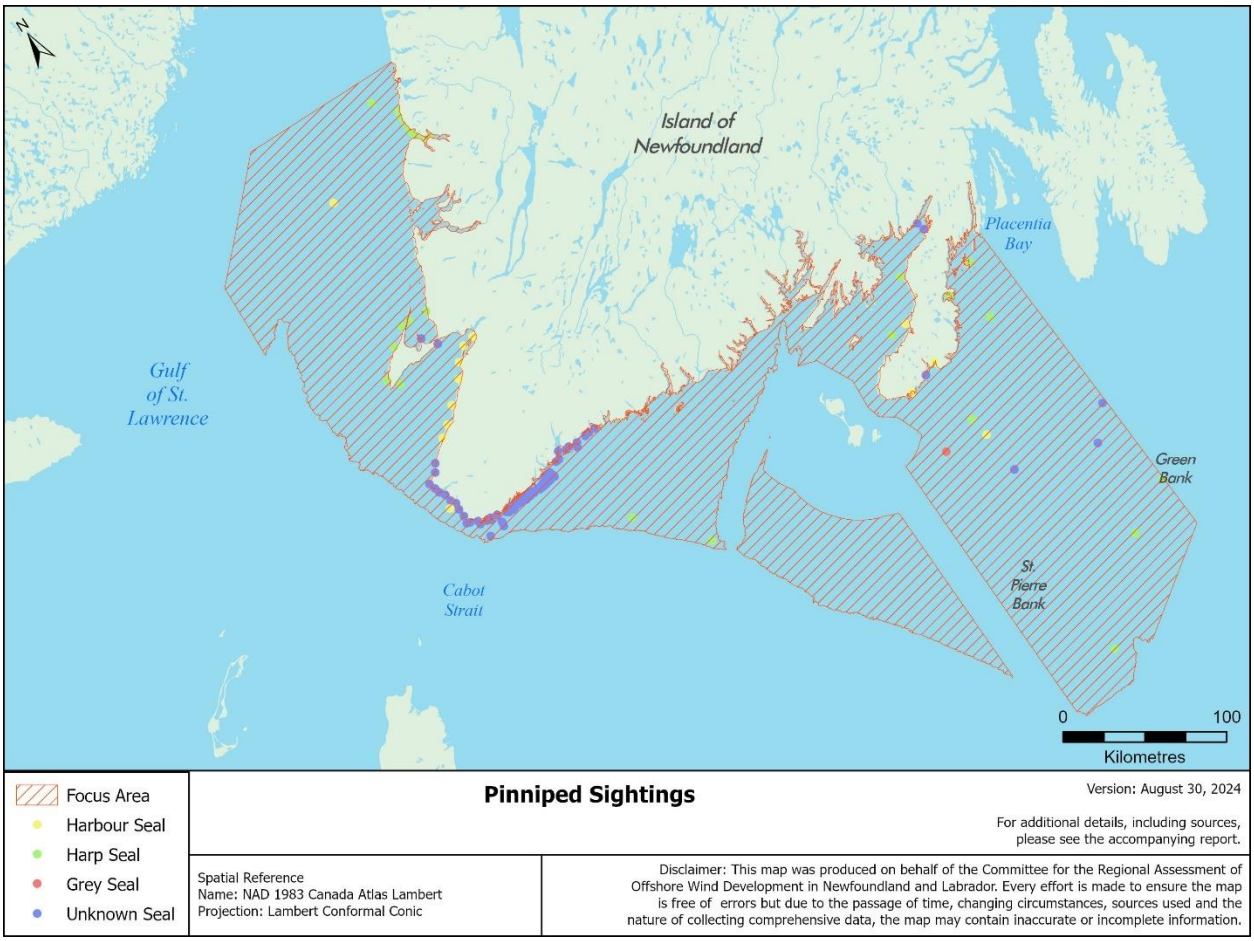
Sources: (Abend & Smith, 1999; AMEC, 2014b, 2014a, 2018a; Bernard & Reilly, 1999; Best, 1979; CNLOPB, 2010; COSEWIC, 2006b, 2008b, 2011c, 2014a, 2019e, 2020, 2022a; DFO, 2012b, 2017a, 2018e; Ford, 2002; Jefferson et al., 2015; Kingsley & Reeves, 1998; Lesage et al., 2007; MacDonald et al., 2017; NOAA, 2014, 2019b, 2019a, 2020, 2021e, 2021a; Olson & Reilly, 2002; Pitman & Brownell Jr., 2020; Rice, 1989; Richard et al., 2001a; R. Wells & Scott, 2009; Westell et al., 2022; Whitehead & Arnbom, 1987).

7.5.1.3 Pinnipeds

Seals that are known to occur in the Focus Area include Harp Seals, Harbour Seals, Hooded Seals, and Grey Seals. In general, each of these seal species can occur at most times of the year. Harp and Hooded seals share whelping locations on the "front" 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). All seal species that appear in the Focus Area 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; Vvn Opzeeland & Miksis-Olds, 2011). 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 but there are none are currently considered "at risk" by COSEWIC or SARA (COSEWIC, 2005, 2007, 2021a; DFO, 2020a). 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, 2021d, 2021c, 2021b). However, all seal species in the Focus Area can currently support these practices. Improved tracking of hunting related mortalities is needed (COSEWIC, 2007; DFO, 2020a; NOAA, 2019c, 2021d, 2021c, 2021b). The greatest existing threats to seals in Newfoundland are fisheries bycatch, entanglement in fishing gear, and pollution populations (COSEWIC, 2007; DFO, 2020a; NOAA, 2019c, 2021d, 2021c, 2021b). 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 are very rarely seen on the island of Newfoundland and their presence in the region is considered as extra-limital observations (AMEC, 2018b; COSEWIC, 2017a). Similarly, Ringed Seals 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, so they will not be considered further within the Report. Either species may be considered in future if technological advancements broaden the potential range for offshore wind along the coast of Labrador and northern Newfoundland.

Figure 7.5.4 Pinniped sightings in the Focus Area.



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 occur along the coast of the southwestern tip of the island of Newfoundland near Port aux Basques, Cape Anguille, and Bay Saint George.

Data Source: (DFO, 2023a; Government of Canada, DFO, 2024; OBIS, 2024).

Table 7.5.3 Pinniped Species that occur in or adjacent to the Focus Area[1].

Type	Species	Habitat and Movement	Presence in Focus Area[2]
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 in the south for early winter. The species molts in the south in late spring (Apl-May) before returning northward for summer feeding. • There exist two herd breeds 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 ice leaving the GSL through Cabot Strait which is within the Focus Area. • Large molting groups consisting of older harp seal occur on the sea ice off northeastern Newfoundland and in the nGSL during late spring. • Harvested for subsistence purposes in Labrador and commercially hunted in the GSL and off northern Newfoundland.	Present in the Focus Area. 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 known to occur in bays, estuaries, inlets and on occasion coastal rivers. Commonly found <20km from shore. • Shallow diver, with most dives occurring at depths <4m. • 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 conducted by pups. • Pupping occurs in spring (May-Jun). • Adults are found 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 in the Focus Area year-round.

Type	Species	Habitat and Movement	Presence in Focus Area[2]
	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, found at southern range in the winter/spring on the Newfoundland continental shelf and head north to the Denmark Strait to molt in summer (Jun- Aug). • Pupping and breeding occurs in spring (March). • Post-breeding adults may migrate through the Cabot Straight from May-June, which lies within the Focus Area.	Present in the Focus Area. 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 Noce 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. Found in alone or in small groups at sea. • Breeding occurs in the Southern Gulf of St Lawrence during the fall and whelping occurs in the winter (Dec – Jan). • 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.

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.

[1]Adapted from Environmental Assessment Update: Eastern Newfoundland Offshore Geophysical, Geochemical, Environmental and Geotechnical Programs 2015-2024, by AMEC, 2018, Prepared for ExxonMobil Canada Ltd. Copyright 2018.

[2]"Present" means the Focus Area is included in the species distribution range.

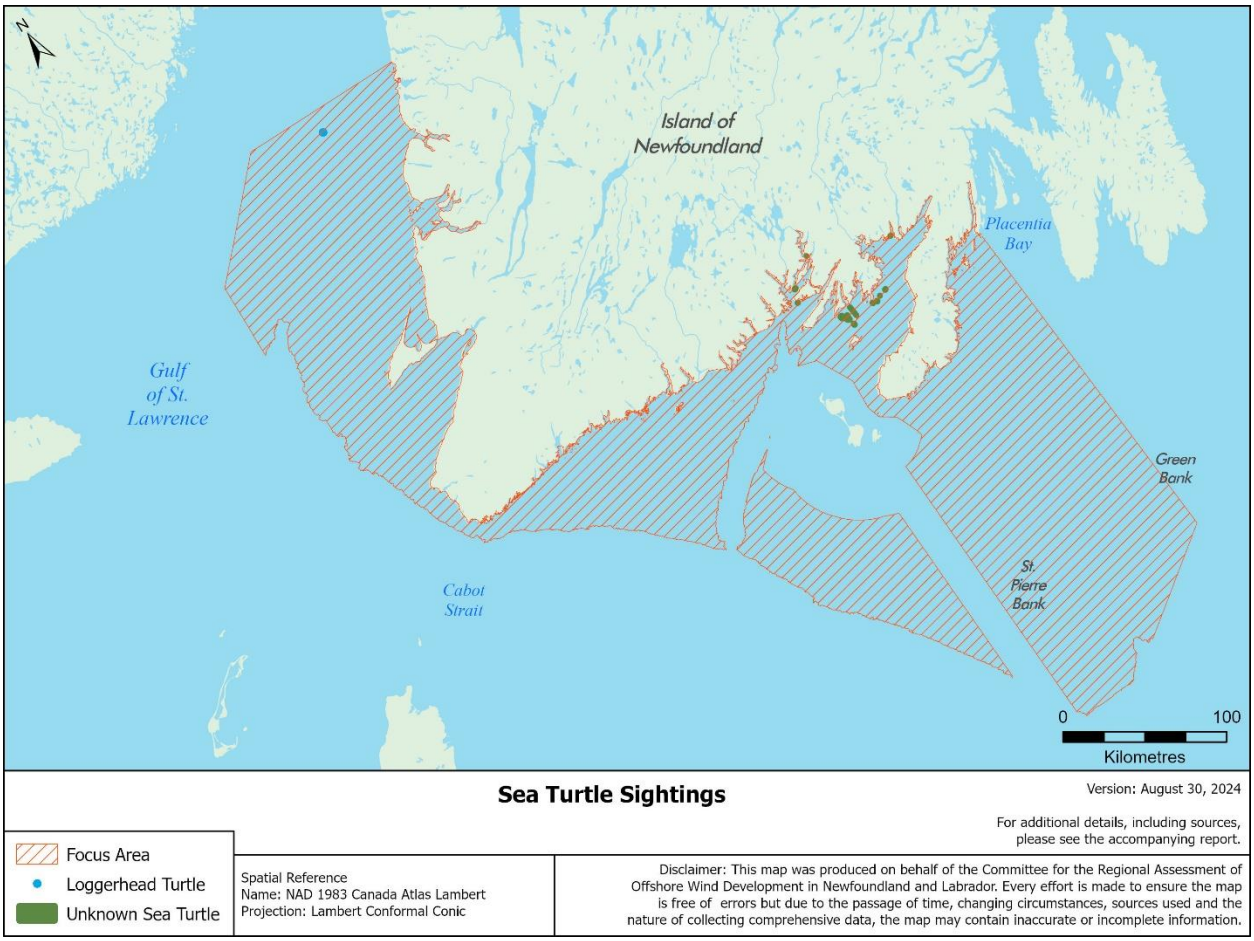
Sources: (Andersen et al., 2009; Baird, 2001, 2001; Bowen et al., 2001; Breeze et al., 2002; CNLOPB, 2010; COSEWIC, 2007; DFO, 2020a; A. Hall, 2002; Hamilton et al., 2023; Hammilll et al., 2012; Kovacs, 2002; Lesage et al., 2011; Lesage & Hammill, 2001; NOAA, 2019c, 2021d, 2021b; Stenson & Kavanagh, 1994)

7.5.1.4 Sea Turtles

Leatherback and Loggerhead sea turtles are regularly seen in the Focus Area in the summer (AMEC, 2018b; COSEWIC, 2010e, 2012d). 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 et al., 2012). 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, 2010e, 2012d). Both The greatest existing threats to sea turtles in Newfoundland are fisheries bycatch, entanglement, habitat degradation (physical and acoustic disturbances), pollution, and vessel strikes (COSEWIC, 2010e, 2012d).

Hawksbill, Green, and Kemp's Ridley sea turtles prefer tropical and subtropical waters but are sometimes found near the Focus Area in summer months (ExxonMobil, 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, 2014a; NOAA, n.d., 2024c; Seminoff et al., 2015). As accidental visitors, these species are unlikely to be found in the Focus Area of the Regional Assessment so they will not be considered further within the Report. While not listed under *SARA* or COSEWIC, these species are listed on the IUCN Red List as Critically Endangered (Hawksbill sea turtle, Kemp's Ridley sea turtle), and Endangered (Green Sea Turtles). If their presence in the Focus Area increases as a result of warming ocean temperatures causing changes in their distribution, then they may be considered in future Regional Assessments.

Figure 7.5.5: Sea Turtle sightings in the Focus Area.



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 occur around Harbour Breton in Fortune Bay.
Data Source: (DFO, 2023a; Government of Canada, DFO, 2024; OBIS, 2024).

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[1]
Dermochelyidae – Leatherback turtle	Leatherback Sea Turtle (*Dermochelys coriacea*)	• Typically found in coastal shelf waters with depths of < 200 m. • Ranges from tropical to sub-polar regions and undertakes extensive migrations between feeding areas and to tropical nesting areas. • Present in Atlantic Canadian waters from April to December with peak times from July to 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 in the Focus Area from April to December. Placentia-Bay area is a high use habitat for the species.
Cheloniidae – Sea turtles	Loggerhead Sea Turtle (*Caretta caretta*)	• Found in oceanic (>200m) and near-shore zones (<200m) 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 in the Focus Area. Most likely to be present in small numbers during the spring and summer months.

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.

[1]Adapted from Environmental Assessment Update: Eastern Newfoundland Offshore Geophysical, Geochemical, Environmental and Geotechnical Programs 2015-2024, by AMEC, 2018, Prepared for ExxonMobil Canada Ltd. Copyright 2018.

[2]"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.

Sources: (AMEC, 2018b; COSEWIC, 2010e, 2012d; DFO, 2012a; Dow Piniak et al., 2012; Eckert et al., 2012; Martin et al., 2012; NMFS, 2020; Schofield et al., 2007; Templeman, 2007; Wallace et al., 2019; Wyneken & Lohmann, 2013)

7.5.1.5 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. The primary mechanisms for identifying and protecting marine mammals and sea turtles in Canada are *SARA* and COSEWIC. Every species identified as a 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. COSEWIC also provides an assessment report detailing the 'at risk' status and detailed information on the species at its population. Other international (e.g. IUCN Red List, International Whaling Commission), federal (e.g. *Fisheries Act* (1985), *SARA* (2002), *Oceans Act* (1996)), provincial (e.g. *NL Endangered Species Act* (2004), *NL Wildlife Act* (2013)), and non-government organizations (e.g. CPAWS, Canadian Sea Turtle Network) contribute to "at-risk" designations and conservation efforts. Impacts directly related to offshore wind development in the Focus Area are described in further detail in Section 7.5.2 of this Report.

Four species of baleen whales (*mysticetes*) found in the Focus Area are considered to be species at risk. The greatest existing threat to baleen whales in Newfoundland and Labrador are entanglement with fishing gear, vessel collisions, and underwater noise (COSEWIC, 2002, 2013b, 2019a, 2019c).

Five species of toothed whales (*odontocetes*) found in the Focus are considered to be species at risk. 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 found in the Focus Area are species at risk. 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, 2010e, 2012d).

Table 7.5.5. Species at Risk in or adjacent to the Focus Area and their Federal 'At Risk' Status[1].

Species	Population	Population Trend	NL Region Status	*SARA* Schedule 1 Listing	COSEWIC Assessment	Anthropogenic threats
North Atlantic Right Whale (*Eubalaena glacialis*)	-	Decreasing (COSEWIC)	At-Risk	Endangered	Endangered	Entanglement and vessel collisions.
Sei Whale (*Balaenoptera borealis*)	Atlantic	Stable/ Unknown (COSEWIC)	None	None	Endangered	Habitat degradation (acoustic), vessel strikes, and pollution.
Blue Whale (*Balaenoptera musculus*)	Atlantic	Stable / Decreasing (COSEWIC)	At-Risk	Endangered	Endangered	Vessel collisions, vessel traffic, entanglement, and pollution.
Fin Whale (*Balaenoptera physalus*)	Atlantic	Stable / Increasing (COSEWIC)	At-Risk	Special concern	Special concern	Habitat degradation (acoustic), vessel collisions, entanglement, and pollution
Killer whale (*Orcinus orca*)	Northwest Atlantic/ Eastern Arctic	Unknown (IUCN)	At-Risk	None	Special Concern	Habitat degradation (physical and acoustic) and pollution.
Harbour Porpoise (*Phocoena phocoena*)	Northwest Atlantic	Decreasing/ Unknown (IUCN)	At-Risk	None	Special Concern	Bycatch, habitat degradation (acoustic), pollution, and prey depletion.
Beluga Whale (*Delphinaptera leucas*)	St. Lawrence Estuary	Decreasing (COSEWIC)	None	Endangered	Endangered	Pollution, habitat degradation (physical and acoustic), and prey depletion.
Sowerby's Beaked Whale (*Mesoplodon bidens*)	-	Unknown (COSEWIC)	At-Risk	Special Concern	Special Concern	Habitat degradation (acoustic), vessel collisions, entanglement, and pollution.

Species	**Population**	**Population Trend**	**NL Region Status**	***SARA* Schedule 1 Listing**	**COSEWIC Assessment**	**Anthropogenic threats**
Northern Bottlenose Whale (*Hyperoodon ampullatus*)	Davis Strait-Baffin Bay-Labrador Sea	Unknown (COSEWIC)	At-Risk	None	Special Concern	Entanglement and habitat degradation (acoustic).
	Scotian Shelf	Increasing (COSEWIC)	At-Risk	Endangered	Endangered	
Leatherback Sea Turtle (*Dermochelys coriacea*)	-	Decreasing (COSEWIC)	None	Endangered	Endangered	Fisheries bycatch, entanglement, habitat degradation (acoustic), pollution, and vessel strikes.
Loggerhead Sea Turtle (*Caretta caretta*)	Atlantic	Decreasing (IUCN)	At-Risk	Endangered	Endangered	

This table lists the threatened and endangered species that occur in or around the Focus Area including the affected population, population trends, *SARA* Schedule 1 listing status, COSEWIC status, and the current anthropogenic threats they face.
[1]Adapted from Environmental Assessment Update: Eastern Newfoundland Offshore Geophysical, Geochemical, Environmental and Geotechnical Programs 2015-2024, by AMEC, 2018, Prepared for ExxonMobil Canada Ltd. Copyright 2018.
Sources: (COSEWIC, 2002, 2005, 2006b, 2006a, 2007, 2008b, 2010e, 2011c, 2012d, 2013b, 2014a, 2019b, 2019e, 2019a, 2019c, 2020, 2021a, 2021c, 2022a, 2022b; Hammond et al., 2008b)

7.5.1.6 Key Areas and Times

Many of the marine mammals and sea turtles within the Focus Area are seasonal migrants as the region contains important feeding grounds and acts as a thoroughfare between the Atlantic Ocean the GSL with the exception of Harbour Seals (Hamilton et al., 2023) which reside along the south coast of Newfoundland year-round. 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).

Though some baleen whales, toothed whales, dolphins, and porpoises can occur in the Focus Area year-round, summer months (April - August) are when there is the highest likelihood of *mysticete* and *odontocete* presence. 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., 2001b, 2001a; Stewart & Leatherwood, 1985). Sea turtles only occur in the Focus Area during the summer (COSEWIC, 2010e, 2012d). 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. Adult seals can occur year-round, with winter and spring the most abundant months for Harp and Hooded seals due to whelping and summer the most abundant time for Grey Seals (DFO, 2020a; Hamilton et al., 2023; Lesage et al., 2007; Stenson & Kavanagh, 1994).

Important feeding and migration areas for Blue Whales have been identified in St. George's Bay and off the southern coast of Newfoundland which occur in the Focus Area (DFO, 2023i). Important areas have also been identified for Leatherback Sea Turtles near the southeastern GSL and waters off eastern Cape Breton Island, and waters south and east of the Burin Peninsula, Newfoundland 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 (N. Wells et al., 2019).

Five EBSAs have been identified within or near the Focus Area by DFO or by the UNCBD for which the criteria for their identification, evaluation, and selection has included their importance to marine mammals and sea turtles in terms of biodiversity, density and 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 of this Report.

7.5.2 Potential Effects

There are several marine mammal and sea turtle species, including species at risk, that reside in or pass through the Focus Area (see Section 7.5.1 of this Report) that may be impacted by a variety of activities throughout all phases of offshore wind development. These activities are described in Section 4 of this Report. Impacts would predominately include the production of underwater noise and vibration, physical alteration to the environment through the presence of structures, and increased vessel activity. Table 7.5.8 summarizes potential impact pathways and effects during each project phase.

7.5.2.1 Effects of Planned Offshore Wind Activities

Offshore wind development may potentially 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. While some impacts are present throughout every stage of offshore wind development such as marine vessel traffic and operation, other impacts may only occur during specific phases of development (Table 7.5.8).

7.5.2.1.1 Underwater Noise and Vibration

Marine mammals rely on sound for orientation, navigation, communication, recognition, predator avoidance, feeding, mate selection, and offspring-mother bonding (DFO, 2004; LGL Limited, 2010; Lüdeke, 2017; Madsen et al., 2006). Whereas, sea turtles are only known to rely on sound for navigation, foraging, and predator avoidance (Dow Piniak et al., 2012). There is some evidence that nesting sea turtles use low-frequency grunts to communicate on land but the extent of auditory communication among sea turtles is not well studied (Mrosovsky, 1972).

Aquatic species such as marine mammals and sea turtles vary in their hearing frequency ranges and sensitivity to various sound levels and pressures (Cunningham & Reichmuth, 2016; Dow Piniak et al., 2012; Erbe, 2002; NMFS, 2021). These differences as well as proximity to the source, type of activity/equipment, and duration of noise generating activities can result in different responses across species to underwater noise generated by offshore wind development (Cunningham & Reichmuth, 2016; Dow Piniak et al., 2012; Erbe, 2002; NMFS, 2021). Due to the various exposure levels and durations required to impact different species, the physiological effects caused by offshore wind development for both marine mammals and sea turtles 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, 2004; 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., 1995; SEER, 2022).

Auditory injury is often associated with a loss of hearing or hearing sensitivity (noise-induced threshold shift) caused by noise exposure over a significant period of time and sound pressure level (Finneran, 2016). If the NITS is temporary and returns to normal the injury is considered a TTS, but 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 sound. However, widely accepted thresholds based on recent scientific literature exist in other jurisdictions such as 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 estimated auditory range and general hearing threshold levels for marine mammals are detailed in Table 7.5.6. Hearing ranges, auditory injuries, and behavioural responses to underwater noise is not well understood in sea turtles (DFO, 2004; A. N. Popper et al., 2014). However, other species thought to have similar hearing capacity have been used to conservatively estimate the general hearing threshold levels at which sea turtles may die or experience mortal injuries (Table 7.5.7) (DFO, 2004; A. N. Popper et al., 2014). The differences in responses for marine species to sound stimulus across sound types, exposure levels, age, sex, environmental conditions, source proximity, and other factors make guidance thresholds for underwater noise levels difficult to quantitatively define and are more suitable for project-level assessments and therefore not included in Table 7.5.6 or 7.5.7 (Lurton & DeRuiter, 2011; Southall et al., 2007).

The effects and presence of underwater noise throughout offshore wind development varies. Noise associated with marine vessel activity which is likely to occur throughout all phases of offshore wind development 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 7.4.2 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, 2004; Erbe et al., 2019; Weilgart, 2013). 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 (Erbe et al., 2019; Nedwell & Howell, 2004; Nolet, 2017; Richardson et al., 1995). Offshore wind farms can also be serviced by helicopter and, possibly increasingly, by drones which produce noise at the surface and may impact marine mammal and sea turtle species that exhibit surface activities, though the effects are likely to be negligible due to the limited time of exposure (Erbe et al., 2019; Nedwell & Howell, 2004; Nolet, 2017; Richardson et al., 1995).

During the pre-construction phase, site surveys are performed to characterize site conditions and the seafloor (CSA Ocean Sciences Inc., 2021). Systems used for penetrating the seafloor for offshore wind development are lower energy (quieter), generating noise throughout the water column that may have behavioural impacts on some marine mammal and sea turtle species (CSA Ocean Sciences Inc., 2021). When site surveying equipment was used at maximum power the estimated distance to permanent damage to hearing sensitivity (PTS) was 15m for all marine mammal and sea turtle species Responses to site mapping activity can occur at varying distance depending on the method used with some marine mammal species exhibiting behavioural responses up to 500m away and sea turtles observed to have behavioural responses at 2m (CSA Ocean Sciences Inc., 2021). Site survey associated with offshore wind development are not expected to pose a significant risk to the auditory systems of marine mammals or sea turtles due to the generally lower source levels, intermittent short pulse, and direction of some methods (Lurton & DeRuiter, 2011).

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 sound at both high and low frequencies that may cause auditory injury at close range (Kaldellis et al., 2016; Lüdeke, 2017). A description of how foundation types and pile driving methods may affect the level of impact are described in Section 7.4.2 of this Report.

Cetaceans sensitive to higher frequency may be at the greatest risk for behavioural changes, displacement, or noise-related injury because of the high frequencies 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 than 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 temporal and spatial scales (Dow Piniak et al., 2012).

The operation phase generates temporary underwater noise through maintenance activities and the continuous low-amplitude sounds 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 and are not expected to cause direct physical injury (SEER, 2022).

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). Overall, the operation phase of offshore wind development is not expected to have a significant negative effect on marine mammal abundance and distribution as any effects are likely to be small, especially compared 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 sound 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; MMS, 2007).

Decommissioning of offshore wind turbines often requires the removal of turbine structures, scour protection, and cables 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 emissions produced by such activities are anticipated to be similar to those produced during the construction phase of offshore wind development (NRCan, 2021). The noise and sound pressure generated may be significant enough to 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, Brookes, & Thompson, 2014; Maxwell et al., 2022).

Table 7.5.6. Estimated Auditory Bandwidths for Marine Mammals.

Group	Type	Estimated Auditory Bandwidth[1]	Hearing Class	Impulsive Sound (dB SPL_{peak})[2]		Impulsive Sound (dB SEL_{cum})[3]		Non-Impulsive Sound (dB SEL_{cum})[3]	
				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

This table provides estimated auditory bandwidths and hearing frequency classes for a variety of whale, porpoise, dolphin, and pinniped types. 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.

[1]Estimated auditory bandwidths were averaged for groups but individual species within group types may vary.

[2]dB (decibel) SPL_{peak} has a reference value of 1 µPa.

[3]24-hour cumulative sound exposure; dB SELcum has a reference value of 1 µPa2-s underwater and (20 µPa)2-s in air.

Sources: (Bartol et al., 1999; Cunningham & Reichmuth, 2016; DFO, 2004; Dow Piniak et al., 2012; Lenhardt, 2002; Lurton & DeRuiter, 2011; NMFS, 2018, 2021; A. N. Popper et al., 2014; Southall et al., 2007; Zahn et al., 2021)

Table 7.5.7 Estimated Auditory Bandwidths for Sea Turtles.

Group	Type	Estimated Auditory Bandwidth	Hearing Group	Impulsive Sound (dB SPL	Impulsive Sound (dB SEL	Non-Impulsive Sound (dB SEL
				Mortality or Mortal Injury		
Testudines (Turtles)	*Cheloniidae* and *Dermochelyidae* (Sea turtles)	100 Hz – 1000 HZ	High Frequency[2]	210	>207	No quantitative threshold; risk is low for near, intermediate, and far field exposure

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.

[1]Sea turtles may be particularly sensitive to lower frequencies (100 - 700Hz) (Bartol et al., 1999; DFO, 2004; Dow Piniak et al., 2012; Lenhardt, 2002).

[2]Estimated auditory bandwidths were averaged for groups but individual species within group types may vary.

[3]dB (decibel) SPL_{peak} has a reference value of 1 µPa.

[4]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, 2004; Dow Piniak et al., 2012; Lenhardt, 2002; Lurton & DeRuiter, 2011; NMFS, 2018, 2021; A. N. Popper et al., 2014; Southall et al., 2007; Zahn et al., 2021)

7.5.2.1.2 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, 2022). The installation of gravity foundations specifically, often requires dredging of the sea floor in order to level the area which can cause temporary, localized increases in sediment suspension within the water column, increasing turbidity and potentially decreasing species diversity and feeding efficiency for marine mammals and sea turtles (CSA Ocean Sciences Inc., 2021; ICF, 2020; Todd et al., 2015). The benthic disturbance and sediment suspensions can also cause avoidance or temporary attraction behaviours in marine mammals and sea turtles by affecting prey species and disrupting foraging opportunities (CSA Ocean Sciences Inc., 2021; Stantec, 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.

7.5.2.1.3 Presence of Infrastructure

Structures introduce to the marine environment can cause changes in plankton, invertebrate, and fish distributions which may affect the foraging and distribution of some marine mammal and sea turtles (CSA Ocean Sciences Inc., 2021; DFO, 2004; ICF, 2020; National Academies of Sciences, Engineering, and Medicine, 2024). A description of how artificial reefs may form and cause food web and changes in predator distribution and the level of impact from different foundation types are described in Section 7.4.2 of this Report. 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). Such attraction effects are likely beneficial to marine mammals and sea turtles due to the potential increase in biomass and abundance of prey species that would provide improved feeding opportunities (ICF, 2020).

In cases where offshore wind farm projects exclude fishing activities and vessel traffic, shelter effects may 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).

7.5.2.1.4 Entanglement

A description of the entanglement risk posed by offshore wind development to marine species is provided in Section 7.4.2 of this Report. Secondary entanglement poses a significant risk to some of the migratory species at risk in Newfoundland, including the Fin Whale, Harbour Seal, Harbour Porpoises, and Loggerhead Sea Turtle (Maxwell et al., 2022; SEER, 2022).

7.5.2.1.5 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

creating the opportunity for collisions, with high density regions having a higher risk of vessel collisions (NYSERDA, 2017c; SEER, 2022). The type and severity of injuries caused by vessel collisions depends on the size, type, and speed of the collision as well as the species 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 and collisions often result in sharp force trauma, such as propeller injury (Laist et al., 2001; NYSERDA, 2017c; Schoeman et al., 2020; Vanderlaan & Taggart, 2007). However, large vessel may pose less of a risk to marine mammal and sea turtle species that exhibit surface behaviour by being more easily detected and avoided (SEER, 2022). 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, 2022).

7.5.2.1.6 Artificial light

Artificial light from equipment of infrastructure during offshore wind development may attract fish or plankton resulting in new foraging opportunities for marine mammals and sea turtles (Stantec, 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).

7.5.2.1.7 Presence of Electromagnetic fields

A description of where and how EMFs are emitted from offshore wind farms is described in Section 7.4.2 of this Report. Offshore wind cables can emit EMF which can interfere with the essential life functions that requires sea turtles to detect naturally occurring electric/or magnetic fields in the ocean (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, 2022; Stantec, 2022).

7.5.2.1.8 Presence of HDVC

The mechanism of HVDC effects are described in Section 7.4.2 of this Report. Attraction of prey species may affect the foraging behaviours of some marine mammals and sea turtles but the effects from the warm water are likely to be minimal and so would any associated secondary effects (Middleton & Barnhart, 2022).

Table 7.5.8 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). • Temporary changes to communication (e.g., avoidance, habituation, displacement, attraction, disorientation). • Temporary or permanent changes in foraging efficiency. • Temporary or permanent changes in predator avoidance success. • Temporary or permanent psychological changes (increased stress). • Same as for Sonar/Acoustic seafloor mapping and Seismic Surveys • 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.
Visual and spatial disturbance	
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.
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.
Collisions	
All	• Temporary or permanent increased risk of collisions.

Project Phase	Effects
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.

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.
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; Dong Energy et al., 2006; Dow Piniak et al., 2012; Erbe et al., 2019; Gordon et al., 2003; R. 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, Fewtrell, Duncan, Jenner, Jenner, Penrose, Prince, Adhitya, et al., 2000; Middleton & Barnhart, 2022; MMS, 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, 2017a, 2021; O'Hara & Wilcox, 1990; Orr et al., 2013; Przeslawski et al., 2015; Putland et al., 2018; Raoux et al., 2017; Richardson et al., 1995; Ridgway et al., 1969; Russell et al., 2014; Schoeman et al., 2020; SEER, 2022; 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; A. Wright et al., 2007)

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7.5.2.2 Indirect Effects of Planned Offshore Wind Activities

Marine mammals and sea turtles that occur within the Focus Area are culturally, economically, and environmentally 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 results on these groups, species, and activities.

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 concern about the potential impacts to marine mammals and sea turtles on the Regional Assessmentss public registry. 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.

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 Users	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
Sustainability, Climate Change, and other Considerations	Impacts to ecological sustainability through changes in biodiversity, behaviours, distribution, abundance, health, and ecosystem.	10

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)

7.5.3 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 marine mammals and sea turtles (BOEM, 2024; Degraer et al., 2021; MMS, 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, seasonal species distributions and efficient monitoring protocols
Underwater Noise and Vibration	• Plan pre-construction, construction, and decommissioning activities that produce noise efficiently to use the minimum duration necessary. • Plan seismic surveys to use the minimum energy required. • Use foundation types or installation methods that do not require pile driving. • 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. • 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. • Use trained marine mammal or protected species observers to maintain and exclusion buffer zone around pile driving and air source array (500m) 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. • 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. • Pre-fabricate parts onshore when possible to reduce the introduction of noise to the marine environment.

Mitigation Measures	Description
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. • 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 of 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).
Visual and Spatial disturbance	• *Same as for Project Siting* • Repair of 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 at-risk species 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. • Establish vessel exclusion zones or areas of avoidance. • Use trained marine mammal or protected species observers to monitor or marine mammal observers. • 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. • Conduct Aerial surveys to monitor marine mammal and sea turtle species. • 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.

Mitigation Measures	Description
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 birds.
Subsea Power Cables and Emf Emissions	• Bury cables to a depth of 1.5 to 2 m to mitigate impacts of the strongest magnetic and induced electrical fields by employing sediment as a physical barrier to sensitive species. • Selecting 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 additional protective layer around cables installed on top of the seafloor.

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.

Sources: (Bennun et al., 2021; BOEM, 2022; Brandt et al., 2013; Castellote et al., 2008, 2012; CMACS, 2003; CSA Ocean Sciences Inc., 2021; DFO, 2004, 2008b; Lüdeke, 2017; Maxwell et al., 2022; Nehls et al., 2015; NOAA, 2008, p. 2008; Nowacek et al., 2004; NYSERDA, 2017c, 2017a, 2021; OSPAR Commission, 2012; SEER, 2022; Stantec, 2022; Svendsen et al., 2022; Verfuss et al., 2015, 2019; A. J. Wright et al., 2007)

7.5.4 Engagement Outcomes

Most participants expressed general concerns about how offshore wind development will affect marine species and a need for more longitudinal 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 whereabouts 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 consultation. 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. One participant voiced their concerns about offshore wind 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, 2024 March 14).

Some Indigenous groups and public participants have expressed their concern 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.

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 indicated they are concerned for the impact of offshore wind 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 Madness, Humback whales feeding on Capelin near Stephenville, Vlog#3 Whale Watching on Newfoundland’s scenic west coast and more).

7.5.5 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 phases and activities are also poorly understood due to their complexity.

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 distributions.

Limitations such as these are the cause of the existing data gaps and limitations in regard to a variety of marine species within the Focus Area. Detailed descriptions of data and knowledge gaps are described in the relevant sections below.

7.5.5.1.1 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 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 off 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 found in the Focus Area except for the North Atlantic Right Whale, Common Bottlenose Dolphins, Striped Dolphins, Beluga Whales, and Cuvier’s Beaked Whale.

7.5.5.1.2 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.

7.5.5.1.3 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. Sightings data also come from systematic surveys using aerial and vessel platforms which 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.

7.5.5.1.4 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 (A. J. 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 focuses primarily on structures that require pile driving; additional research on the underwater noise generated by non-pile foundations is required.

7.5.5.1.5 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 areas and improve monitoring efforts. Existing data on vessel collisions favours 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 collective quantitative movement and behavioural data (Copping & Hemery, 2020; Fowler et al., 2020; Hemery et al., 2024).

7.5.5.1.6 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. 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.

7.5.5.1.7 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).

7.5.5.1.8 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.

7.5.6 Committee Conclusions and Recommendations

The ocean waters around Newfoundland and Labrador are changing rapidly as are some of the historical marine communities (DFO, 2023). As an outcome of preparing the Regional Assessment, several recommendations to address data and information important to considering offshore wind energy development are made:

- A program of surveys in the Focus Area initiated by DFO 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; autonomous underwater vehicles.
- Research and survey effort should include identification of migratory routes and/or important areas for all species at risk, marine mammals, and sea turtles.
- Project specific environmental impact assessments should be based on a minimum of 2 years of site-specific surveys as part of a long-term monitoring and research program.
- The Committee suggests ongoing monitoring by NRCan and the Department of Industry, Energy, and Technology for Newfoundland and Labrador 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 entanglement related to other turbine and offshore wind structures should also be conducted.

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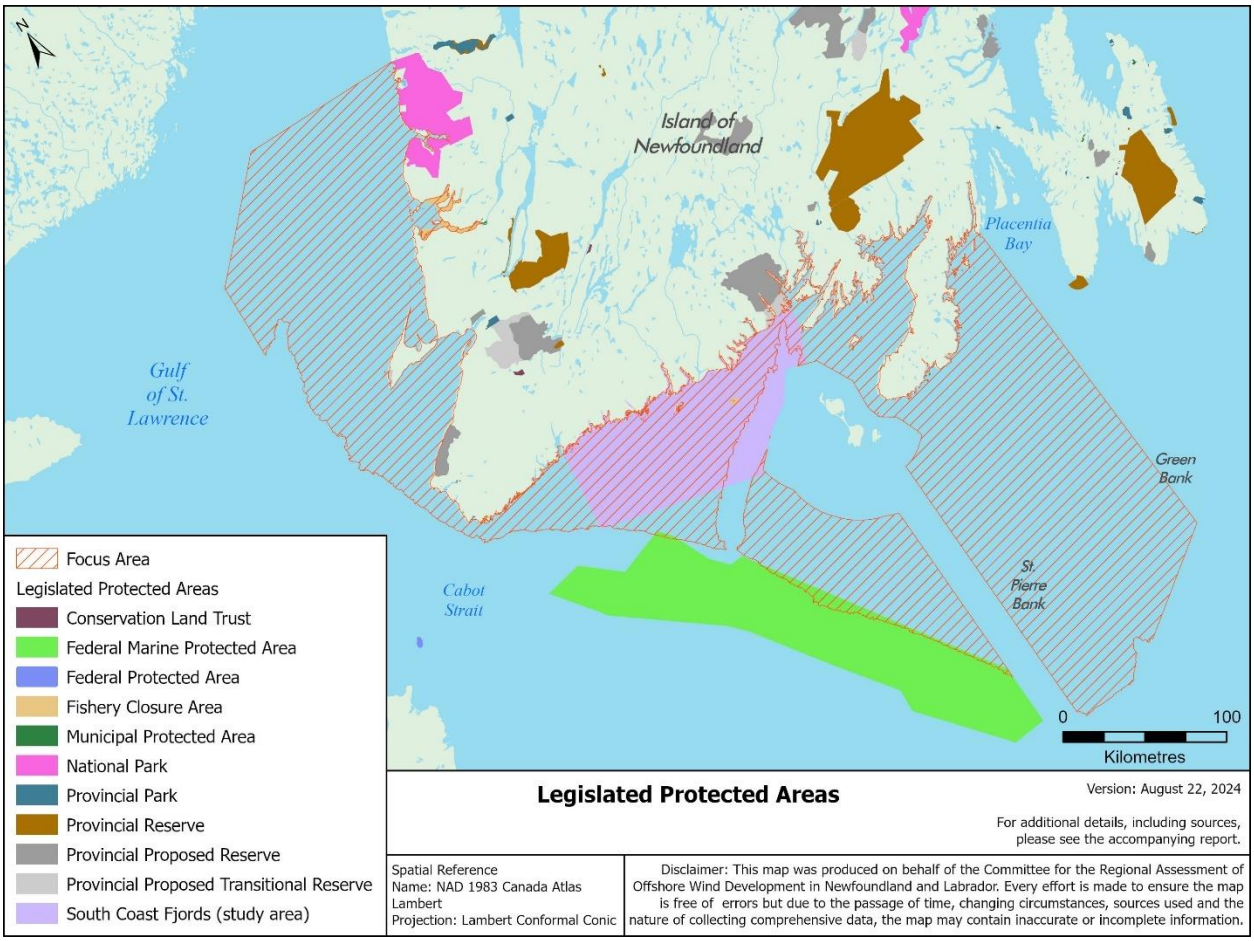
7.6 Protected and Special Areas

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



Map depicts protected areas under Federal and Provincial legislation that will be further discussed in subsequent sections.
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: (DFO, 2024a).
Fishery Closure Area: (DFO, 2023a) 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 below.

Table 7.6.1: Federal Legislation and Associated Special Areas

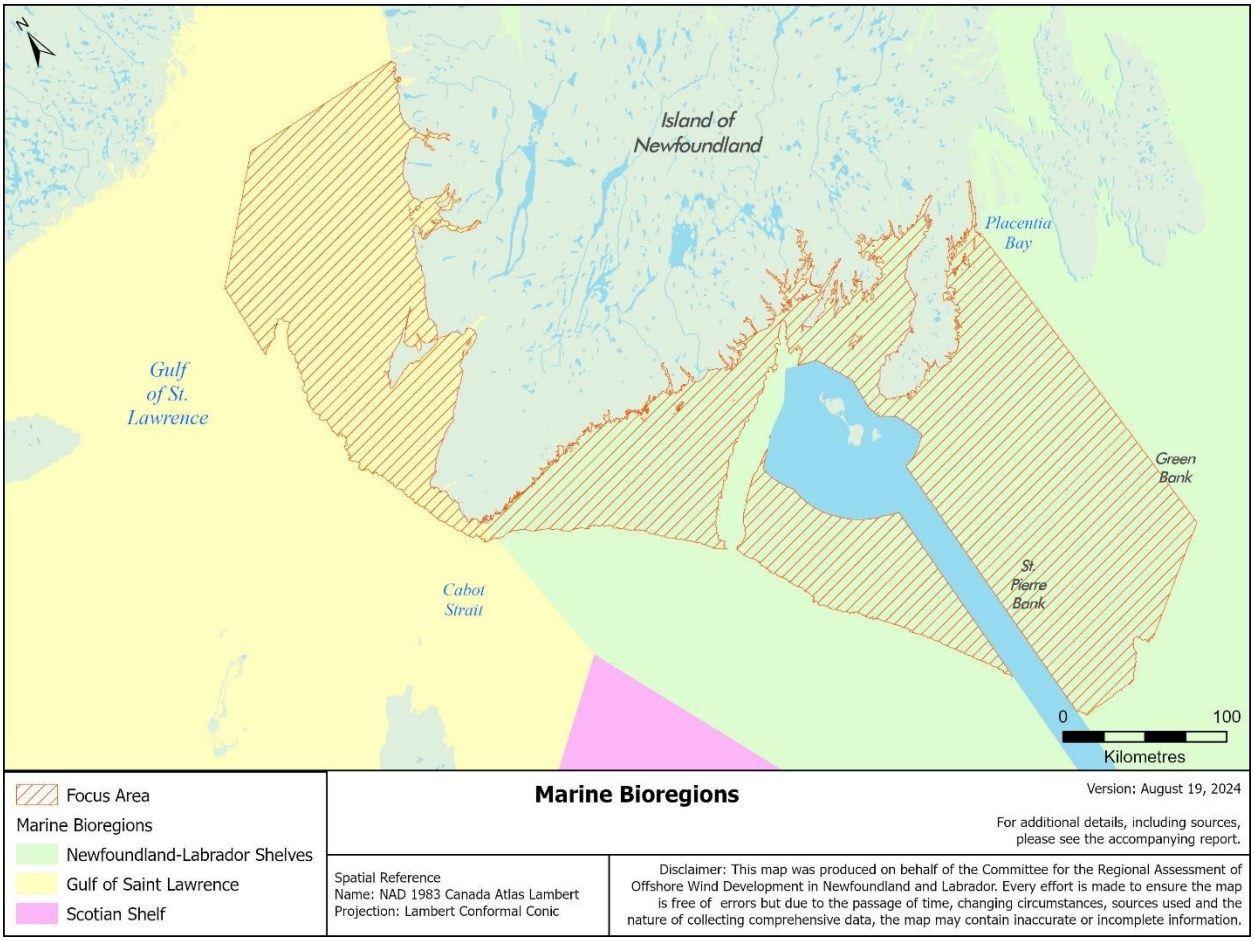
Legislation	Type of Special Area	Lead Department or Agency	Purpose
Oceans Act, 1996, c.31	MPAs	DFO	To conserve and protect fish, marine mammals, and their habitats; unique areas; areas of high productivity or biological diversity; maintaining ecological integrity of marine areas.
Fisheries Act, 1985, 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., 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.

Table outlining federal protective legislation and the types of protected areas they support (ECCC, 2017).

7.6.1.2 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.

Figure 7.6.2. Bioregions within the Focus Area



Map depicting bioregions that fall within the Focus Area, including the Newfoundland-Labrador Shelves and Gulf of St. Lawrence regions.
Source: (NRCan, 2024)

7.6.1.3 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, 2004). 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 (Templeman, 2007; DFO, 2013; DFO, 2019a):

- 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, 2004).

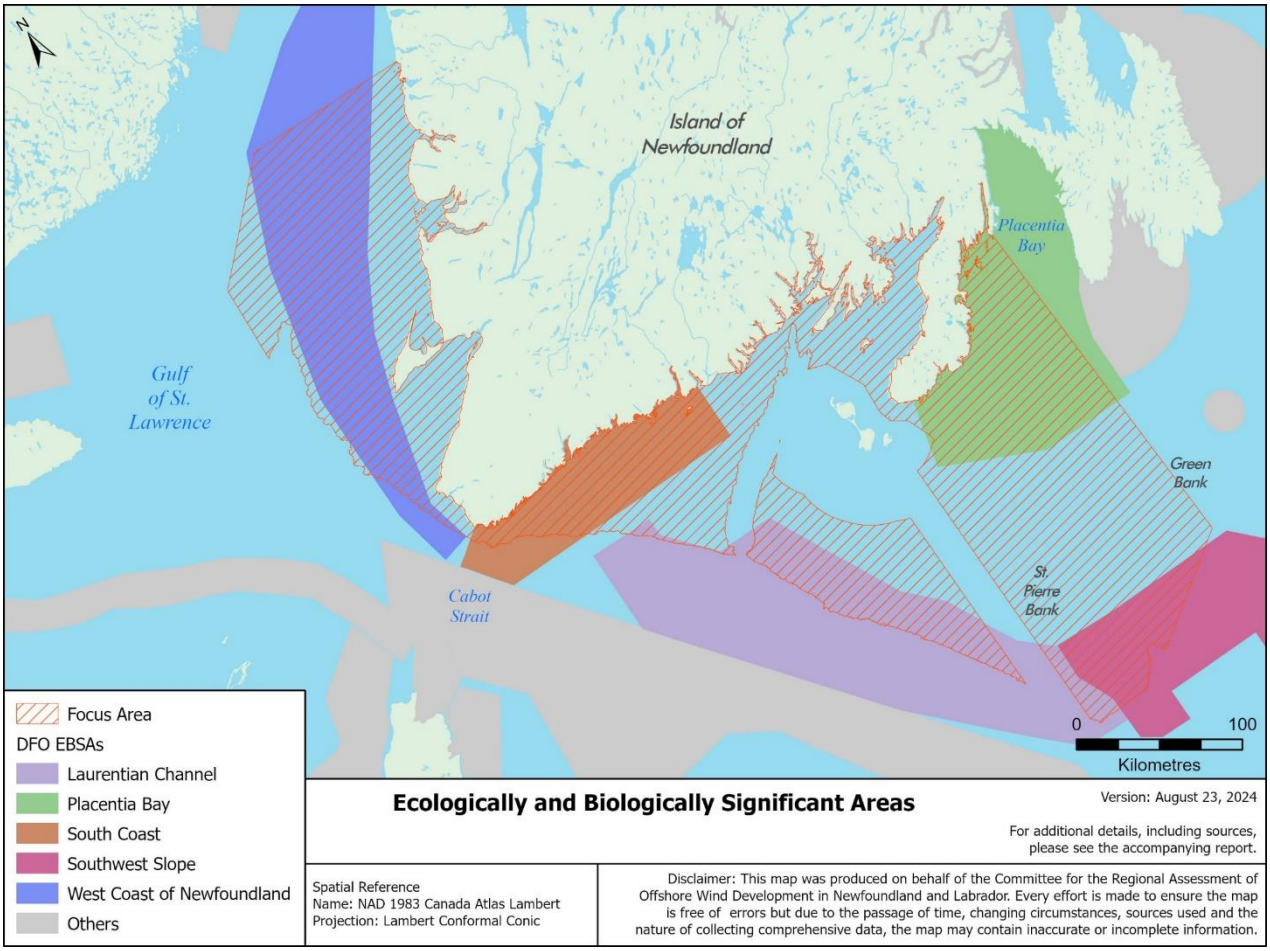
To date, 29 EBSAs have been identified within the NLS Bioregion area through multiple processes (Templeman, 2007; Wells et al., 2017; DFO, 2019a) and 10 EBSAs have been identified within the Estuary and GSL bioregions (DFO, 2007). These EBSAs have undergone further study and refinement since their initial identification, and their boundaries have been adjusted based on new data and analysis (DFO, 2016; Wells et al., 2017; DFO 2019a). 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, small and large gorgonian corals, stony cup corals and sea pens.

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 (DFO, 2009 & DFO, 2019a).

Figure 7.6.3. Ecologically and Biologically Significant Areas within the Focus Area



Map depicting EBSAs within the Focus Area. These include Laurentian Channel, Placentia Bay, South Coast, Southwest Slope and West Coast of Newfoundland.
Source: (DFO, 2021).

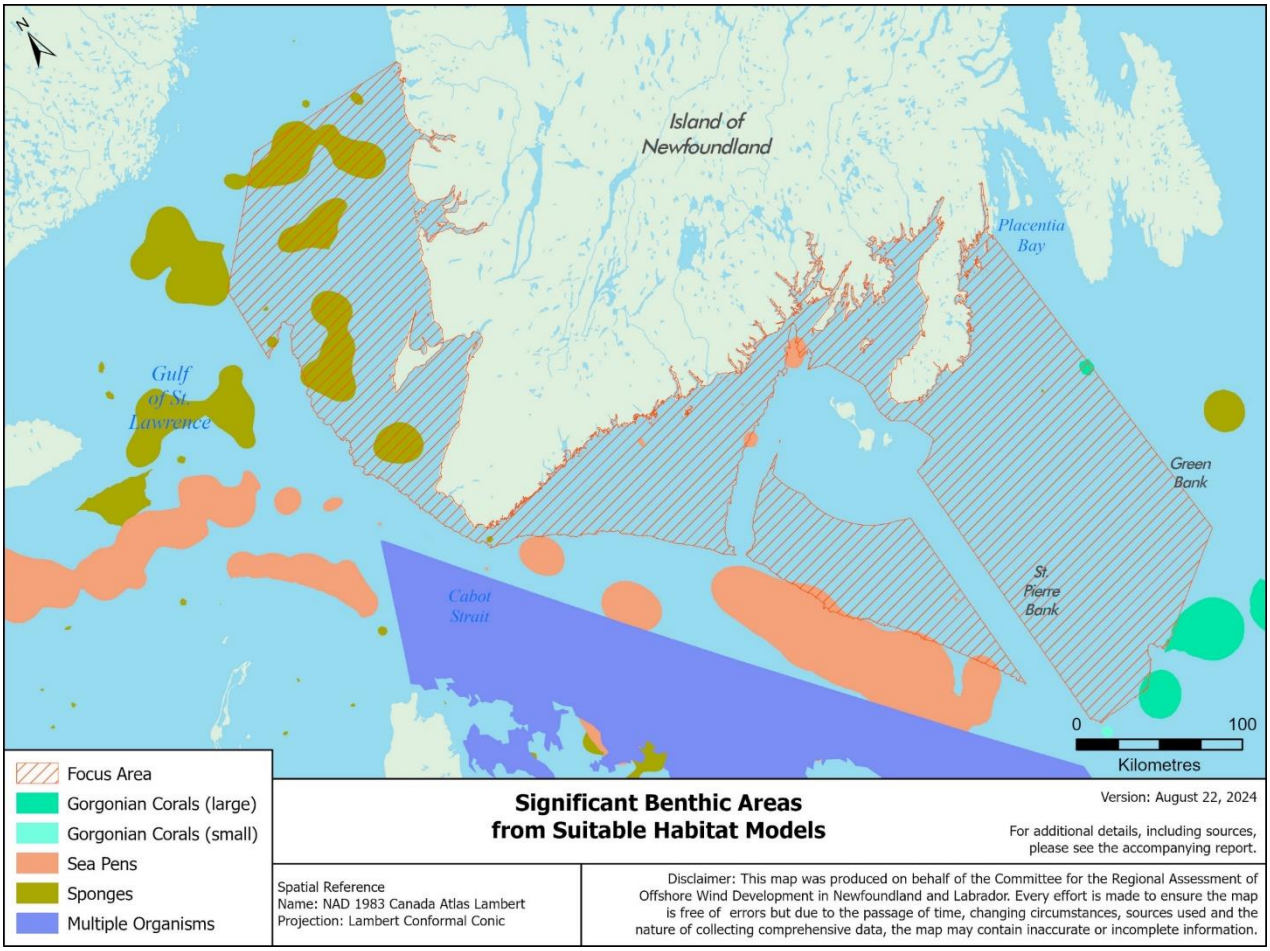
7.6.1.4 Significant Benthic Areas

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 SiBAs.

SiBAs 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, 2017a). 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 SiBA types among cold-water corals and sponges based on the dominant taxa, namely SiBAs for sponges, sea pens, large gorgonian and small gorgonian corals (DFO, 2017b). These areas do not carry legal protection and there are no regulated prohibitions or restrictions of activities within them. The SiBAs 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



Map showing SiBAs within the Focus Area. These include areas inhabited by large and small Gorgonian Corals, Sea Pens and Sponges.
Source: (DFO, 2024b)

7.6.1.5 Marine Protected Areas and Areas of Interest

The creation and establishment of MPAs in Canada is facilitated through the federal *Oceans Act*, 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 consultation 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, 2023b). 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, 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, 2019b).

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 disturbs, damages, destroys or removes (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*;

Name of MPA	Area within or adjacent to Focus Area	Prohibited Activities	Exceptions
			• 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 describing the Laurentian Channel MPA, along with its prohibited activities and exceptions (DFO, 2019b).

7.6.1.6 Marine Refuges and Fisheries Closure Areas

The identification of Marine Refuges is another mechanism that the Government of Canada, through DFO and the *Fisheries Act*, 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 our oceans by 2025 and 30% by 2030, as highlighted in the Fifth International Marine Protected Areas Congress (DFO, 2023c). Marine Refuges are considered by DFO as "Other Effective Area Based Conservation Measures", which are complementary to MPAs to help further protect coastal and marine areas. The process for determining these areas uses five broad criteria (DFO, 2017c):

1. Providing a clearly defined geographic location;
2. Conservation or Stock Management Objectives: The measure must have a conservation or stock management objective, and the objective must reference at least one species of regional importance or a habitat that is important to biodiversity conservation;
3. Presence of Ecological Components of Interest: The measure must contain at least two ecological components of interest: a habitat that is important to biodiversity conservation and a species of regional importance that uses the habitat;
4. Long-term Duration of Implementation: The measure must either be entrenched via legislation, or provide clear evidence that the measure is intended for long-term use (minimum of 25 years); and
5. The Ecological Components of Interest are Effectively Conserved: No human activities that are incompatible with conservation of the ecological components of interest (the species and habitat(s)

identified through criterion #2 and #3) may occur or be foreseeable within the defined geographic location.

Once these areas are selected, they are implemented using management measures under the *Fisheries Act*, 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, 2023c). 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, 2017c). 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

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 (DFO, 2023c).

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*) 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* 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, 2015).

7.6.1.7 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. 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, 2023a).

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, 2023a).

Currently, there is no designated NMCA within Newfoundland and Labrador waters; however, Parks Canada, along with the Province, 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 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, 2023b). 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, 2023a). 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.

7.6.1.8 National Wildlife Areas, Marine Wildlife Areas, and Migratory Bird Sanctuaries

NWAs and Marine National Wildlife Areas (MNWAs) are established and maintained by ECCC under the *Canada Wildlife Act*. 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* and regulated under the *Migratory Bird Sanctuary Regulations*, 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 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 (Environment Canada, 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.

7.6.1.9 National Parks and Historic Sites

National Parks are established and managed by Parks Canada through the *National Parks Act 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,* 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.

7.6.1.10 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 (Department of Environment and Climate Change, 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	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	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	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 describing different provincial legislations for protected areas (Parks NL, n.d.a, Department of Environment and Climate Change, n.d.b, Department of Fisheries, Forestry and Agriculture, n.d.a & Department of Fisheries, Forestry and Agriculture,

7.6.1.10.1 Wilderness and Ecological Reserves

Wilderness and ecological reserves are established in Newfoundland and Labrador through the WER Act, 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 (Department of Environment and Climate Change, n.d.b). 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 if 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 consultation.
- 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 guillemot, 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 100m and 20m of the cliffs, respectively, containing nesting birds during breeding season (April 1 – October 30).

Title of Ecological Wilderness Reserve	Area within or adjacent to Focus Area	Key Features	Rules of the Reserve
Lawn Bay Ecological Reserve	3.846 km² (3.707 km² 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). • Established as a provisional reserve in 2009, gained full ecological reserve status in 2015.	• 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 100m of the islands during the breeding season (March 15 – October 30). No distance restrictions during the rest of the year. • Tankers or other vessels longer than 20m 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 300m, take off or land within the reserve from April 1 – October 30.

Title of Ecological Wilderness Reserve	Area within or adjacent to Focus Area	Key Features	Rules of the Reserve
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.

Title of Ecological Wilderness Reserve	Area within or adjacent to Focus Area	Key Features	Rules of the Reserve
Bay du Nord Wilderness Reserve	2,895 km²	• Contains the largest protected river system in Newfoundland and Labrador. • 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 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 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 600m, except during take-off and landing. • Dogs and horses are permitted as long as they are under control at all times.

Table describing ecological and wilderness reserves within and adjacent to the Focus Area (Department of Environment and Climate Change, n.d.c).

7.6.1.10.2 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* 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 • Hunting

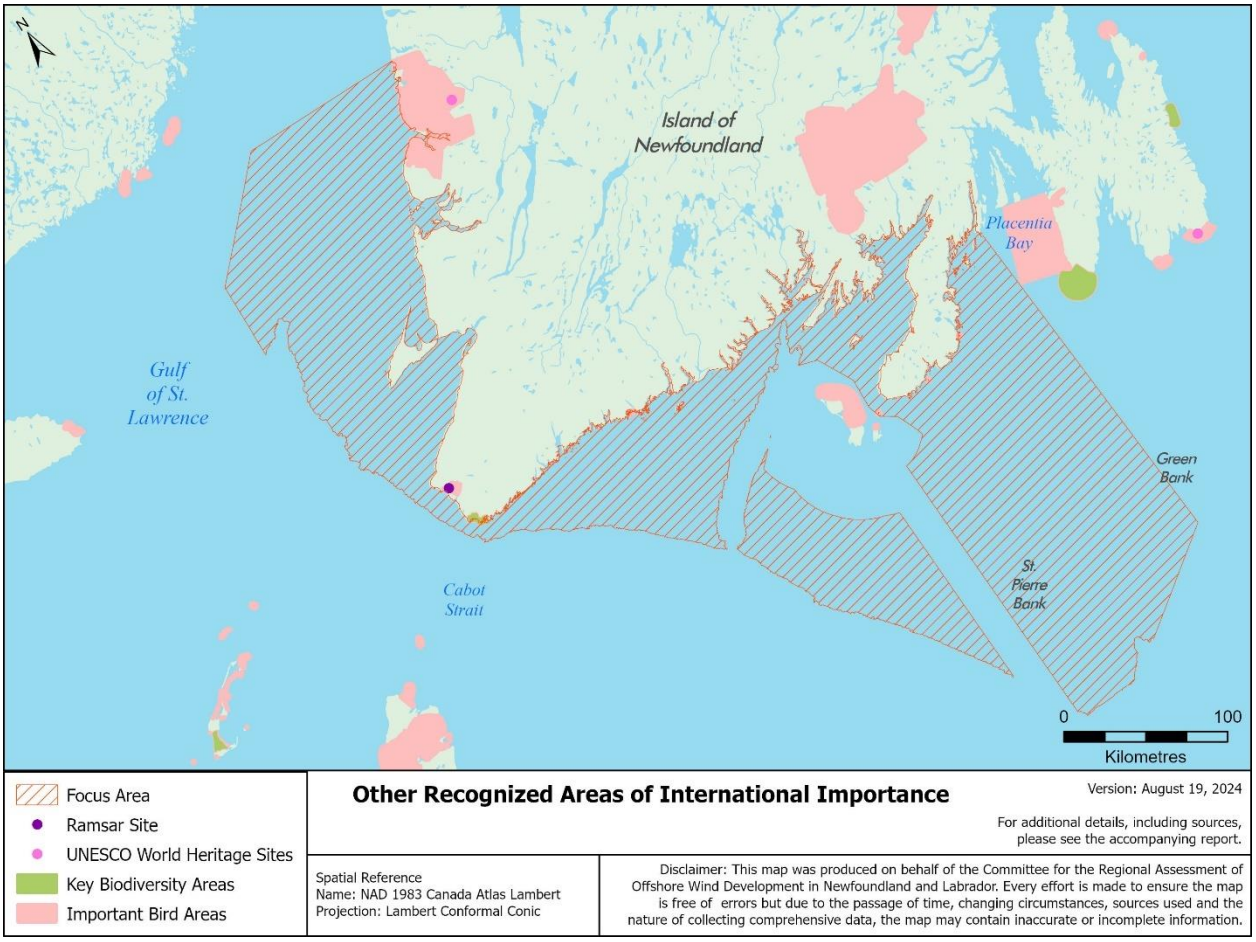
Title of Provincial Parks	Area within or adjacent to Focus Area	Prohibited Activities
		• Off-road vehicles • Snowmobiles
Sandbanks Provincial Park (Camping)	2.26 km²	• Introducing and/or removing any natural items • Cutting trees • Hunting • Off-road vehicles • Snowmobiles
Frenchman's Cove (Camping)	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 summarizing provincial parks and their prohibited activities that are adjacent to the Focus Area (Government of Newfoundland and Labrador, 2024; Parks NL, n.d.b).

7.6.1.11 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



Map depicting areas of international importance, including IBAs, KBAs, UNESCO WHS and Ramsar Sites.
Source:
Ramsar Site: (Ramsar Convention, 2001).

UNESCO World Heritage Site: (UNESCO, n.d.).

KBAs: (Key Biodiversity Areas, n.d.).

IBAs: (IBA Canada, n.d.d.).

7.6.1.11.1 Important Bird Areas

The 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).

There are thirteen IBAs within or 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, and details of these IBAs are listed in the table below:

Table 7.6.8. Important Bird Areas located within or adjacent to the Focus Area

Title of IBA	Areawithin or adjacent to the Focus Area	IBA Criteria	Conservation Status	Species
Cape St. Mary's (NF001)	329.39 kms^2	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 • Razorbill
Bay du Nord Wilderness Reserve and Middle Ridge Wildlife Reserve (NF018)	3,804.04 kms^2	Nationally Significant: Restricted Range Species	Wildlife Reserve	• Rock Ptarmigan • Willow Ptamigan • Canada Goose • Amercian Black Duck • Green-winged Teal • Common Goldeneye • Common Merganser • Harlequin Duck
Placentia Bay (NF028)	1,398.05 kms^2	Globally Significant: Congregatory Species	N/A	• Dovekie • Manx Sherwater • Red Crossbill

Title of IBA	Areawithin or adjacent to the Focus Area	IBA Criteria	Conservation Status	Species
Corbin Island (NF030)	4.17 kms^2	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 kms^2	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 • Black Guillemot
Green Island (NF032)	5.61 kms^2	Globally Significant: Congregatory Species, Colonial Waterbird/Seabird Concentrations	IBA Conservation Plan written/being written, MBS (federal)	• Leach's Storm Petrel • Herring Gulls • Common Terns • Arctic Terns • Black Guillemots • Manx Shearwaters
Miquelon Island (Northeast Coast) (NF034)	346.76 kms^2	Globally Significant: Congregatory Species	IBA Conservation Plan written/being written	• Piping Plover • Red-necked Grebe

Title of IBA	Areawithin or adjacent to the Focus Area	IBA Criteria	Conservation Status	Species
Grand Colombier Island (NF036)	7.19 kms^2	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 kms^2	Nationally Significant: Threatened Species	Ecological Reserve (provincial)	• Piping Plover •
Grand Bay West to Cheeseman Provincial Park (NF038)	40.33 kms^2	Nationally Significant: Threatened Species	Provincial Park (including Marine)	• Black-headed Gull • Piping Plover
Codroy Valley (NF040)	35.46 kms^2	Nationally Significant: Restricted Range Species	N/A	• Piping Plover • Red Crossbill • Ovenbird • Red-throated Hummingbird • Gray Catbird • Red-eyed Vireo • Rose-breasted Grosbeak • Bobolink

Title of IBA	Areawithin or adjacent to the Focus Area	IBA Criteria	Conservation Status	Species
				• Warbler species (Magnolia, Black-throated Green, Bay-breasted, Cape May and Blackburnian)
Codroy Valley Estuary (NF041)	13.56 kms^2	Continentally Significant: Congregatory Species	N/A	• Piping Plover • Canada Goose • Wood Duck • Green-winged Teal • American Black Duck • Northern Pintail • Gadwall • Lesser and Greater scaup • Common and Red-breasted merganser • Eurasian Wigeon Duck • Tufted Duck • Northern Shoveler • American Qigeon • Blue-winged Teal
GMNP (NF045)	1,865.12 kms^2	Nationally Significant: Restricted Range Species	National Park	• Black-headed Gull • Dovekie • Great Black-backed Gull • Iceland Gull

Title of IBA	Areawithin or adjacent to the Focus Area	IBA Criteria	Conservation Status	Species
				• Piping Plover • Rock Ptarmigan • Red Crossbill • Ovenbird • Harlequin Ducks

Table of IBAs within or adjacent to the Focus Area (IBA Canada, n.d.d).

7.6.1.11.2 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).

7.6.1.11.3 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, 2018). 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.

7.6.1.11.4 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.

7.6.1.11.5 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 (WBRs) currently counts 701 sites in 124 countries all over the world. Canada has 19 WBRs located in British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick and Nova Scotia (UNESCO, 2021). With no WBRs within the province, there are none located within the Focus Area.

7.6.1.12 Indigenous Protected and Conserved Area

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. This area can be seen in Figure 5 of MFN's Comments on the Interim Report.[57]

7.6.2 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.

[57] A link to the Registry post was not available in time for inclusion in this Report, but it should be uploaded to the Registry in the near future.

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 bats 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. • vation at risk for these areas. • The impact for floating offshore wind developments are 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.

Project Phase	Impact Pathways	Description of Effects
		• 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.
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 describing the potential effects of offshore wind 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 MSP Platform, n.d.; Fari et al., 2021; Gusatu et al., 2021; Lloret et al., 2023)

7.6.3 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 principle, 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 Principle	• Micro siting of turbines could help mitigate impacts on specific marine habitats. Considerations of the benthic environment and other offshore wind 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 is to locate them away from vulnerable habitats and species in the first place. • The precautionary principle should guide offshore wind development, particularly near protected areas, due to limited knowledge about the impact of offshore wind 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. • To promote sustainable use of the sea, marine spatial planning that optimizes the location of offshore wind 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 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, 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 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 outlining mitigation measures in relation to protected areas.
Sources: (Bennun et al., 2021; European MSP Platform, n.d.; Greenhill et al, 2021; Lloret et al., 2023; Spiropoulou et al., 2014)

7.6.4 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 their 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 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 consultation 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 for offshore wind due to the depths ranging from 300-1000m. On EBSAs and SiBAs, 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. [58] Within this letter and a letter from QFN posted to the Registry Comment page 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.

[58] A link to the Registry post was not available in time for inclusion in this Report, but it should be uploaded to the Registry in the near future.

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 (Parks Canada, 2023d).

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, 2023d) 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, 2023e). In regard to provincially protected areas, the Government of Newfoundland and Labrador (2024) 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 Southeast Avalon Conservation Planning Initiative and Southern Slope Area Marine Refuge, which are both under consideration.

7.6.5 Data Gaps and Limitations

Addressing data gaps related to offshore wind 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 is an overall newer industry across the world, there is insufficient long-term monitoring data on the cumulative and extended effects of offshore wind 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, 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.

7.6.6 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 that application of additional buffers to MPAs be considered during project-level impact assessments.
- The Committee recommends offshore wind project proponents undertaking project level impact assessments consider, in consultation with DFO, setback distances from areas important for the various species on which MPA 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 prior to issuing call for bids, in consultation with the applicable regulators.
- The Committee recommends that project-level impact assessments identify SiBAs overlapping a proposed project and ensure the least amount of disturbance to those areas as possible.
- The Committee recommends that developers consult with respective departments 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.

7.6.7 References

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7.7 Fisheries

7.7.1 Existing Conditions

Newfoundland and Labrador has a strong historic connection to the ocean through its fisheries which led to its settlement and the geographic distribution of its population along the coastline. Historically the fishery was based primarily upon groundfish such as the iconic codfish. Since the collapse of groundfish stocks in the early 1990's, as well as other valuable commercial species decline of the redfish, haddock, American plaice, capelin and other species, the fishery has been transformed into a shellfish industry based primarily on snow crab with other species such as shrimp and lobster having regional economic importance (Rose, 2003). These activities are an important component of the Newfoundland and Labrador economy, especially in rural coastal, Indigenous and non-Indigenous communities, and to the overall social and cultural fabric of the province. In recognition of the historical, and socio-cultural importance of fisheries, 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). These jobs and income to local communities from this sector help contribute to the overall economic health and success of coastal communities in the province, and spinoff benefits to sectors that support the industry (e.g., ship repair, tourism, support and service, etc.). In addition to commercial fishing activities from vessels based in Newfoundland and Labrador, there is a limited fishery by commercial harvesters from other parts of Atlantic Canada and Quebec as they also fish within or near the Focus Area.

The following sections are designed to provide an overview of the historical and existing regional conditions for commercial and recreational fish harvesting activities within the Focus Area. Additional information and details on these fisheries can be found in information sources that are referenced within this section.

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. MFN's commercial fishery is a Commercial Communal Fishery under the *Fisheries Act*. 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. MFN owns Netukulimk Fisheries Limited (NFL), which operated 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.[59]

7.7.1.1 Key Sources of Data and Limitations

Sources of data within this chapter include the existing publicly available fisheries information provided by DFO. This includes information on fishing licences within the region, as well as fishing density throughout the region based on species and gear type.

Commercial fishing harvesting spatial data is available publicly through the Government of Canada's Open Government Portal, and can be publicly access 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).

Commercial harvesting locations between 2012 and 2021 for a number of species and gear types are provided based on summaries of total landings by weight (kg) within that timeframe within 10 km^2 grid cells. Landings within this data include georeferenced data from vessels greater than 35 ft and does not include international fishing vessels, which means that there may be landings locations from other vessels that are not captured completely within this dataset. 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 screened out to protect the commercial privacy and sensitivities of those fishers. Therefore, some species landings may or may not be captured in this dataset, but it does not mean that fishing for those species does not occur. Despite these limitations, this dataset can help provide a general regional overview of fishing intensity and trends for species and gear types within the Focus Area. Since it is understood that fisheries taking place within the Focus Area heavily rely on small fishing vessels, less than 35 feet in length, their specific positional fishing information is largely unavailable, aside from NAFO Unit Area fished. Therefore, to ensure these fisheries are as accurately captured as possible, Small Vessel Fishing Activity data is incorporated within each species breakdown, as appropriate (DFO, 2023a).

This section uses information provided by DFO in response to Committee requests for information and advice, as well as publicly available information from DFO, such as fisheries management decisions for various commercial fisheries, and scientific stock assessments to understand the current health of commercial fish species within offshore Newfoundland waters. Other sources of information include reports published by the provincial Department of Fisheries, Forestry and Agriculture, and other fisheries studies from non-government organizations Additionally, outcomes from engagement with fishers, particularly through the Fisheries Advisory Group, has provided information that has

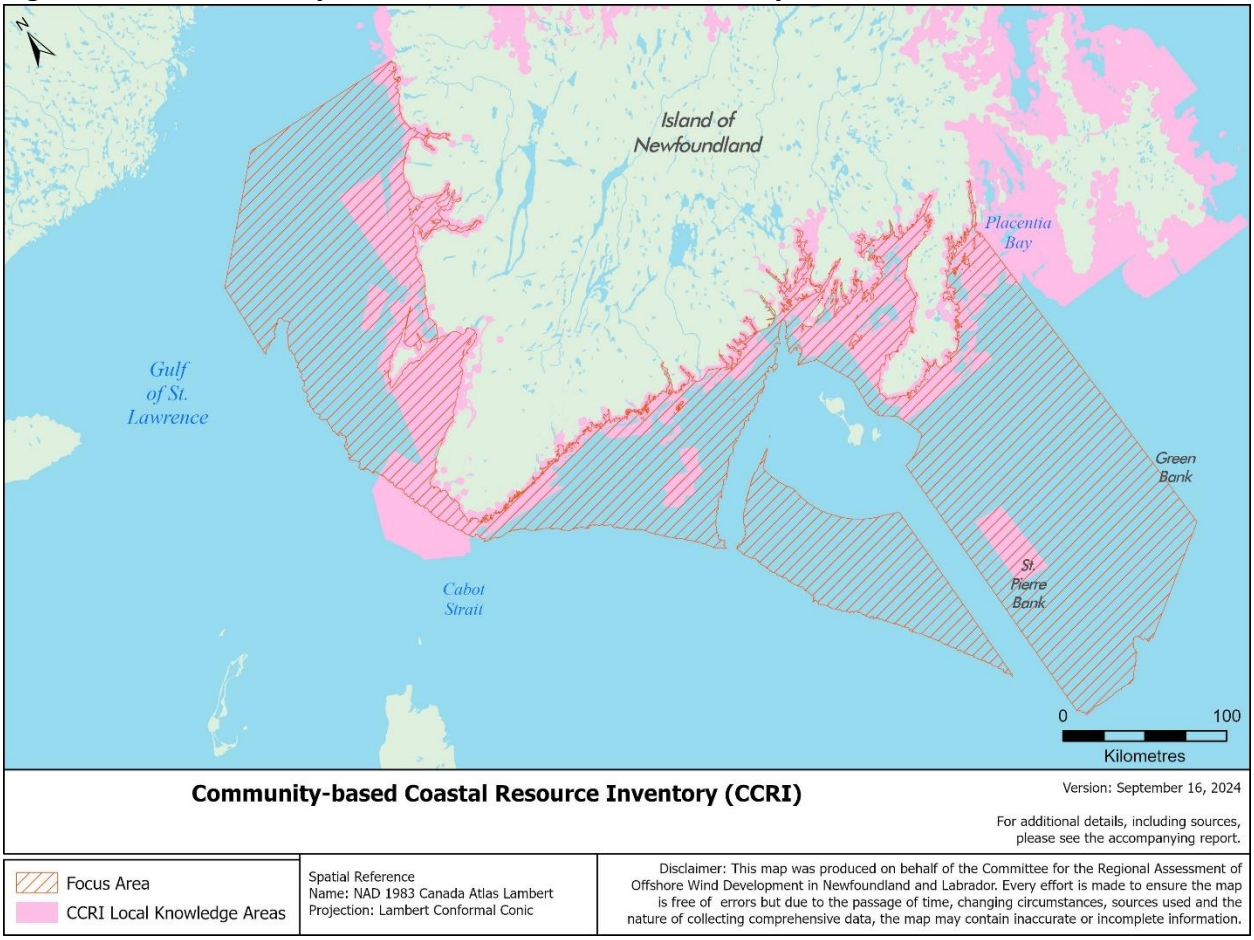
[59] A link to the Registry post was not available in time for inclusion in this Report, but it should be uploaded to the Registry in the near future.

contributed to understanding fishing activity within the Focus Area. This feedback and advice from fishers has been incorporated throughout this section.

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 had also heard concerns through their engagement that fisheries that are not currently existing in areas will rebound over time and that it is difficult to place an industry in a location that may not currently have a fishery, when a fishery could exist in that location in the future. Therefore, if fisheries are not mentioned below, it is not that they are not important or do not exist, it is a summary of what has been provided to the Committee to date.

Another data source that the Committee has considered is the CCRI. From 1996 to 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. This 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 7.7.1.

Figure 7.7.1. Community-based Coastal Resource Inventory



Map depicting CCRI local knowledge data which includes, but not limited to, fisheries, tourism, etc. Source: (DFO, 2024a)

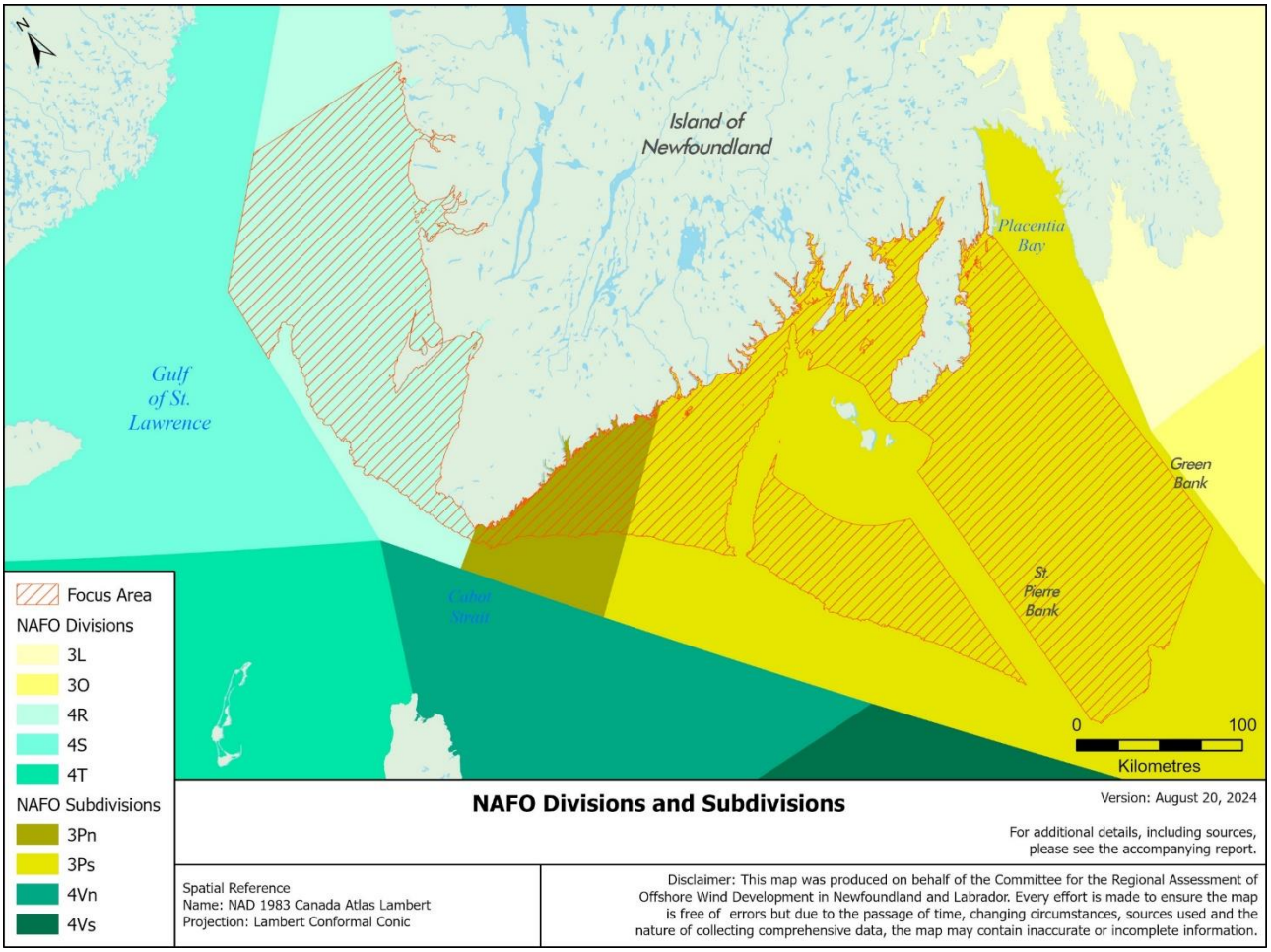
7.7.1.2 Fisheries Jurisdiction and Management Regimes

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*, which provides Canada (via DFO) jurisdiction over fish species within Canadian waters, as well as 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 NL 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, 2023b). The NAFO Divisions in relation to the Focus Area can be seen in Figure 7.7.2 below:

Figure 7.7.2. NAFO Divisions within the Focus Area



Map depicting NAFO Divisions (3Ps, 3Pn & 4R) within the Focus Area.
Source: (DFO, 2021a)

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). The current Regional Assessment Focus Area includes, either wholly or partially, the following NAFO Divisions: 4R, 3Pn, and 3Ps.

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.

7.7.1.3 Commercial Fisheries

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 of $39 million in value for just over 21,000 tonnes of catch, from 2012-2021, while the non-georeferenced portion of the commercial fishery is $43 million (DFO, 2023a).

As mentioned above, the industry provided over 17,000 jobs in 2022 to the province (Government of Newfoundland and Labrador, 2023), which are the backbone of many rural communities that rely on the fishing industry as a main source of direct and indirect economic stimulus. This includes communities along the entire coastline of the province which not only harvest, but also process to prepare for either domestic consumption or export to other provinces or countries. 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.

The main fisheries within Newfoundland and Labrador include those for shellfish, groundfish, and pelagic species. Between these three categories, most of the commercial fish harvesting takes place. This includes the number of licences within the region. Tables 7.7.1 & 7.7.2 below provide an overview of the number of licences and vessels within the region for 2022 (the most recent year publicly available), and the species that occupy them. Lobster licences comprise the largest number of licences for a single species, owing to the commercial importance of the species. Other notable species include herring and mackerel, and groundfish. While shrimp and crab seemingly have lower licence numbers than other species, their value makes them an important fishery within the region. Table 7.7.3 provides an overview of vessels that were operating in the province within 2022.

Table 7.7.1. Commercial Licences within the DFO NL Region, 2022

Province and Region	Core/ Independent Core	Non-Core	Other	Total
Newfoundland and Labrador	2,683	410	13	3,196

Table outlining number of licence types within the province of Newfoundland and Labrador, as of 2022 (DFO, 2023c).

Table 7.7.2. Commercial Licences within DFO NL 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 listing number of licences in Newfoundland and Labrador by species (DFO, 2023d).

Table 7.7.3 Number of Vessels by length (feet) in Newfoundland and Labrador, 2022

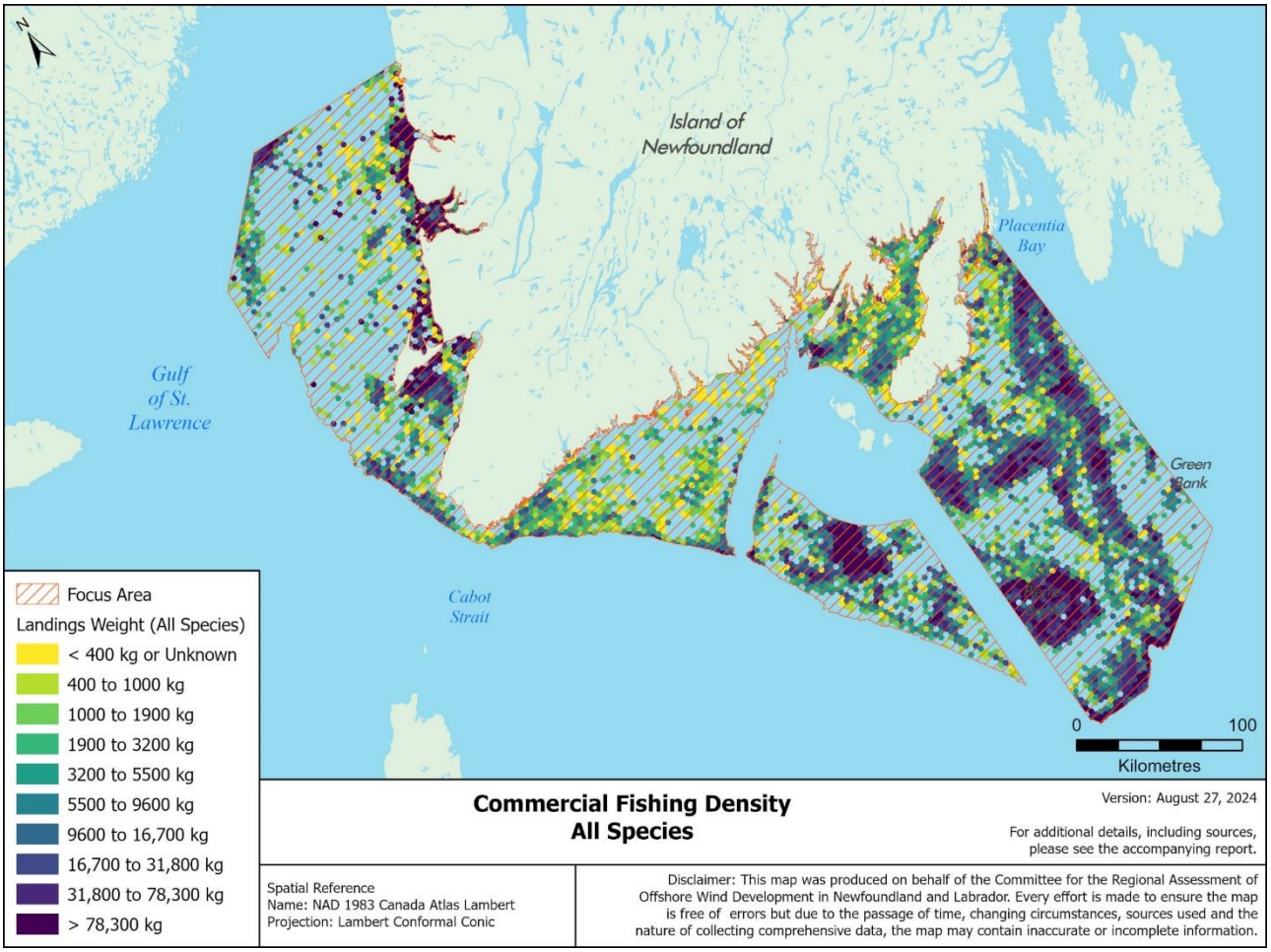
< 35’	35’-44’11”	45’-64’11”	65’-99’11”	>100’	Total
4,604	705	341	30	11	5,691

Table listing number of vessels by size within the Newfoundland and Labrador region in 2022 (DFO, 2023e).

In terms of locations of fishing activity, Figure 7.7.2 provides and overview of fish landings activity from 2012 to 2021 for all recorded species offshore. As mentioned previously, this data is meant to provide a general indication of fishing activity within the Focus Area. As noted, 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 Study 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. It should also be noted that this is representative of catch weights, which could potentially skew the visual representation of fishing activity, as visually higher density areas could have higher overall catch rates due to the species fished in that area (DFO, 2024d).

This large amount of harvesting activity speaks again to the importance of the fishery within Newfoundland and Labrador and surrounding provinces. Seasonality of fisheries does play a role in when intense harvesting takes place. While many fisheries are open year-round, the summer months are typically when the highest levels of activity occur, due to favorable weather conditions. Seasonality will be discussed in subsequent sections related to key fisheries.

Figure 7.7.2. Commercial Fisheries, All Species within the Focus Area



Map depicting commercial fishing catch density for the time period from 2012 to 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.

Source: (DFO, 2024b)

7.7.1.4 Key Fisheries

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.

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 to 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	
	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 the Northwest Head of Brunette Island in water depths greater than 5 fathoms.)			

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
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			
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

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
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
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]	$1,381,000	$5,434,000

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
Redfish (continued)	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			
Turbot	Year-round	Bottom Trawls Longline	4R			$53,625,000
Capelin	Year-round, but June-July are important months. Season dates are established according to bay or fishing area, with input from harvesters.	Traps, tuck seines, purse seines	Areas of higher intensity along the west coast of Newfoundland include bays from Port au Port Bay to the top of the Northern Peninsula			$1,773,000
Lobster	April – June	Traps	3Psb 4Rc 4Rd 4Rb		$34,000,000 (non-georeferenced)	$105,015,000

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, 2023a) and provincial landed values (Government of Newfoundland and Labrador, 2023), where possible.

[1] 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 combined together in the 'Other' category.

7.7.1.5 Shellfish

Shellfish species comprise a large portion of fisheries landings within Newfoundland. 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 are provided below.

Table 7.7.5. 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 providing breakdown by shellfish species and their landed value percentage per month (DFO, 2023a).

[1] Based on Small Vessel Fishing Activity within the Focus Area (non-georeferenced).

Table 7.7.6. 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[1]	36	3Psb
	20	4Rc
	14	4Rd
	14	4Rb
	16	Remaining Areas

Table providing breakdown by shellfish species and their landed value percentage per NAFO area (DFO, 2023).

[1] Based on Small Vessel Fishing Activity within the Focus Area (non-georeferenced).

Table 7.7.7. 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 • 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 North, 58 degrees 39 minutes West), in water depths less than 5 fathoms.

Table providing overview of shellfish fishery closures within the Focus Area (DFO, 2023).

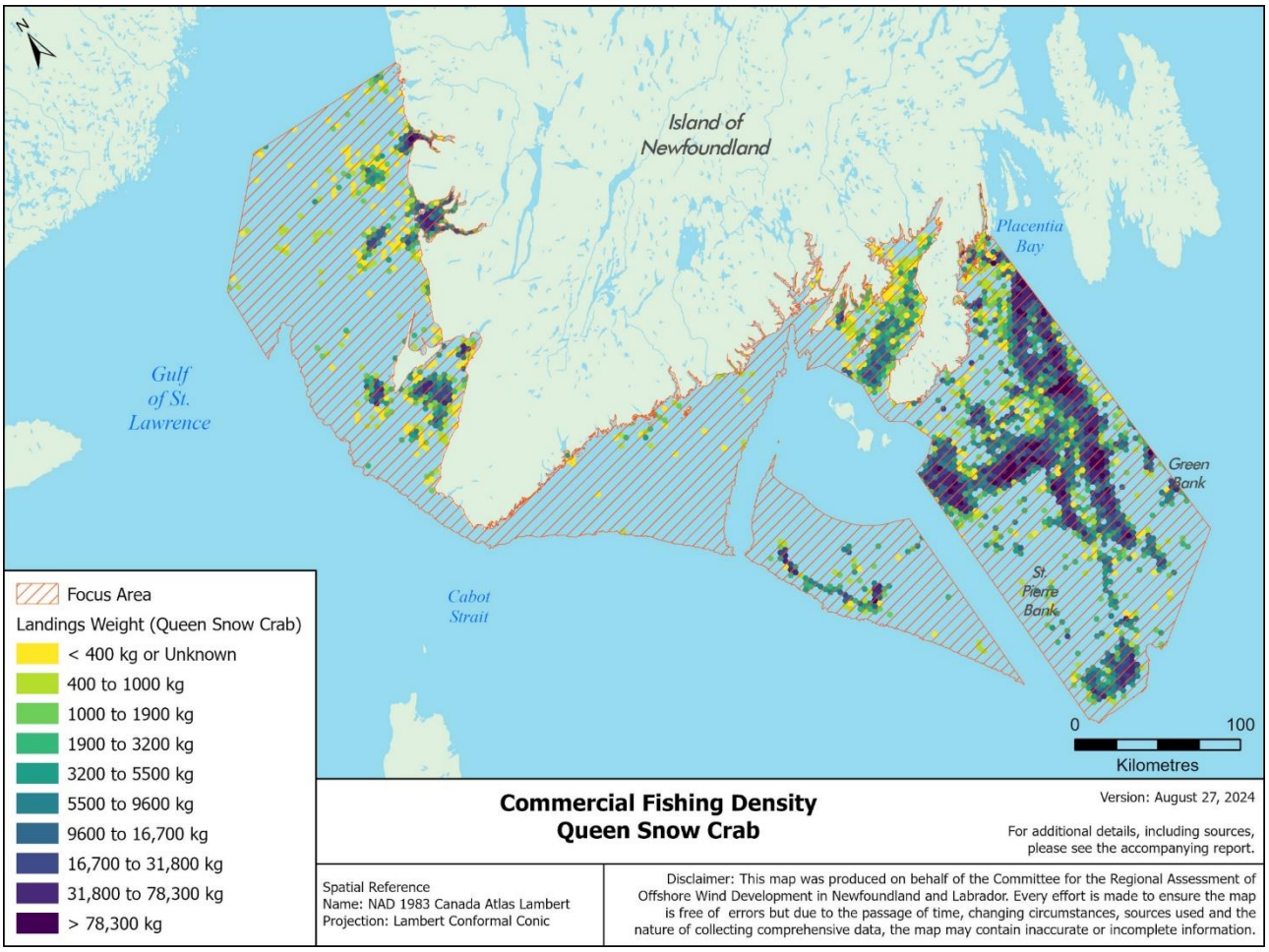
7.7.1.5.1 Snow Crab

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 $2.1 million through the small vessel (non-georeferenced) fishery, over the 2012-2021 period (DFO, 2023). Within the totality of the NAFO divisions that overlap the Focus Area, 3Ps, 3Pn & 4R, about 16% of the provinces 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, 2024d).

While snow crab landings first started in the late 1960s in Trinity Bay, it commenced within the Focus Area in 3Ps in the 1970s, then developing to a regulatory occurring fishery in the mid-1980s, while 4R commenced 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 as groundfish faced 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, 2019a; DFO, 2022a). In their response to the Committee's Request for Advice, DFO provided information on FSC fisheries and Communal-Commercial fishing licences. However, 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.[60] For crab, NFL, holds a quota of 3,000,000 lbs in 2024. Density of the geo-referenced snow crab fishery can be seen in Figure 7.7.3.

[60] A link to the Registry post was not available in time for inclusion in this Report, but it should be uploaded to the Registry in the near future.

Figure 7.7.3. Commercial Snow Crab Fishery Density within the Focus Area



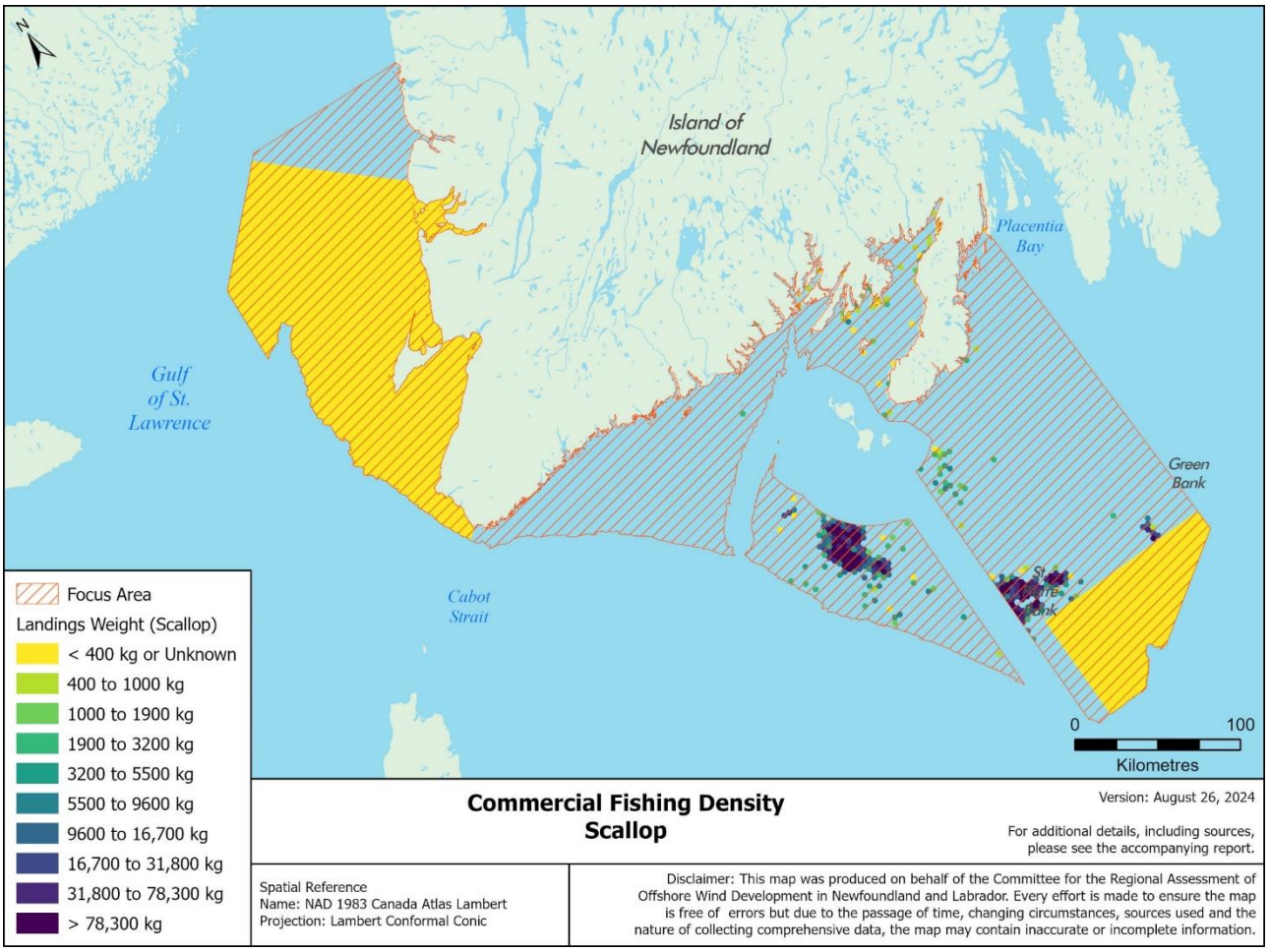
Map depicting snow crab commercial fishing density for the time period from 2012 to 2021 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries spanning 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.
Source: (DFO, 2024b)

7.7.1.5.2 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, 2019b; DFO, 2021b; Coughlan et al., 2023). On average, from 2012 to 2021 the scallop fishery within the Focus Area brings in about $3.1 million yearly (DFO, 2023). 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 FSC and Commercial Communal licences for scallop within the Focus Area. Density of the geo-referenced scallop crab fishery can be seen in Figure 7.7.4.

Figure 7.7.4. Commercial Scallop Fishery Density within the Focus Area



Map depicting scallop commercial fishing density for the time period from 2012 to 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.
Source: (DFO, 2024b)

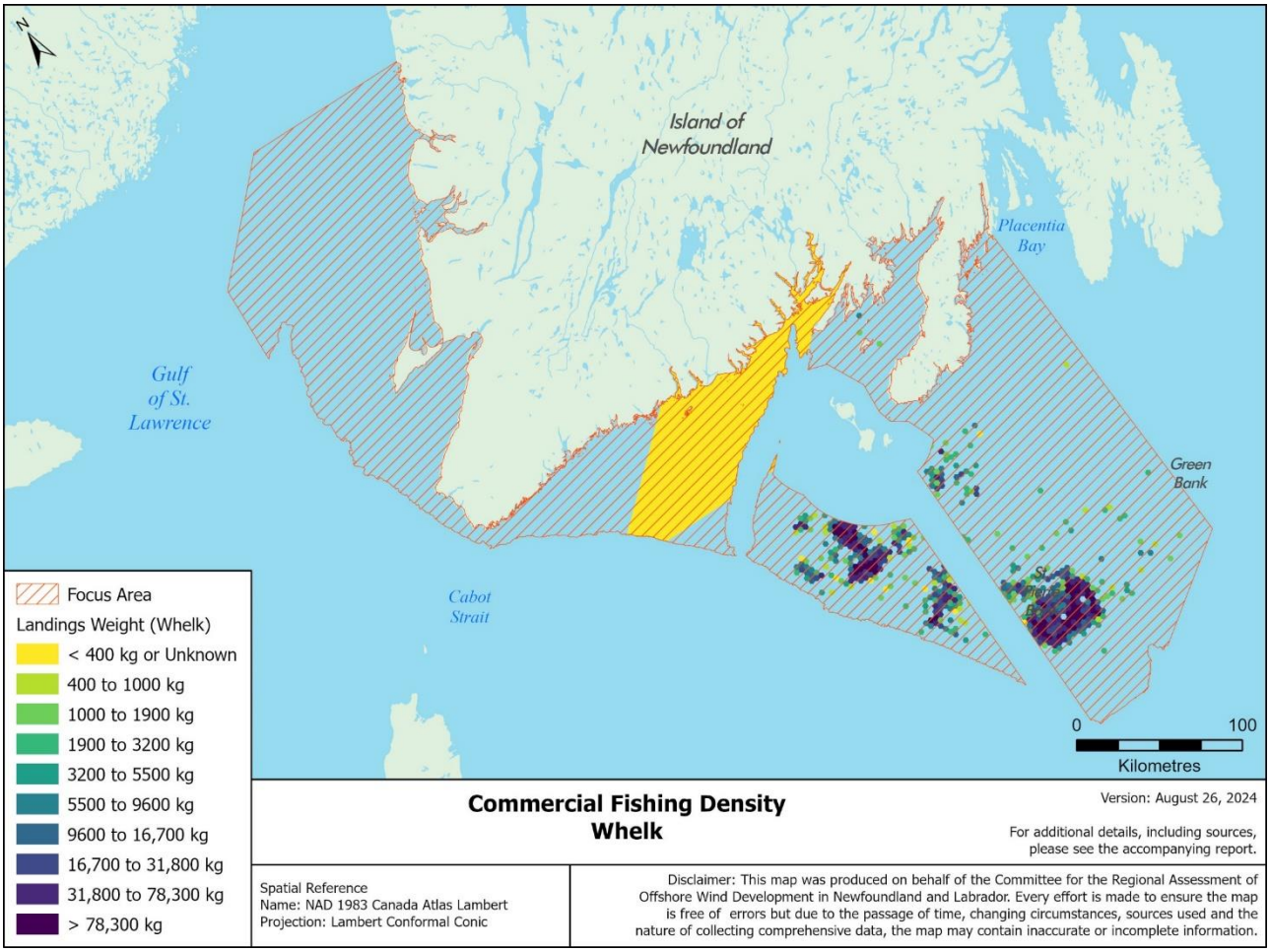
7.7.1.5.3 Whelk

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, 2021c; DFO, 2013). 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, which also allows the female whelks a chance to deposit their egg masses before they are captured (DFO, 2013). 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 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.[61] For whelk, NFL, is a part of the competitive fishery in 2024. Density of the geo-referenced whelk fishery can be seen in Figure 7.7.5.

[61] A link to the Registry post was not available in time for inclusion in this Report, but it should be uploaded to the Registry in the near future.

Figure 7.7.5. Commercial Whelk Fishery Density within the Focus Area



Map depicting whelk commercial fishing density for the time period from 2012 to 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.
Source: (DFO, 2024b)

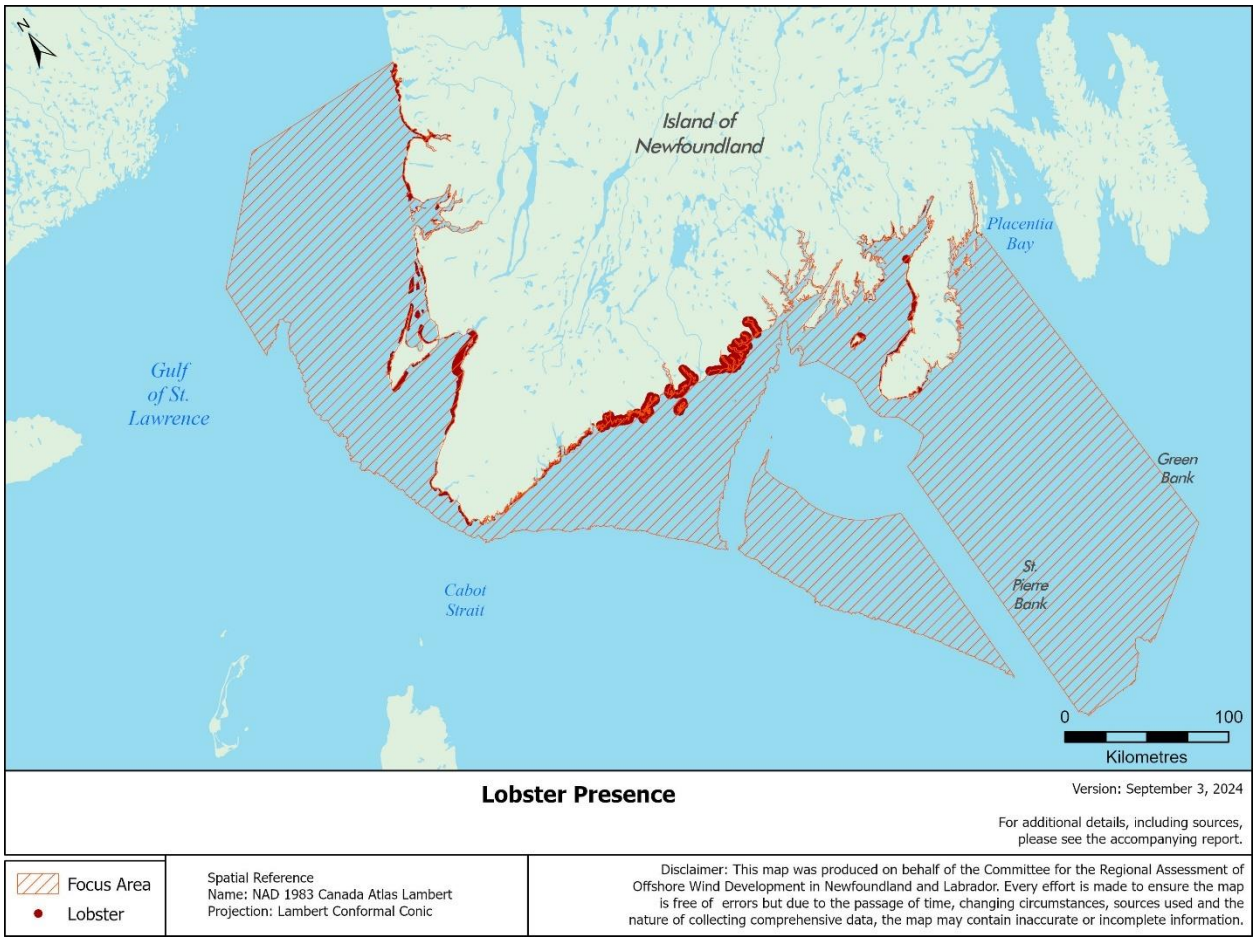
7.7.1.5.4 Lobster

The lobster fishery follows LFAs (LFA), 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 the 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, 2021d; DFO, 2023f). 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 harvested in the province (Government of NL, 2023), with an average annual landed value of $34 million in the small vessel fishery (non-georeferenced), accounting for 80% of total landed value for small fishing vessels within the Focus Area (2012-2021). 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, 2023a). 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 $84 million in 2022, approximately 80% of total landings within the province (Government of Newfoundland and Labrador, 2023; DFO, 2024d).

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 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 7.7.6.

Figure 7.7.6. Lobster Presence within the Focus Area



Map depicting lobster presence within the Focus Area. Since this fishery is not geo-referenced, indicating the presence of lobster may aid in showing approximate areas where this fishery may occur. Source: (DFO, 2024a; Ocean Biodiversity Information System, n.d.)

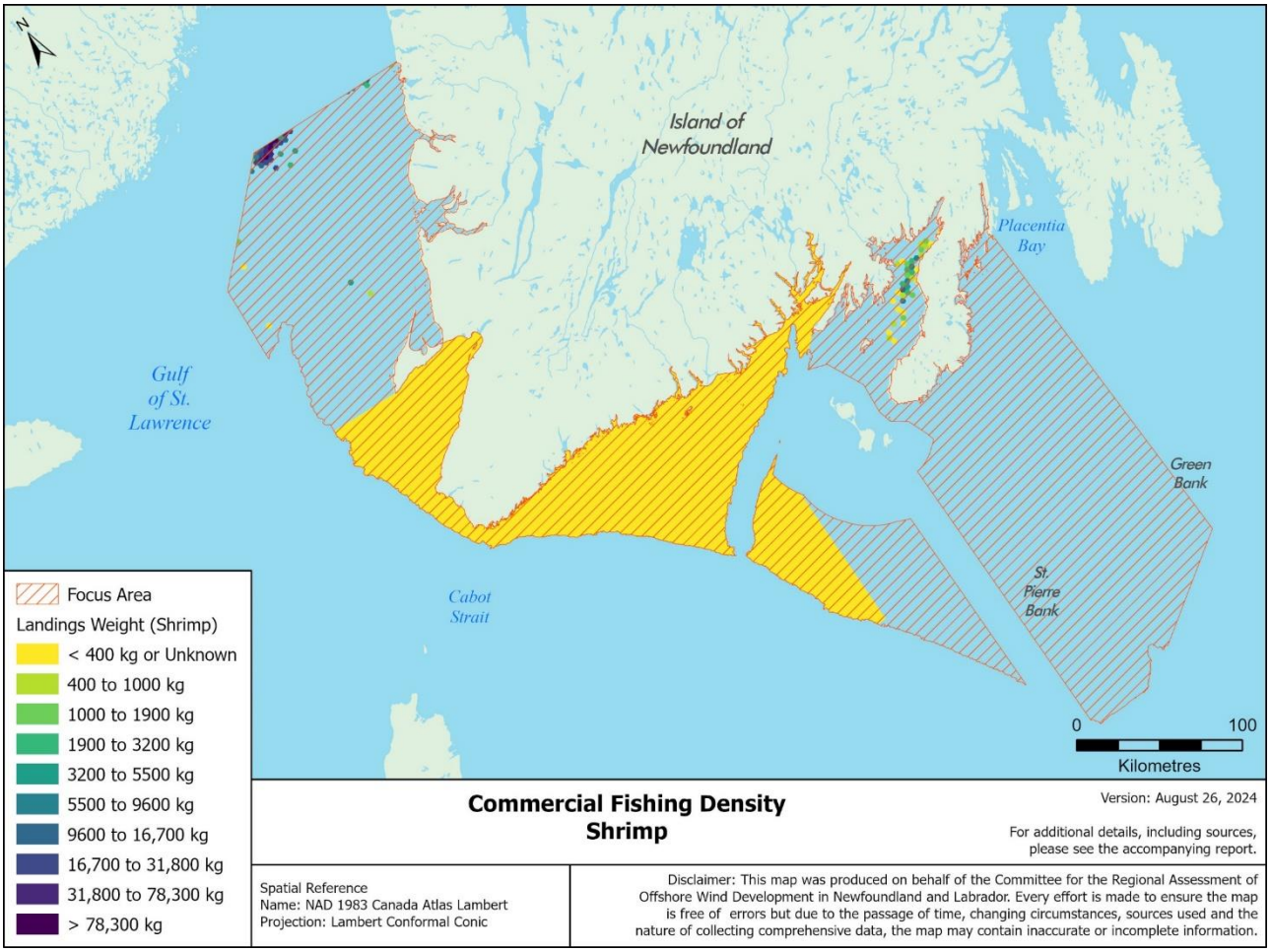
7.7.1.5.5 Northern Shrimp

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 area 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, but then started 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, 2022b).

The 3Ps portion of SFA 7 of the Northern Shrimp fishery falls partially within the Focus Area. This area only opens at the request of the industry and was last open in 2021. 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, 2023). Density of the geo-referenced Northern shrimp fishery can be seen in Figure 7.7.7.

Figure 7.7.7. Commercial Northern Shrimp Fishery Density within the Focus Area



Map depicting northern shrimp commercial fishing density for the time period from 2012 to 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.
Source: (DFO, 2024b)

7.7.1.6 Groundfish

The Newfoundland and Labrador's groundfish fishery, notably Atlantic Cod, has been integral to the province's economy and culture for centuries. It was initially conducted mainly 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, it resulted in restrictions on foreign fishing activity within its waters. Despite this, the intensive fishing continued and led to the implementation of a moratorium on the cod fishery, in areas outside of the Focus Area. This moratorium started in 1992, with additional moratoriums quickly following for many other groundfish in 1994. Since these moratoriums, other groundfish and shellfish fisheries became vital fisheries for the province. In recent years, due to changing marine conditions, an increase in groundfish resources has been seen, potentially signaling a return to a groundfish-dominated ecosystem (DFO, 2021e). 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 groundfish within the Focus Area.

The tables below outlines groundfish species harvested within the Focus Area, along with the notable times and locations of these activities and applicable closures (DFO, 2023a):

Table 7.7.7. Groundfish Fishing Trends, within the Focus Area, throughout the season

Species	Percent of Landed Value	Month
Atlantic cod	22	January
	15	November
	12	February
	12	October
	10	December
	10	September
	19	March – August
Atlantic halibut	21	June
	18	July
	12	August
	12	May
	9	March

	28	January, February, April & September - December

Table providing breakdown by groundfish species and their landed value percentage per month (DFO, 2023a).

Table 7.7.8. Groundfish Fishing Trends, within the Focus Area, based on 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 providing breakdown by groundfish species and their landed value percentage per NAFO area (DFO, 2023a).

Table 7.7.9. 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			That 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

Species	NAFO Area	Specific Area Description	Gear Type	Closure Period	Description
					• 49°10'N 60°00'W • 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
Unit 1 Redfish	• 4R • 3Pn	Redfish closure	Redfish directed gear	Unit 1 index fishery is closed to all fleets in 4RST & 3Pn:	N/A

Species	NAFO Area	Specific Area Description	Gear Type	Closure Period	Description
				• November 1 – March 31 (annual mating closure) • April 1 – June 15 (annual spawning closure)	
Unit 2 Redfish	3Psn	Redfish closure	Redfish directed gear	Unit 2 redfish fishery is closed to all fleets during this period for annual spawning closure: • April 1 – June 30 ○ Except for 3Pn portion of Unit 2 which is closed until July 14th due to mixing.	N/A

Table providing overview of groundfish fishery closures within the Focus Area (DFO, 2023a).

7.7.1.6.1 Cod

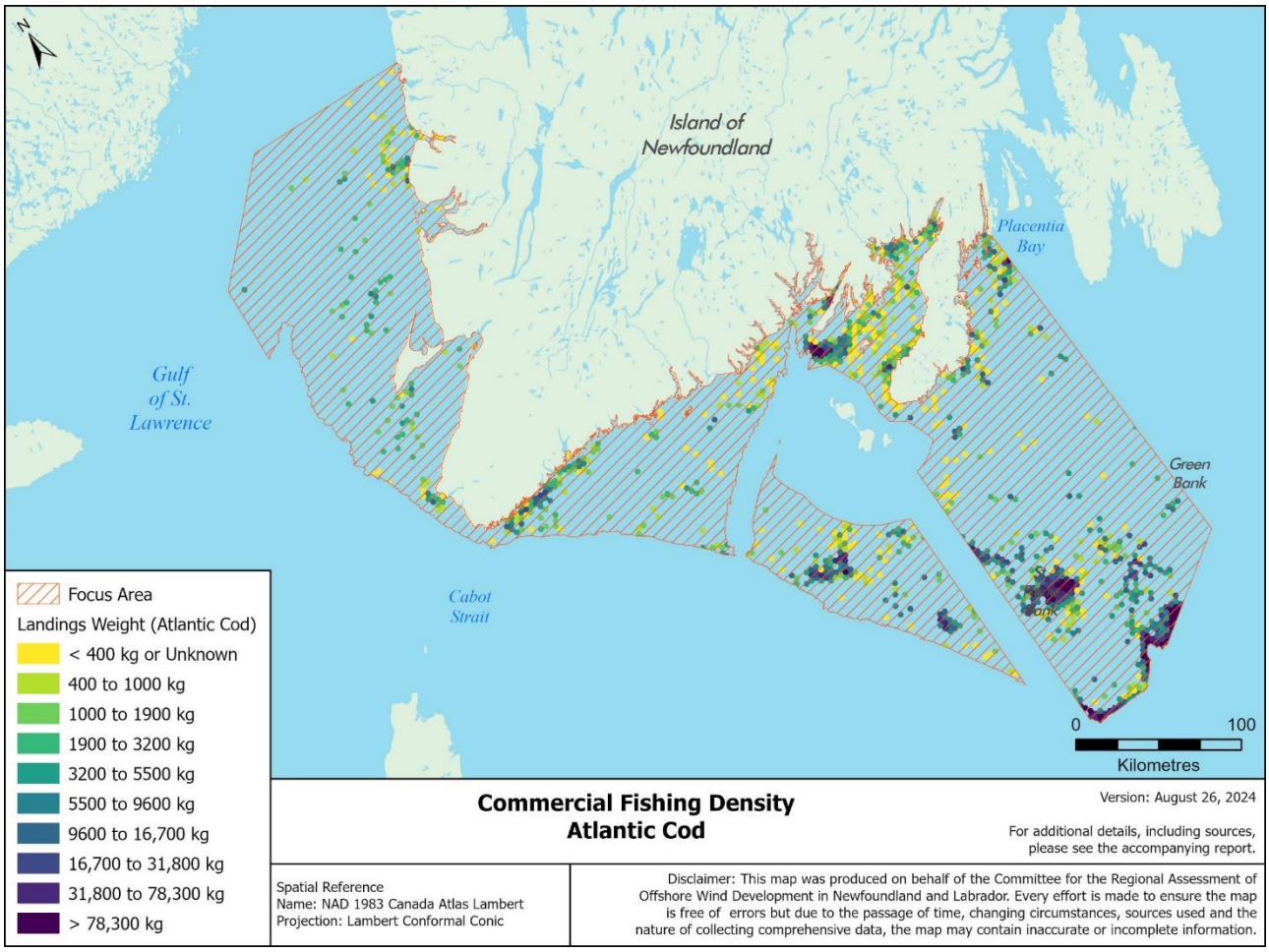
Newfoundland and Labrador's Atlantic cod fishery was historically one of the richest fishing industries in the world, which supported the intense migratory fishery that occurred since the late 15th century. For hundreds of years, cod was plentiful, and nations (mainly England, France and Spain) competed 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)[62] from the 1960s to the 1970s, this was no exception as the cod stock was heavily exploited in these areas. 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. (Wright, 1998; DFO, 2023g). 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. (DFO, 2023a). 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 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. [63]

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

[62] Reports and data that includes the NAFO division 4R, also includes 4S, which is outside of the Focus Area.
[63] A link to the Registry post was not available in time for inclusion in this Report, but it should be uploaded to the Registry in the near future.

within 3Ps, but an all-time high within 3Pn. Density of the geo-referenced cod fishery can be seen in Figure 7.7.8.

Figure 7.7.8. Commercial Atlantic Cod Fishery Density within the Focus Area



Map depicting Atlantic cod commercial fishing density for the time period from 2012 to 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.
Source: (DFO, 2024b)

7.7.1.6.2 Halibut

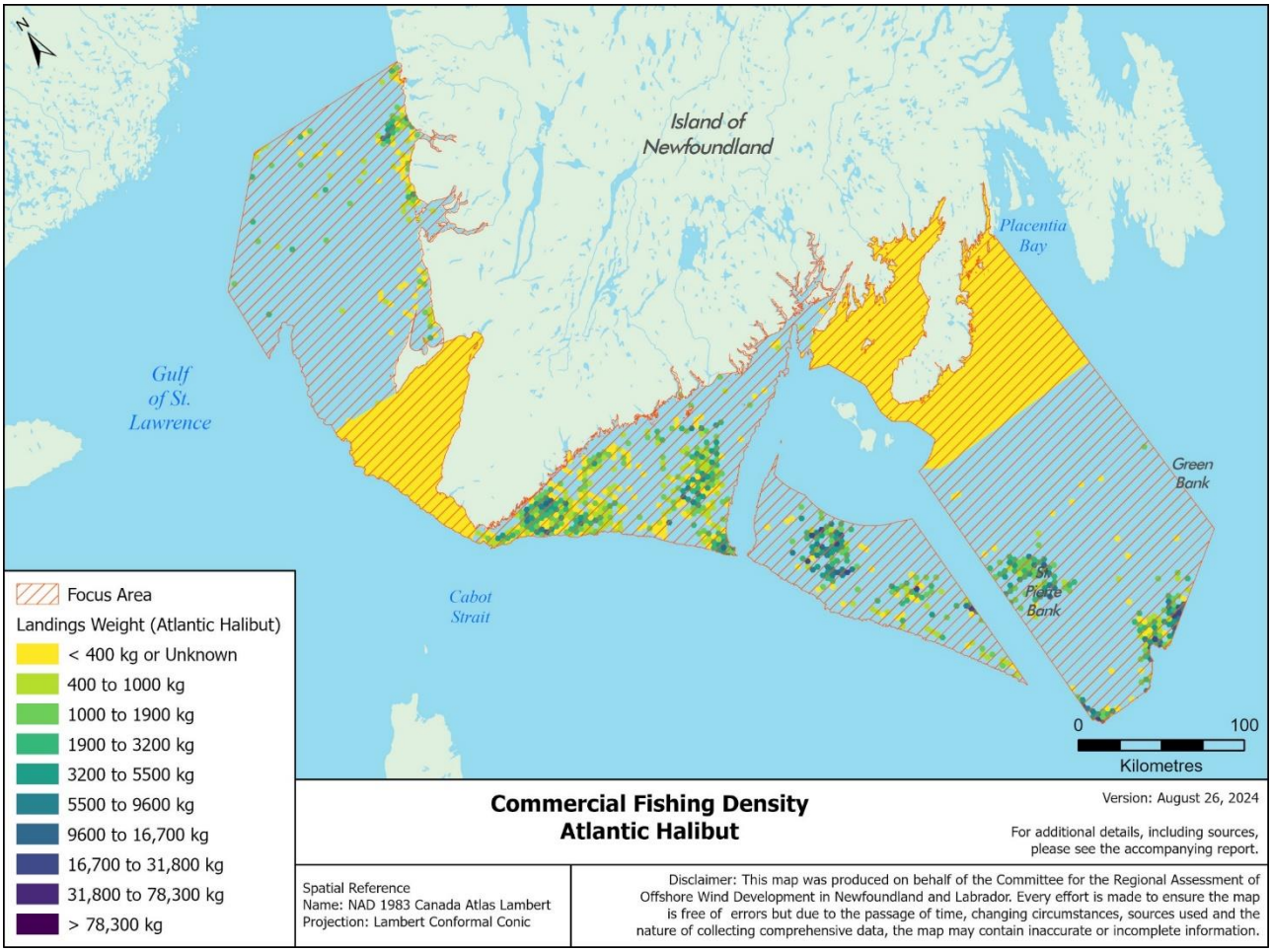
The south coast Newfoundland Atlantic halibut fishery occurs within 3Ps, within the larger fishery management unit of 3NOPs4VWX5Zc along the Scotian Shelf and southern Grand Banks. Within this broader area, the fishery was unregulated until 1988, when a TAC was set at 3,200 tonnes. In 1994, management plans and licence conditions were

implemented, requiring the release of any halibut that was less than 81 cm. The TAC continuously reduced until 1999, where it then increased to 1,000 tonnes as recommended by the Fisheries Resource Conservation Council, and then continued to be increased several times throughout the 2000s (DFO, 2015; DFO, 2018a; DFO, 2023h).

The Atlantic halibut fishery that occurs within the GSL and surrounding areas, is assessed on areas 4RST.[64] 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, 2023i). Between 2012 – 2021, the small vessel fishery for Atlantic halibut averaged $2.7 million of annual income within the Focus Area (DFO, 2023a). 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 7.7.9.

[64] For the purposes of this Regional Assessment, 4R is the only NAFO area partially within the Focus Area.

Figure 7.7.9. Commercial Atlantic Halibut Fishery Density within the Focus Area



Map depicting Atlantic halibut commercial fishing density for the time period from 2012 to 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.
Source: (DFO, 2024b)

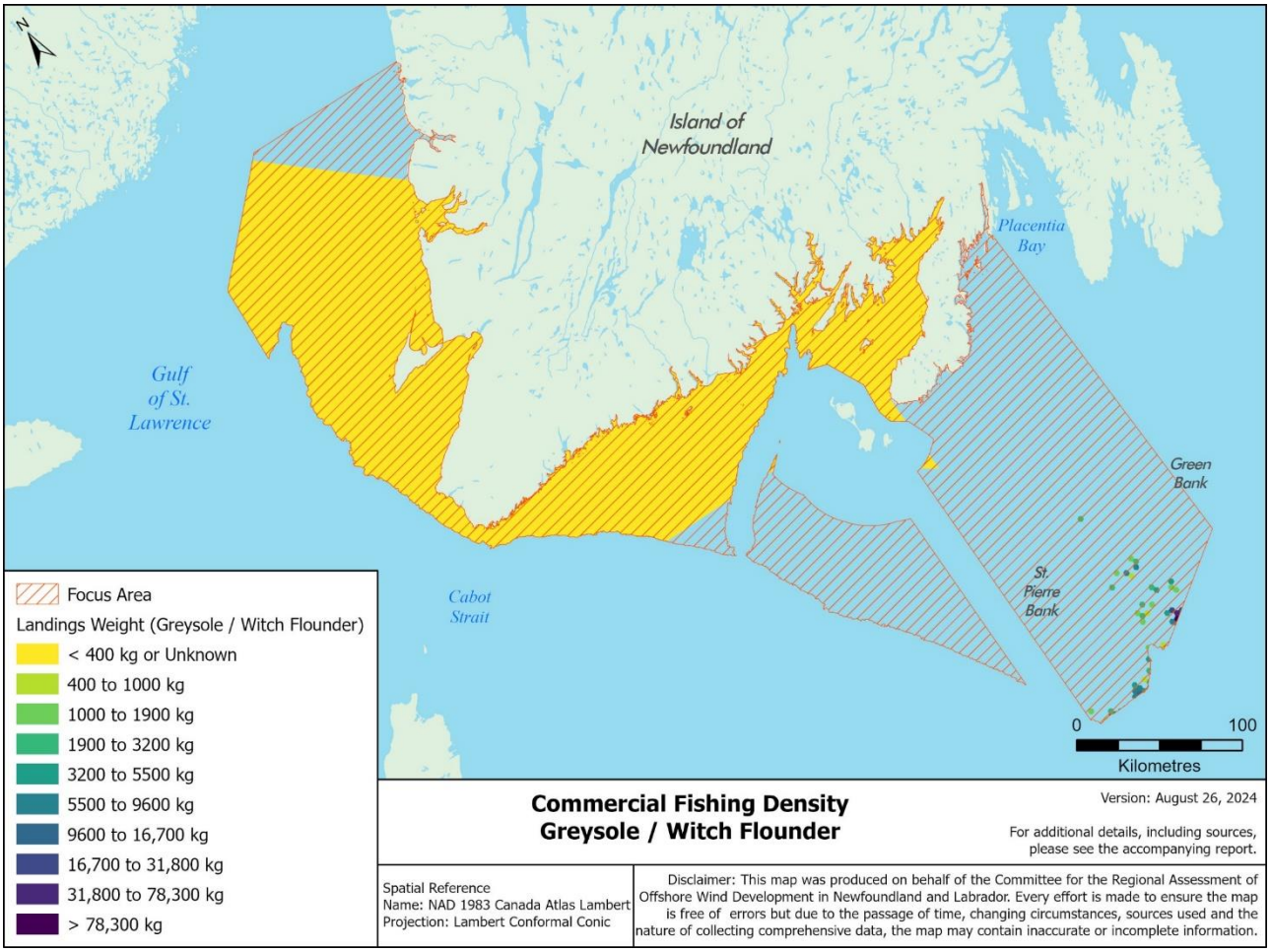
7.7.1.6.3 Greysole/Witch Flounder

The commercial fishery for witch flounder 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 to 1,500 tonnes between the 1970s and the early 1990s and from 200 to 600 tonnes from the mid 1990s to 2017. From 2014 to 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, 2018b). Density of the geo-referenced greysole/witch flounder fishery can be seen in Figure 7.7.10.

Figure 7.7.10. Commercial Greysole/Witch Flounder Density within the Focus Area



Map depicting greysole/witch flounder commercial fishing density for the time period from 2012 to 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.
Source: (DFO, 2024b)

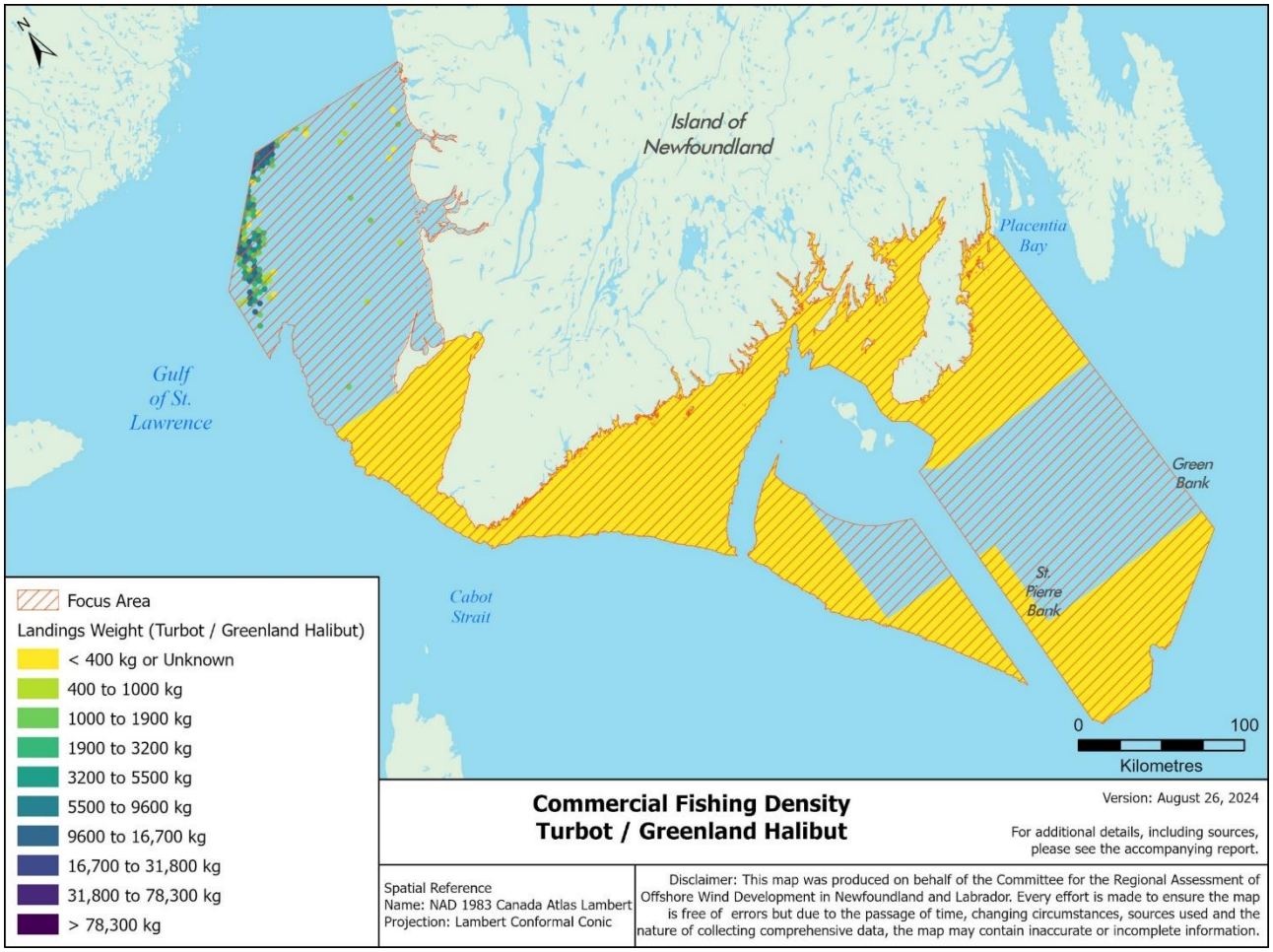
7.7.1.6.4 Turbot/Greenland Halibut

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 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 (Fisheries and Oceans, 2023j).

Density of the geo-referenced turbot/Greenland halibut fishery can be seen in Figure 7.7.11.

Figure 7.7.11. Commercial Turbot/Greenland Halibut Density within the Focus Area



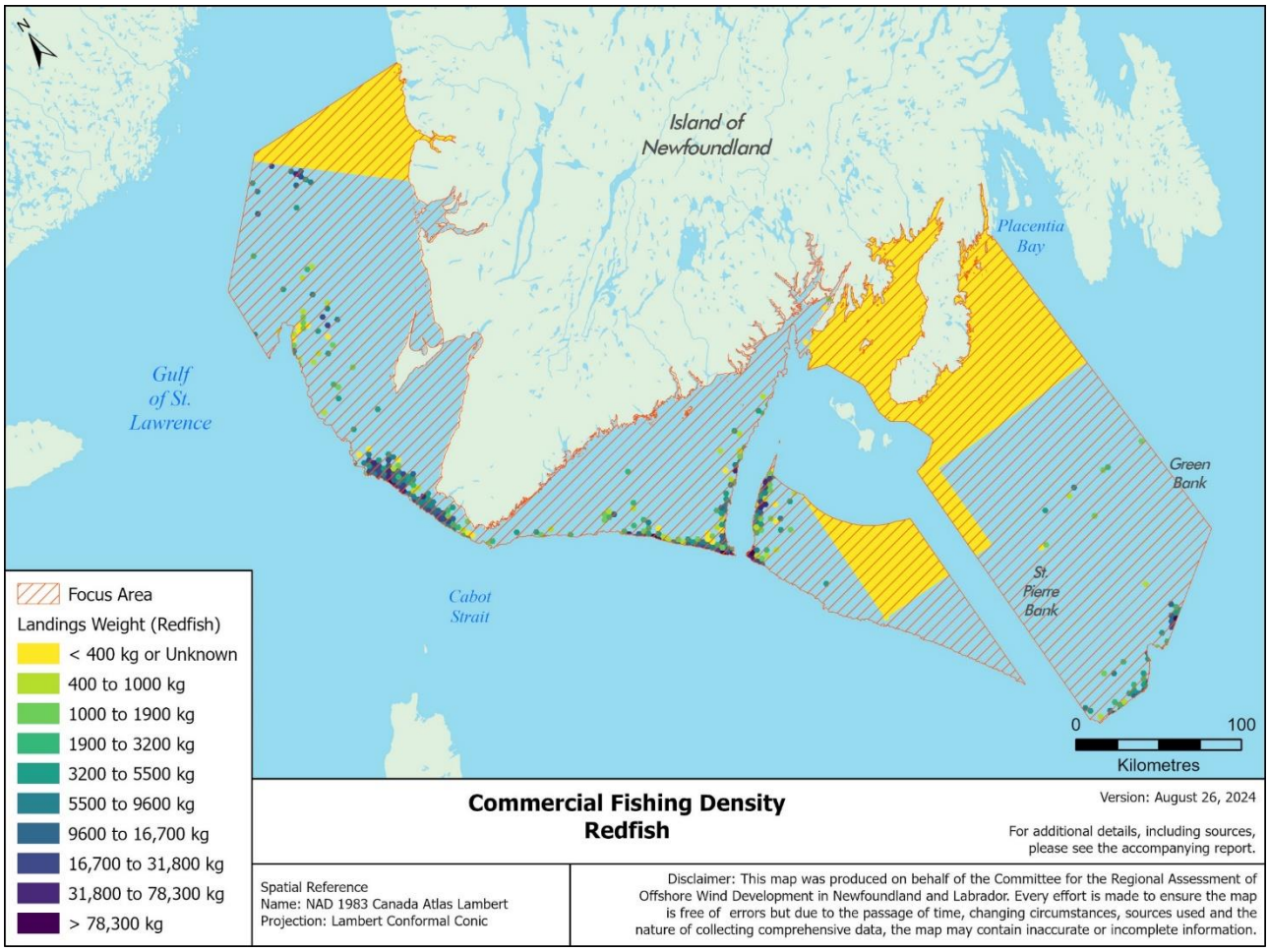
Map depicting turbot/Greenland halibut commercial fishing density for the time period from 2012 to 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., 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.
Source: (DFO, 2024b)

7.7.1.6.5 Redfish

After the development of the redfish fishery in the late 1950s, in 1993 management units were redefined to suit available knowledge and the biology of the stocks, resulting in Unit 1 (4RST and 3Pn4Vn from January to May) and Unit 2 (3Ps4Vs, 4Wfgj and 3Pn4Vn). While there is Unit 3, it does not fall within the Focus Area, so it will not be included in this discussion. In 1993, the TACs for redfish were set at 60,000 tonnes 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, and would average around 500 – 1,000 tonnes in the early 2000s (Fisheries and Oceans, 2022c). Within DFO NL 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, 2023a). Therefore, the above information on TACs and landings, while in overlapping areas with the Focus Area, may not be completely accurate to the Focus Area itself. 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 FSC licences for redfish within the Focus Area. Density of the geo-referenced redfish fishery can be seen in Figure 7.7.12.

Figure 7.7.12. Commercial Redfish Density within the Focus Area



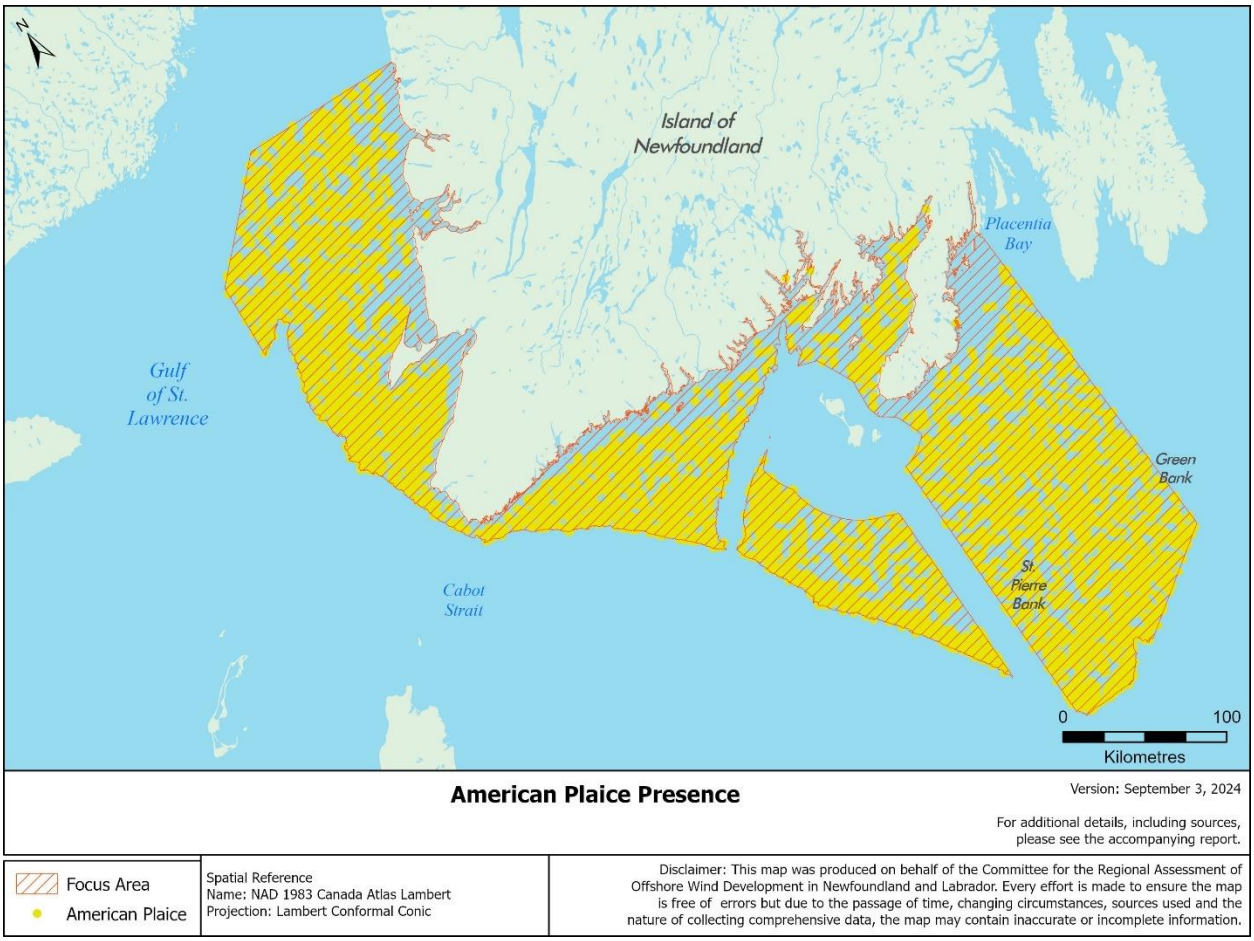
Map depicting redfish fishing density for the time period from 2012 to 2022 within the Focus Area.Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries spanning large area 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.
Source: (DFO, 2024b)

7.7.1.6.6 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 tons 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, 2020). Due to lack of availability of data for density for commercial fishery of American plaice, the presence of this species is indicated in Figure 7.7.13 below.

Figure 7.7.13. American Plaice Presence within the Focus Area



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.
Source: (DFO, 2024a; Ocean Biodiversity Information System, n.d.)

7.7.1.7 Pelagics

On the western and southern Coasts 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 (C-NLOPB, 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 some of the main pelagic species harvested within the Focus Area, along with the notable times and locations of these activities and applicable closures.

Table 7.7.10. Pelagic Fishing Trends, within the Focus Area, throughout the season

Species	Percent of Landed Value	Month
Herring	37	November
	40	December
	23	Remaining Season
Sea cucumber	26	July
	33	August
	23	September
	18	Remaining Season

Table providing breakdown by pelagic species and their landed value percentage per month (DFO, 2023a).

Table 7.7.11. 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
Sea cucumber	40	3Psd
	40	3Psg
	20	Remaining 3Ps areas

Table providing breakdown by pelagic species and their landed value percentage per NAFO area (DFO, 2023a).

Table 7.7.12. 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).

Species	NAFO Area	Specific Area Description	Gear Type	Closure Period	Description
	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.
	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: ○ 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: ○ 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).

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.
Mackerel	4R	Bay of Islands Annual Salmon Migration Closure	Fixed Gear: • Gillnets • Handlines Traps	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 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

Species	NAFO Area	Specific Area Description	Gear Type	Closure Period	Description
					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)
		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	Fixed gear:	Year-round	Prohibited from fishing in a portion of Capelin Fishing Area 13, inside of a straight line drawn from:

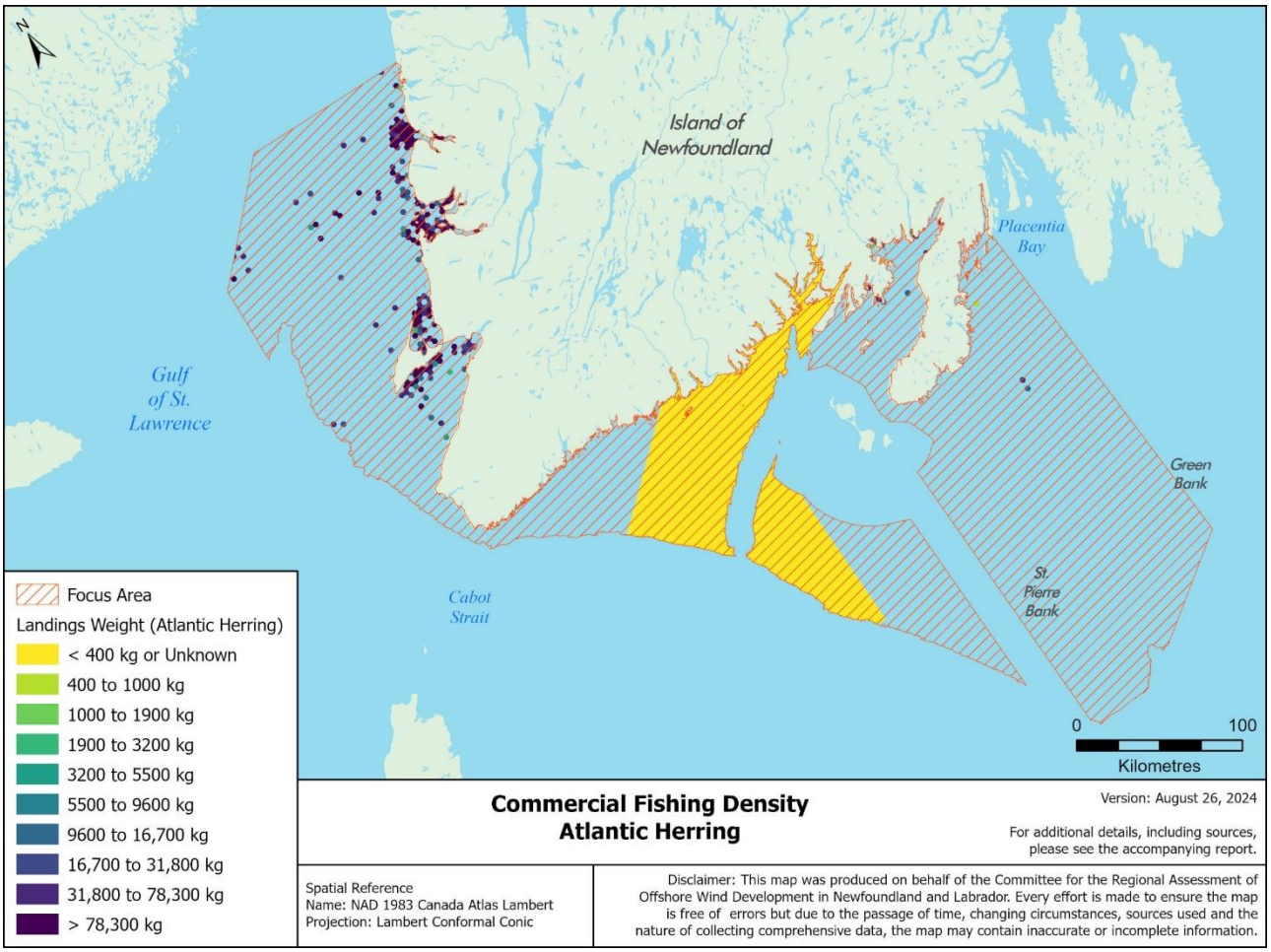
Species	NAFO Area	Specific Area Description	Gear Type	Closure Period	Description
		Migration Closure	• Seines (Barr) • Gillnets Trap nets		• Crabb Point (49°14'N, 58°12'W) to • North Arm Point (49°11'N, 58°07'W) to • Middle Arm Point (49°08'N, 58°09'W) to • Peter Point, Woods Island (49°05'N, 58°10'W) to Shoal Point (49°04'N, 58°11'W) to Fleming Point (49°07'N 58°21'W)

Table providing overview of pelagic fishery closures within the Focus Area (DFO, 2023a).

7.7.1.7.1 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 for 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 herring landings averaged around 30,000 tonnes from 1945-1950, it 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 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 are for both fixed and mobile gear, further divided into three categories: mobile gear greater than 55 feet, mobile gear less than 55 feet and fixed gear. Each sub-category is fully competitive with individual quotas for each fleet and gear type (DFO, 2021f). 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 FSC and Commercial Communal licences for herring within the Focus Area. Density of the geo-referenced Atlantic Herring fishery can be seen in Figure 7.7.14.

Figure 7.7.14. Commercial Atlantic Herring Fishery Density within the Focus Area



Map depicting Atlantic Herring fishing density for the time period from 2012 to 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.
Source: (DFO, 2024b)

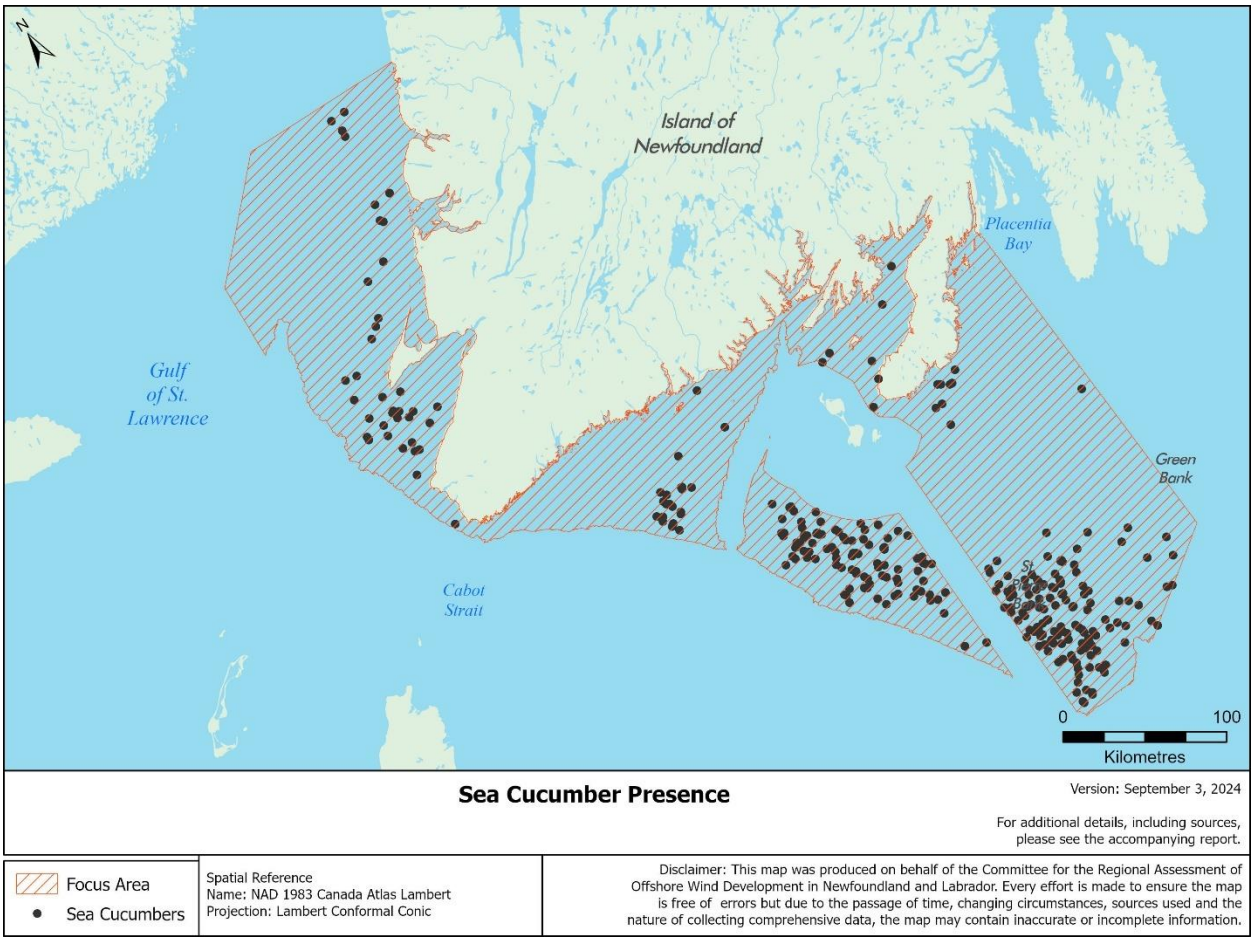
7.7.1.7.2 Sea Cucumber

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, Government of Newfoundland and Labrador's Department of Fisheries and Agriculture and 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 which developed a biomass estimate to help evaluate the potential of commencing a commercial fishery. In 2012, the Sea cucumber fishery officially transitioned to a commercial fishery. 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. 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, 2017; DFO, 2019c). As of 2023, the TAC for the entire area was set at 6,959 tonnes, until 2027 (DFO, 2023k). 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 Sea cucumber within the Focus Area. Within MFN's *Comments on the Regional Assessment of Offshore Development*[65], 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. Due to Sea cucumber fisheries data not being geo-referenced, presence of Sea cucumber can be seen within the Focus Area in Figure 7.7.15.

[65] A link to the Registry post was not available in time for inclusion in this Report, but it should be uploaded to the Registry in the near future.

Figure 7.7.15. Sea Cucumber Presence within the Focus Area



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.
Source: (DFO, 2024a; Ocean Biodiversity Information System, n.d.)

7.7.1.7.3 Capelin

Historically, the Capelin fishery started as a domestic fishery, with an estimated harvest of 25,000 tonnes for spawning caplin across the province, which 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 & 3Pn, are included in this sharing arrangement as follows:

Table 7.7.13. Capelin Sharing Arrangements in the Estuary and Gulf of St. Lawrence Region

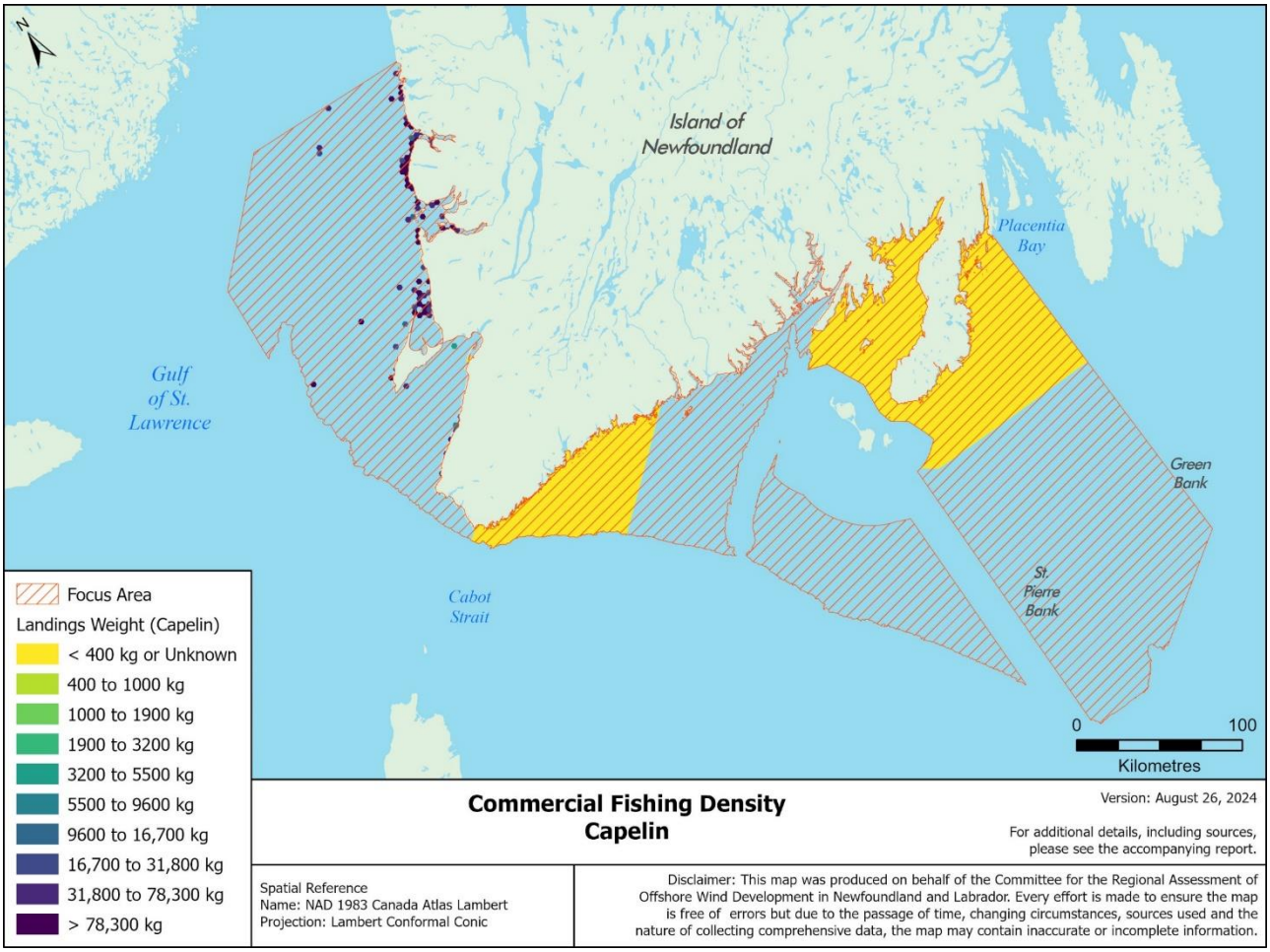
NAFO Division/Capelin Fishing Area	Gear	Type of Quota	Sharing Arrangement (%)
4R (CFA 12[66]-14)	Fixed gear	Competitive	37.82
	Mobile gear <65’	Individual	24.15
	Mobile gear ≥65’	Competitive	24.15

Table outlining sharing arrangement for capelin TAC within the regions that fall into the Focus Area (DFO, 2022d).

While 3Pn is included within the Integrated Fisheries Management Plan for Divisions 4RST, is it has never been included in the stock assessment (DFO, 2022d). 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 FSC and Commercial Communal licences for capelin within the Focus Area. Density of the geo-referenced capelin fishery can be seen in Figure 7.7.16.

[66] CFA 12 includes NAFO Division 3Pn

Figure 7.7.16. Commercial Capelin Fishery Density within the Focus Area



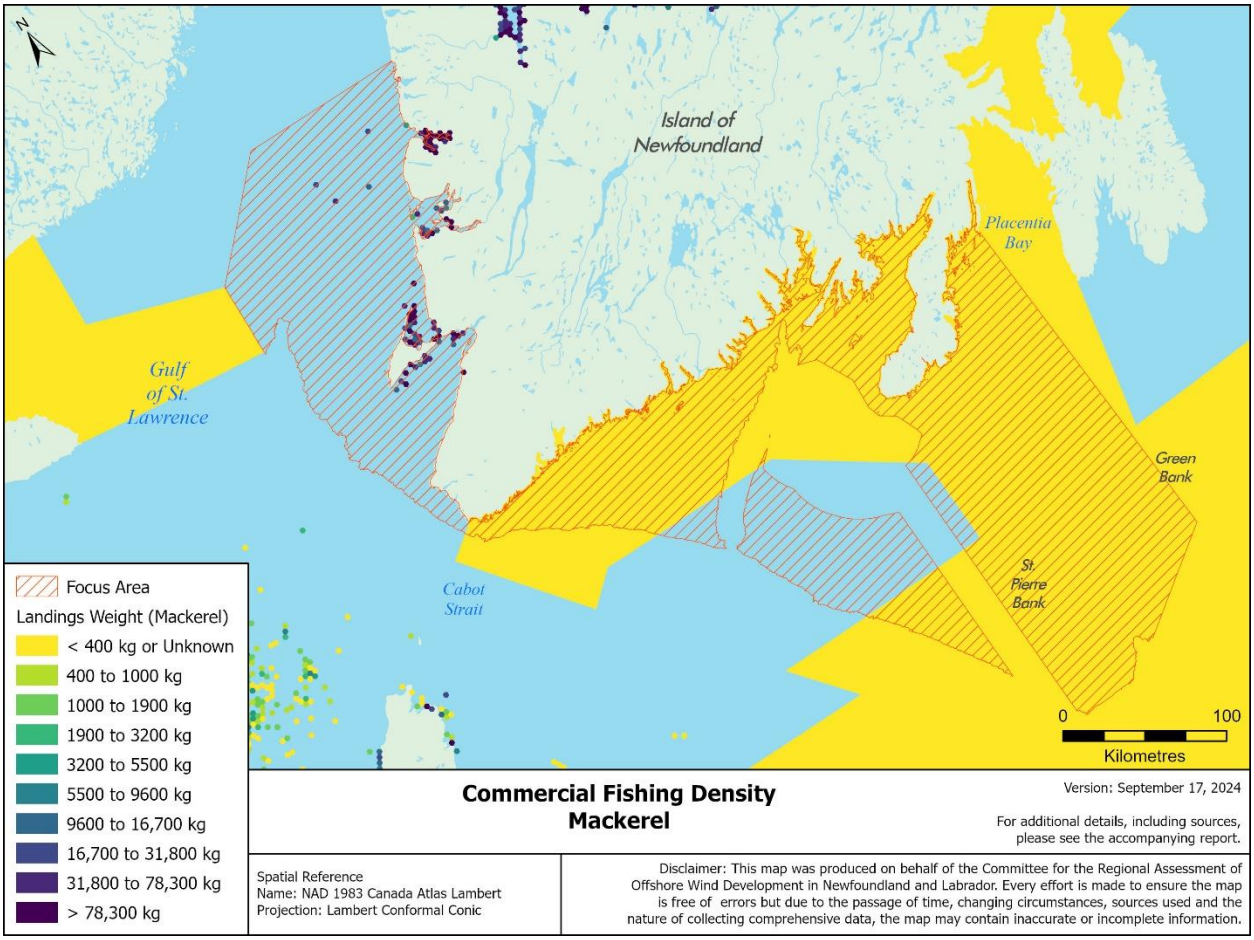
Map depicting Capelin fishing density for the time period from 2012 to 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries spanning large area 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.
Source: (DFO, 2024b)

7.7.1.7.4 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 to 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 & 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, 2022e). 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 FSC and Commercial Communal licences for mackerel within the Focus Area.

Figure 7.7.17. Commercial Mackerel Fishery Density within the Focus Area



Map depicting mackerel fishing density for the time period from 2012 to 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.
Source: (DFO, 2024b)

7.7.1.8 Gear Associated with Commercial Fishing Activities

Several types of fishing gear are used within the Focus Area to harvest various species. 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. This can include baited longline, gillnets, and otter trawls. In general, gear types can be classified into either fixed or mobile gear. Some of these gear types are listed below:

- Longlines
- Shrimp trawls
- Bottom (otter) trawls
- Pots
- Traps
- Seines (various designs)
- Gillnets
- Hand lines
- Harpoon and spear methods

The above list is not intended to be comprehensive, and it is likely that additional gear types can be and are used in the fishery for several different species. Some species are only harvested using one type of gear (e.g., crab pots for snow crab), while other species can be harvested using a variety of gear types (e.g., groundfish and pelagic species via longlines, trawls, nets, etc.).

From 2012 to 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, 2023). 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. Table 7.7.13 outlines the average annual catch and landed value for each gear type:

Table 7.7.13 Average Annual Catch and Landed Value by Gear Type within the Focus Area, 2012-2021

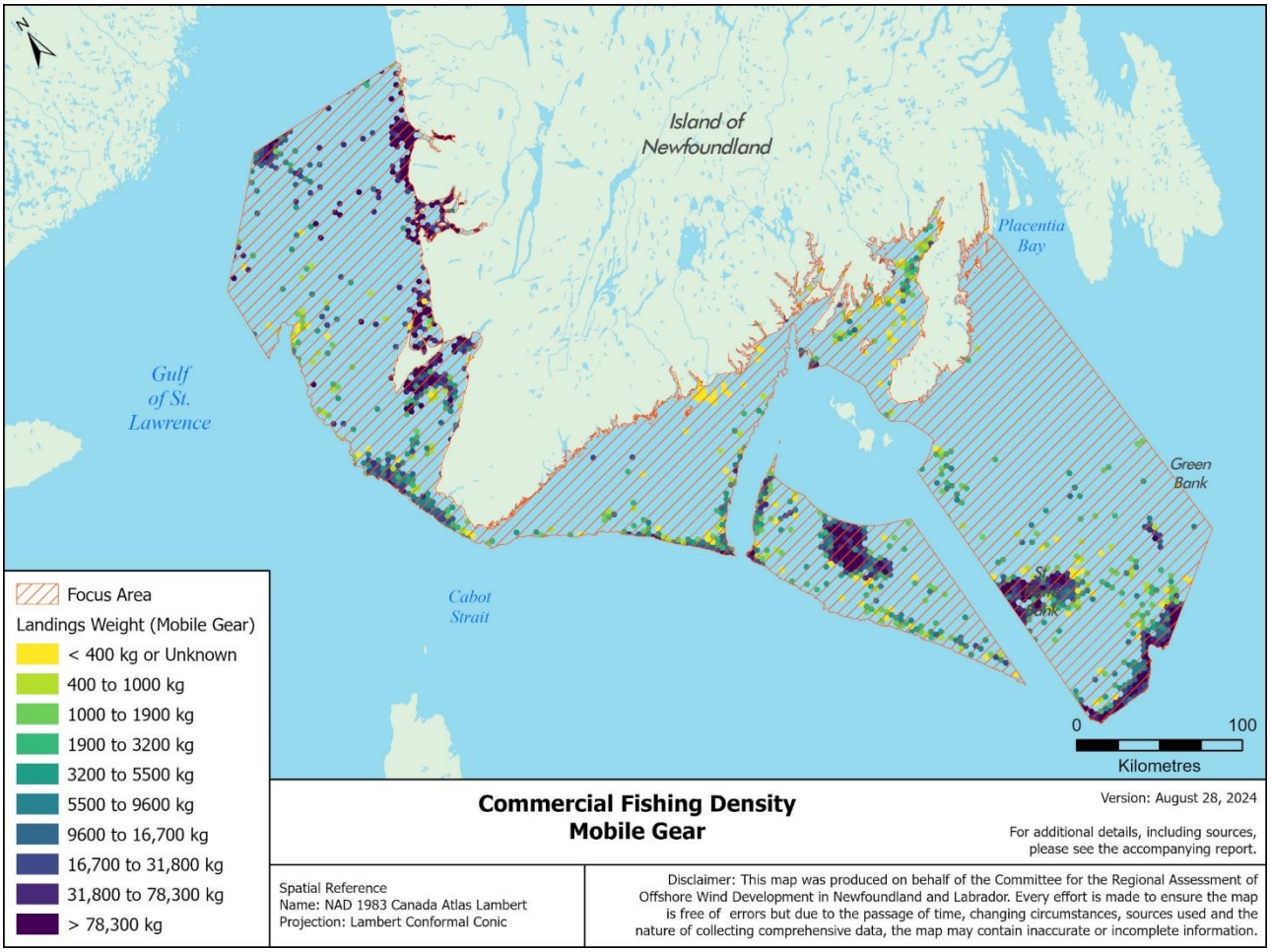
Gear Type	Average Annual Catch (tonnes)	Average Annual Landed Value
Pot	4,200	$23,832,000
Purse Seine	2,800	$3,548,800
Sea Cucumber Drag	1,400	$3,164,000
Dredge (boat)	9,100	$3,122,700
Longline	400	$2,284,000
Bottom Otter Trawl (stern)	900	$1,263,700
Gillnet (set or fixed)	1,000	$1,194,300
Tuck Seine	900	$368,700
Danish Seine	400[1]	$532,800
Shrimp Trawl		
Beach Seine		
Bar Seine		
Troller Line		

Table outlining the annual average catch and landed value for each gear type within the Focus Area (DFO, 2023a).

[1]Danish seine, shrimp trawl, beach seine, bar seine and troller line were combined to form an 'Other' category in the source table.

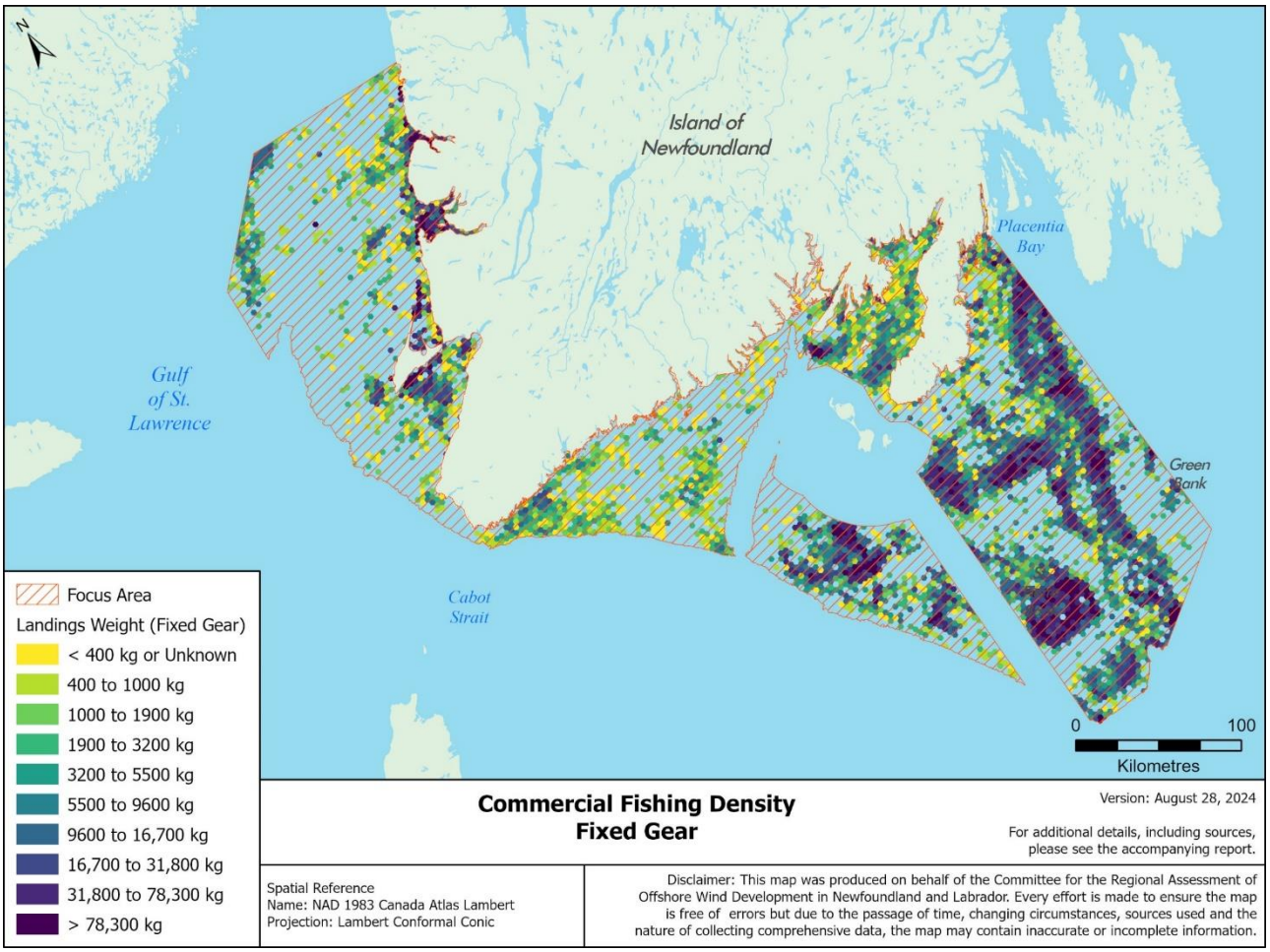
Figures 7.7.18 – 7.7.33 below outlines some of the identified locations for both fixed and mobile gear harvesting locations, based on commercial fisheries landings data from 2012-2021. While both fixed and mobile gear are used throughout the Focus Area, fixed gear is used primarily in the southern portion of the Focus Area around the St. Pierre Bank, and mobile gear is used more along the west coast of Newfoundland.

Figure 7.7.18. All Mobile Commercial Fishing Gear Density within the Focus Area



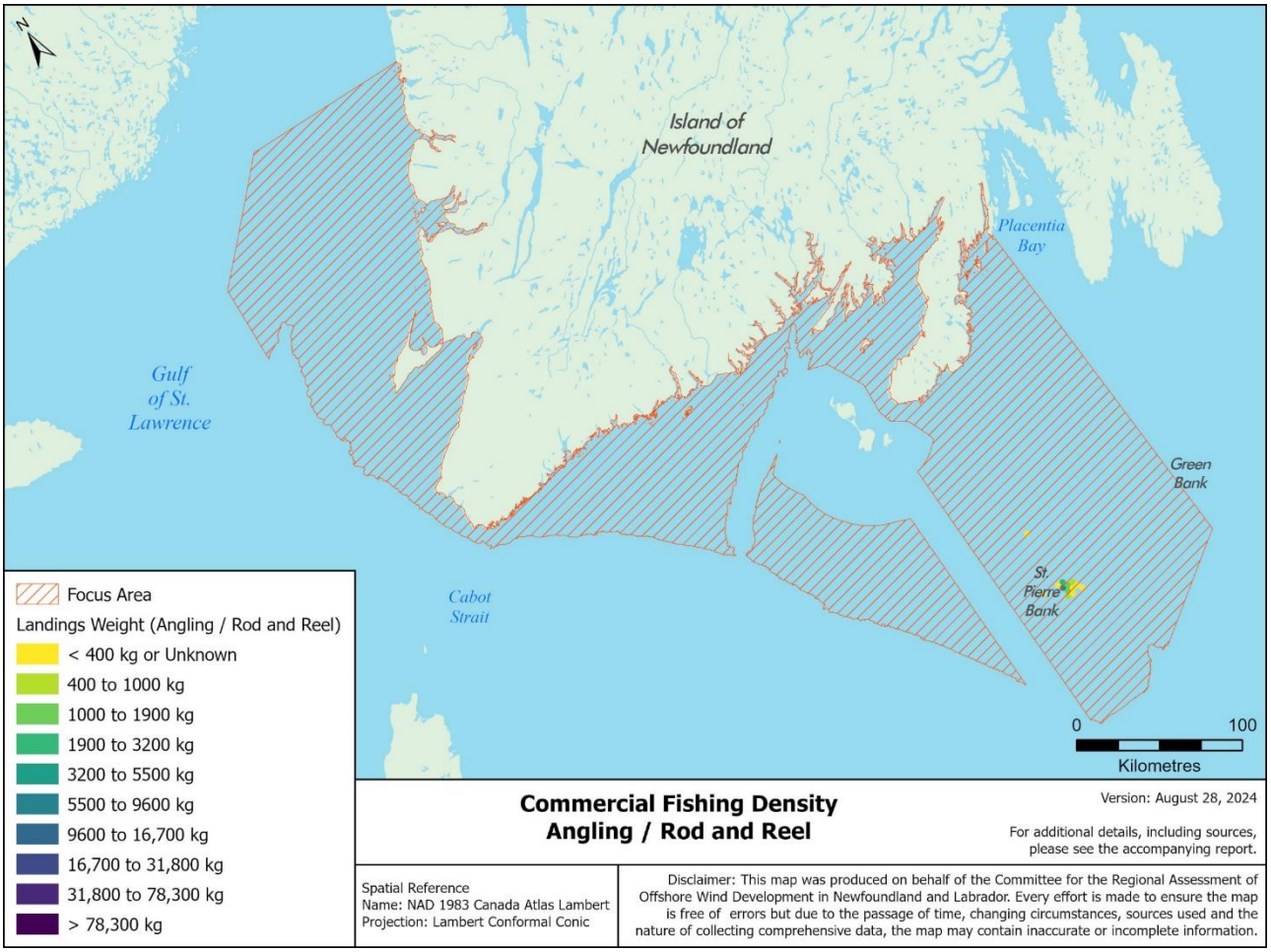
Map depicting all mobile commercial fishing gear density for the time period from 2012 to 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries 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.
Source: (DFO, 2024b)

Figure 7.7.19. All Fixed Commercial Fishing Gear Density within the Focus Area



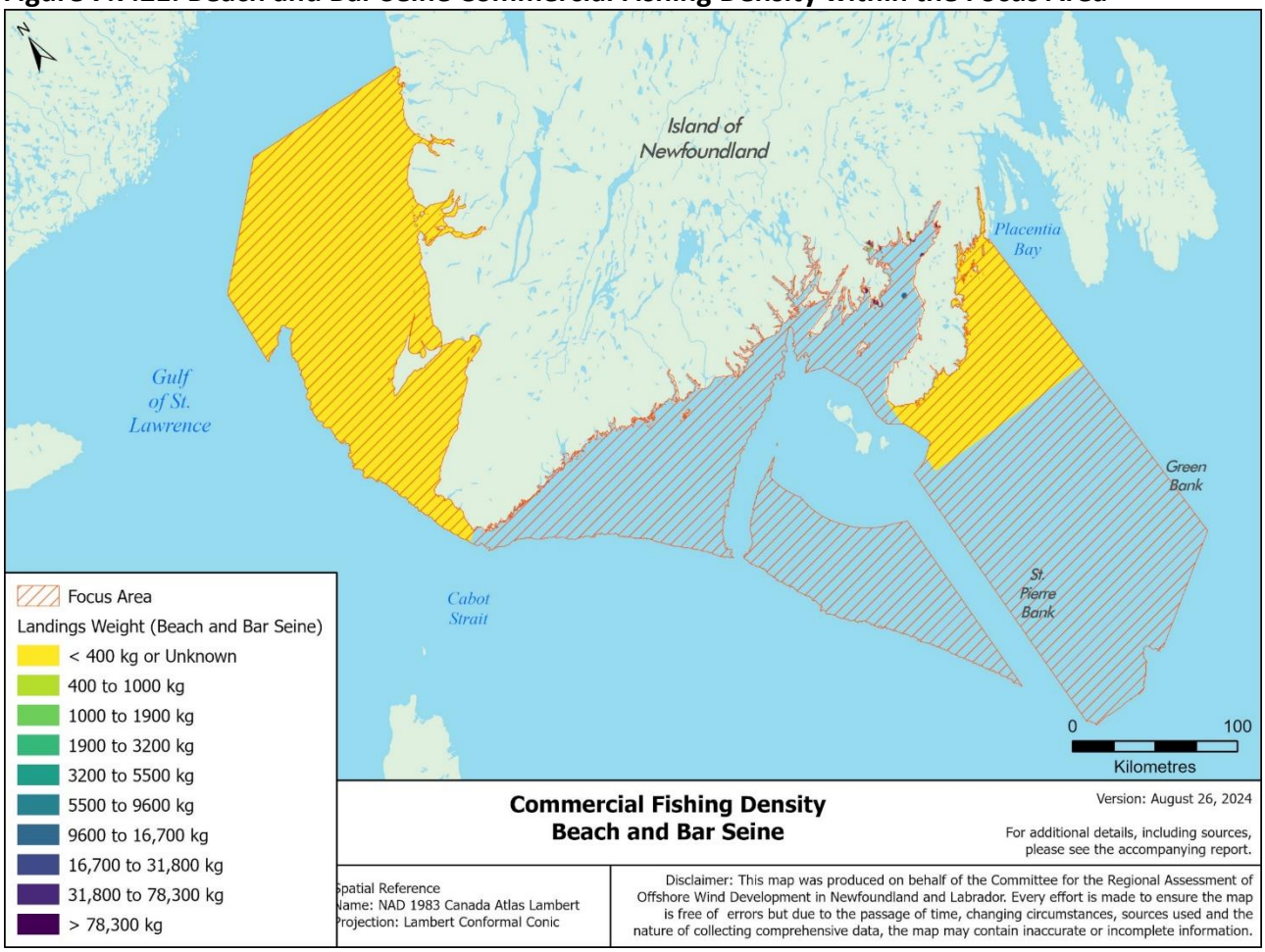
Map depicting all fixed commercial fishing gear density for the time period from 2012 to 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries 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.
Source: (DFO, 2024b)

Figure 7.7.20. Angling/Rod and Reel Commercial Fishing Density within the Focus Area



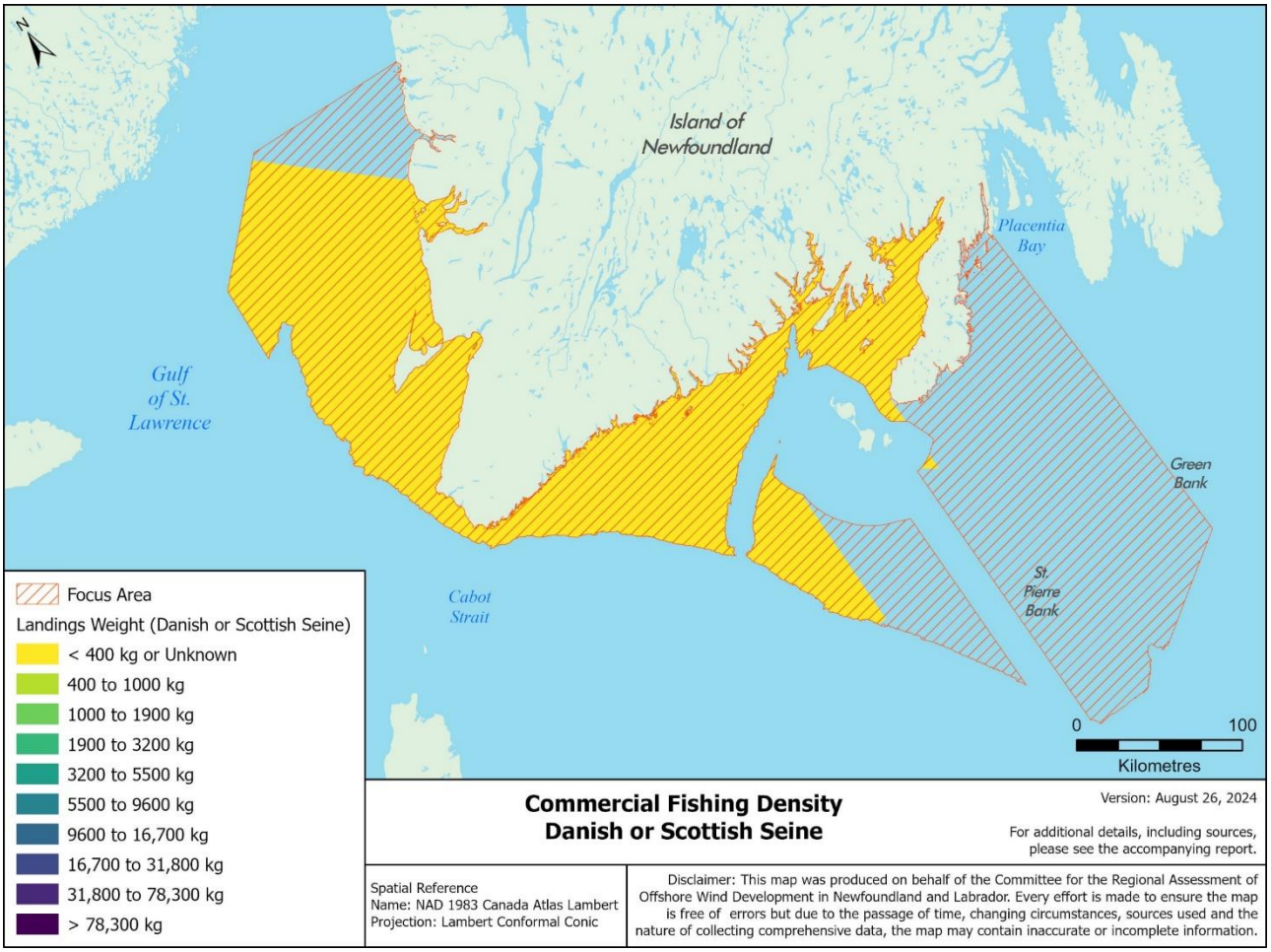
Map depicting angling/rod and reel commercial fishing density for the time period from 2012 to 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries 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.
Source: (DFO, 2024b)

Figure 7.7.21. Beach and Bar Seine Commercial Fishing Density within the Focus Area



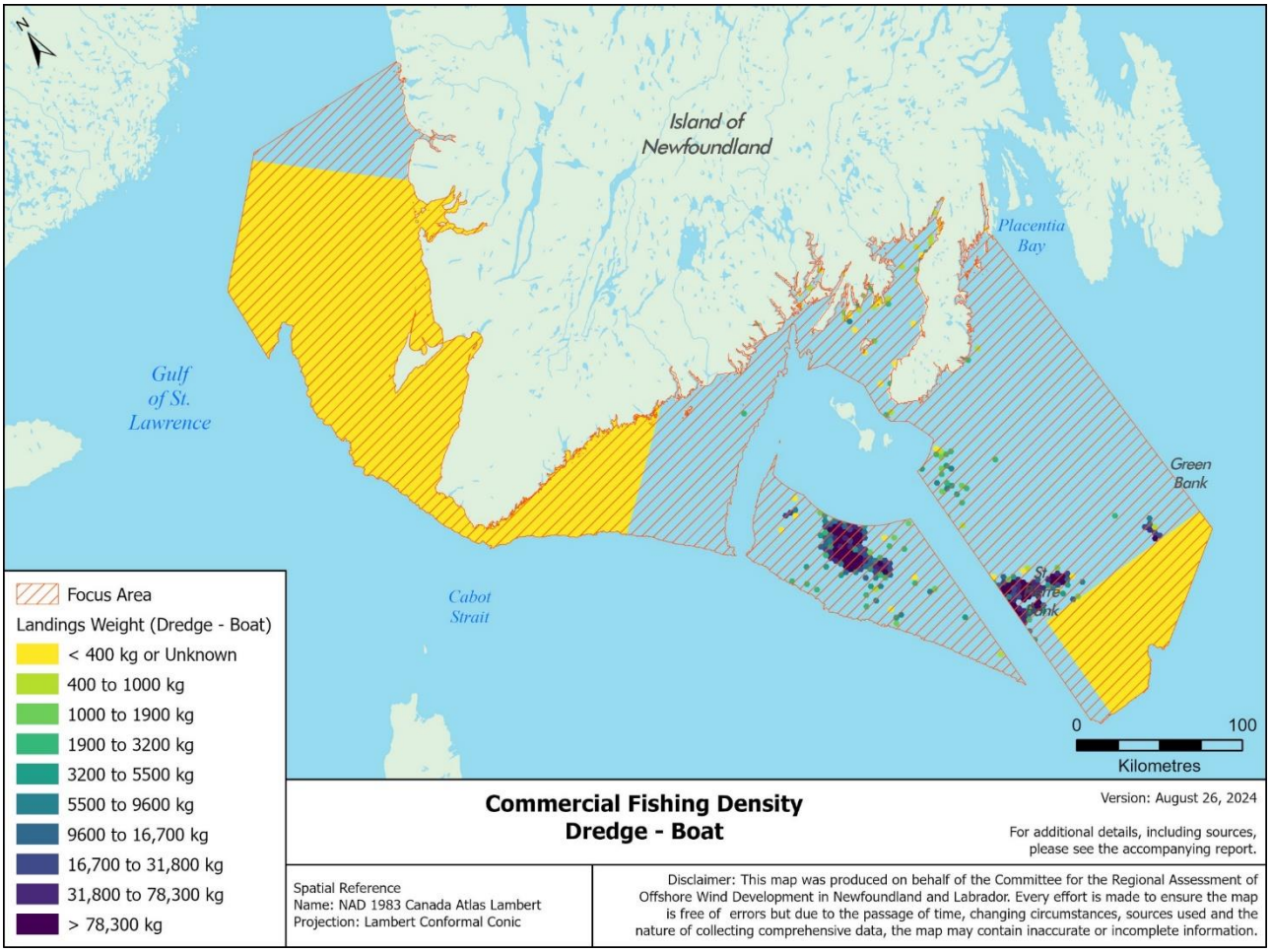
Map depicting beach and bar seine commercial fishing density for the time period from 2012 to 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries 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.
Source: (DFO, 2024b)

Figure 7.7.22. Danish or Scottish Seine Commercial Fishing Density within the Focus Area



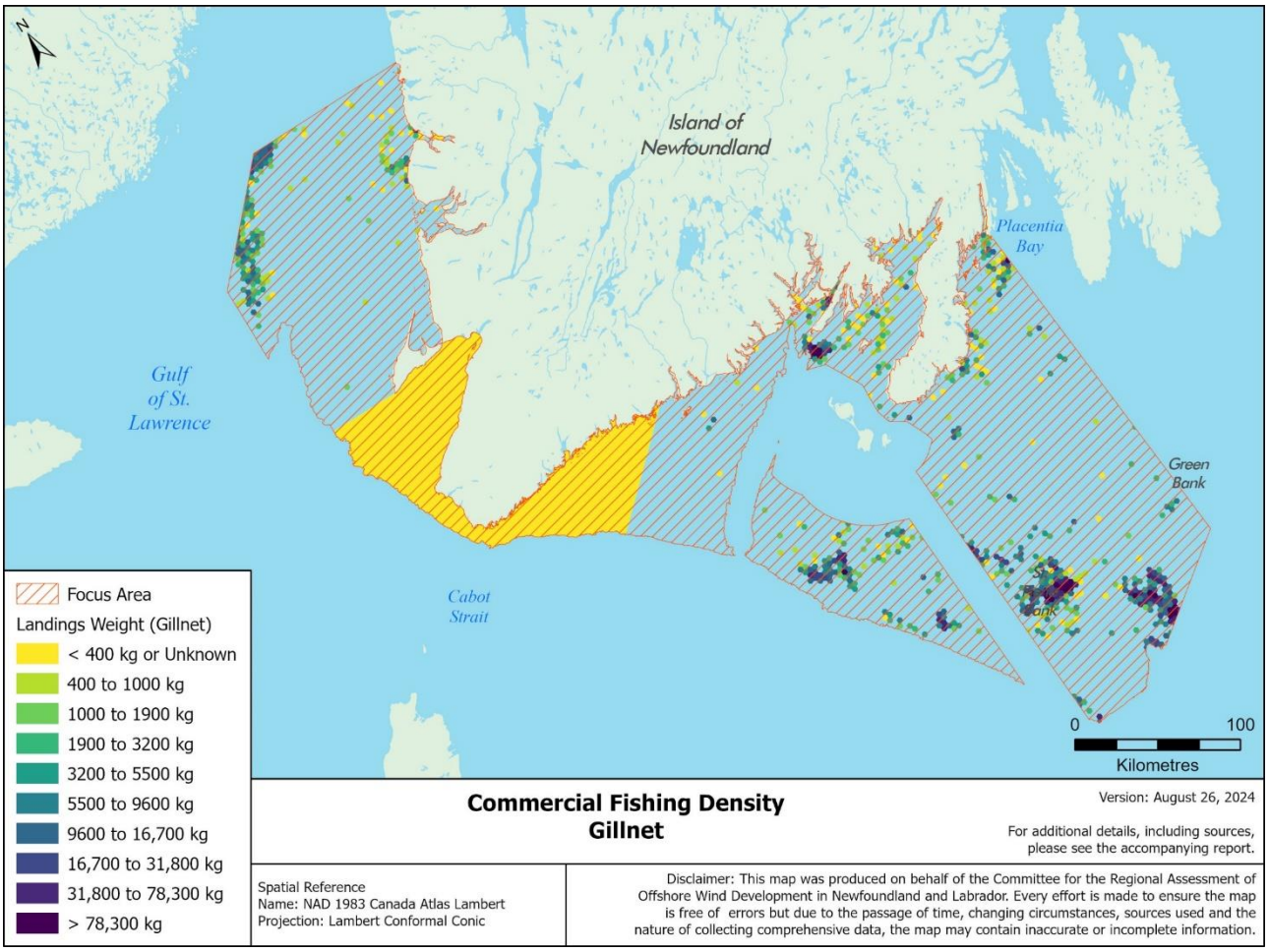
Map depicting Danish or Scottish seine commercial fishing density for the time period from 2012 to 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., 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.
Source: (DFO, 2024b)

Figure 7.7.23. Dredge (boat) Commercial Fishing Density within the Focus Area



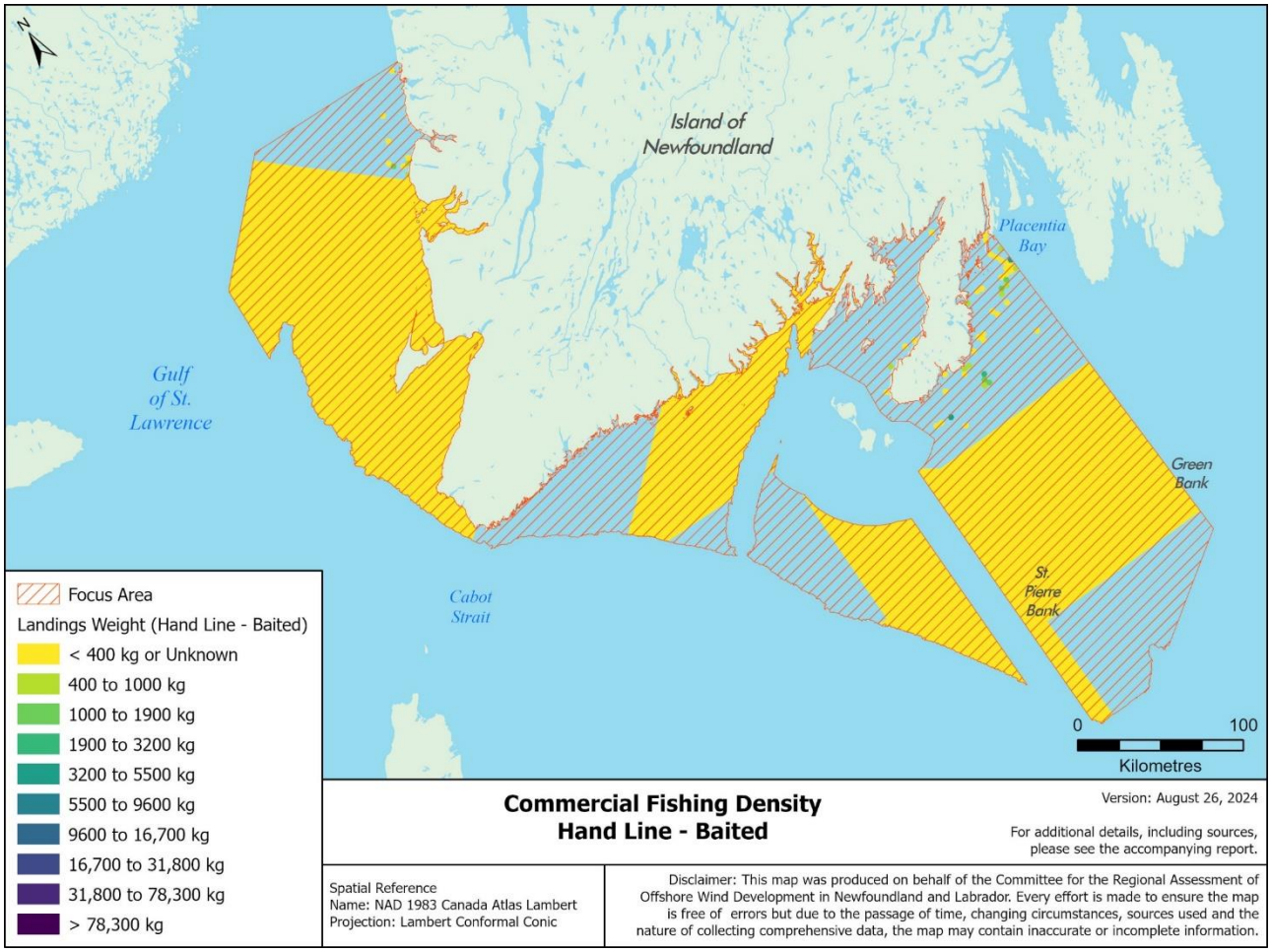
Map depicting dredge (boat) commercial fishing density for the time period from 2012 to 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries 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.
Source: (DFO, 2024b)

Figure 7.7.24. Gillnet Commercial Fishing Density within the Focus Area



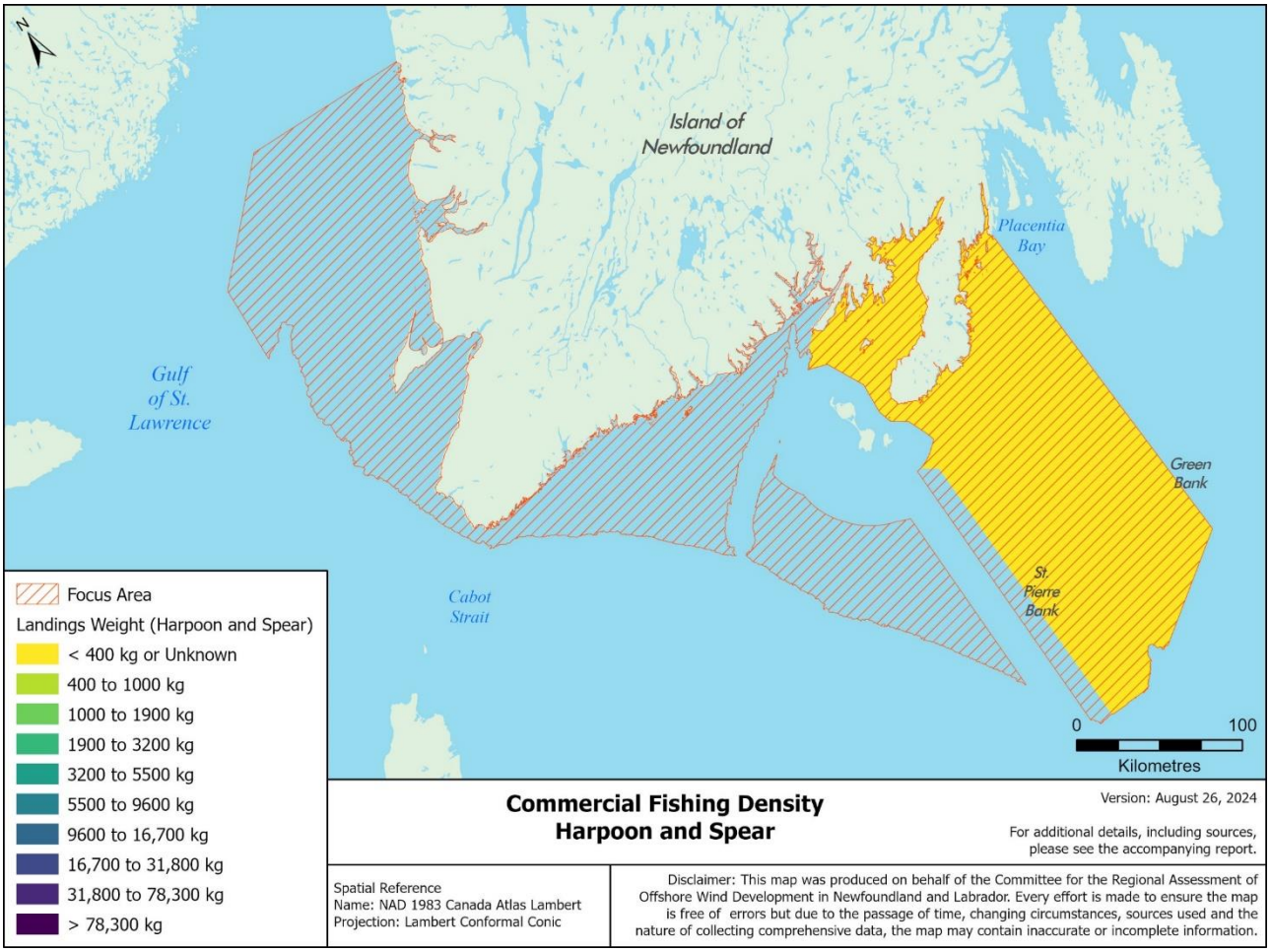
Map depicting gillnet commercial fishing density for the time period from 2012 to 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries spanning 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.
Source: (DFO, 2024b)

Figure 7.7.25. Hand Line (baited) Commercial Fishing Density within the Focus Area



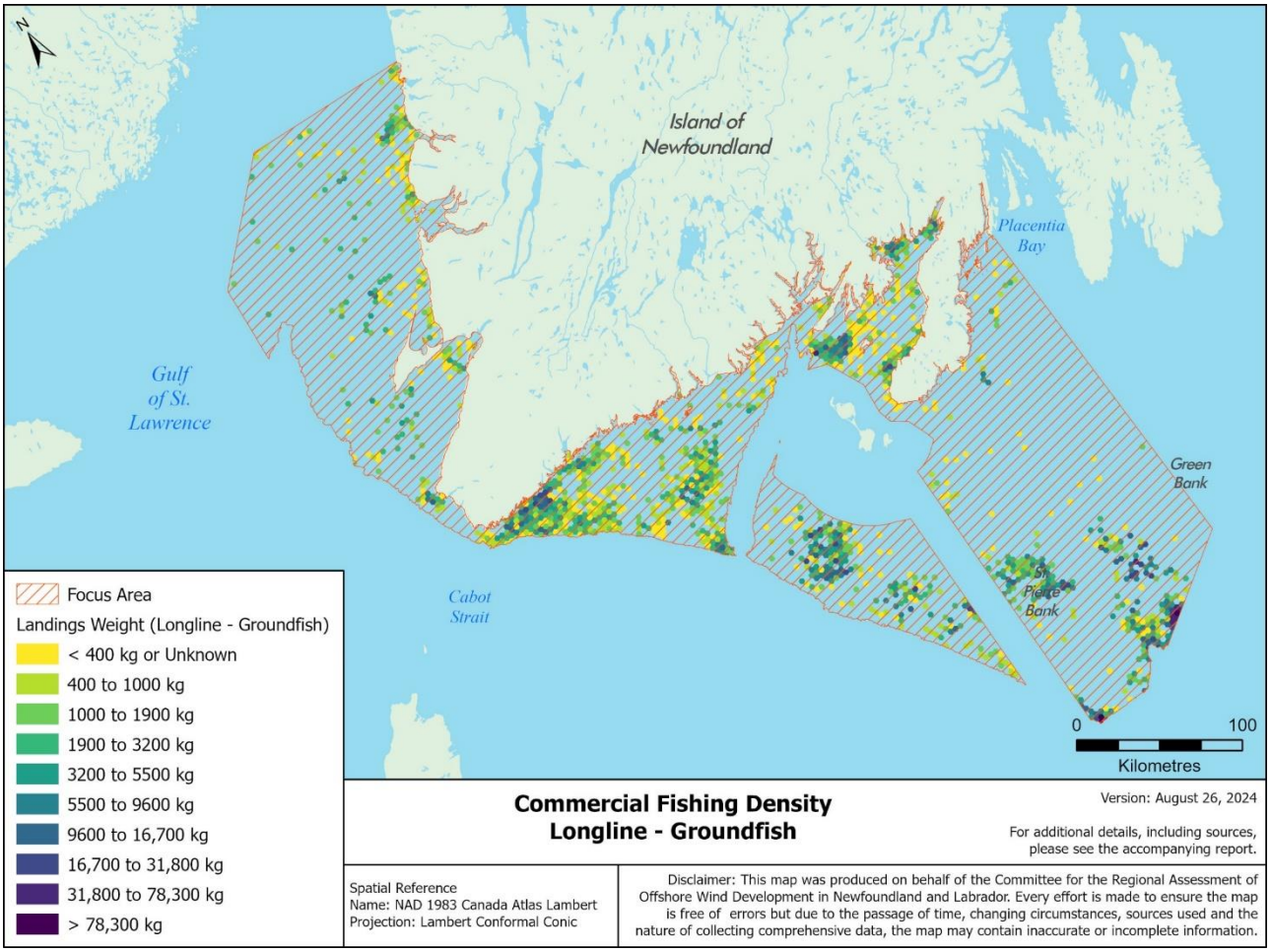
Map depicting hand line (baited) commercial fishing density for the time period from 2012 to 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries 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.
Source: (DFO, 2024b)

Figure 7.7.26. Harpoon and Spear Commercial Fishing Density within the Focus Area



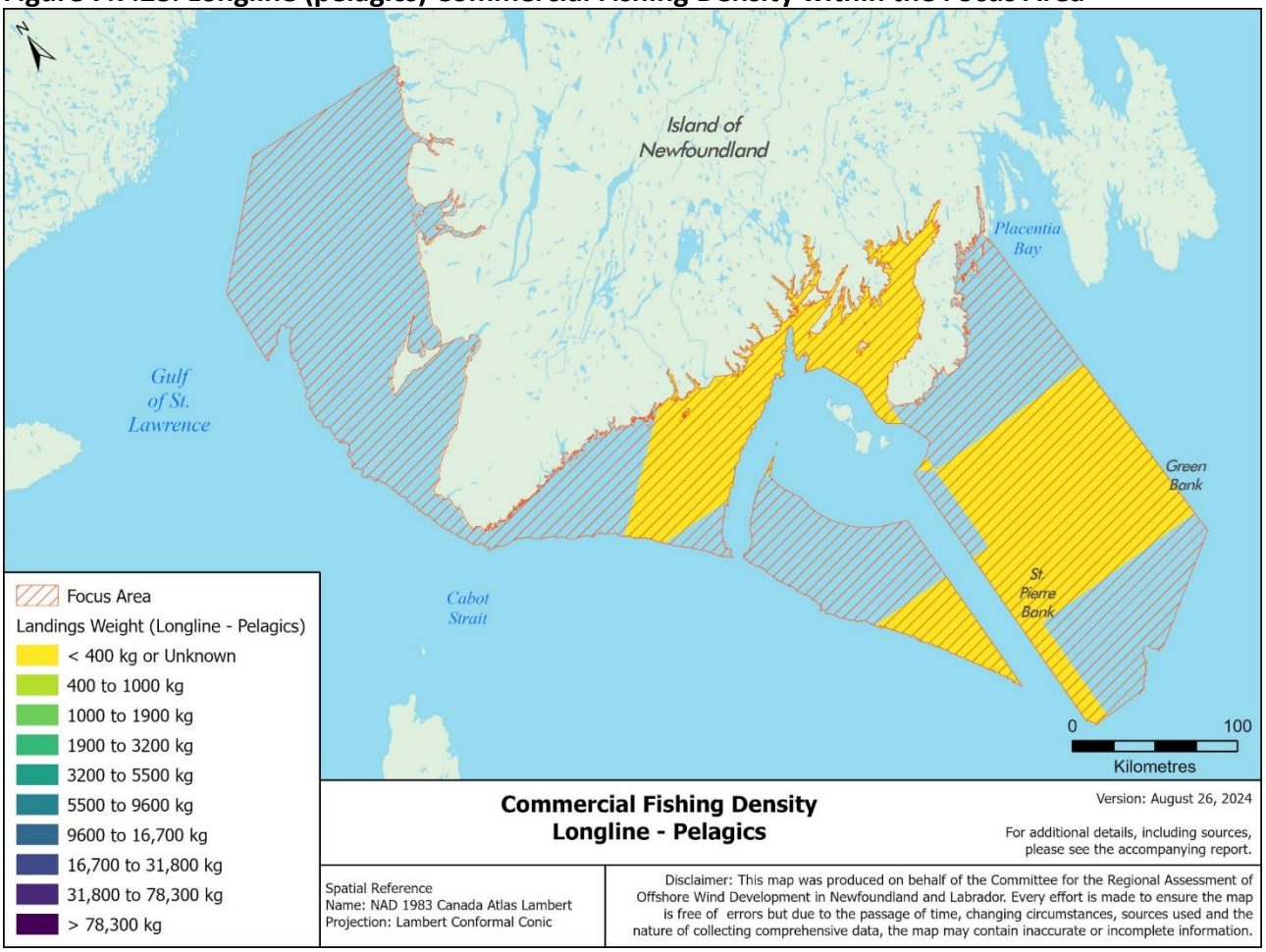
Map depicting harpoon and spear commercial fishing density for the time period from 2012 to 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries 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.
Source: (DFO, 2024b)

Figure 7.7.27. Longline (groundfish) Commercial Fishing Density within the Focus Area



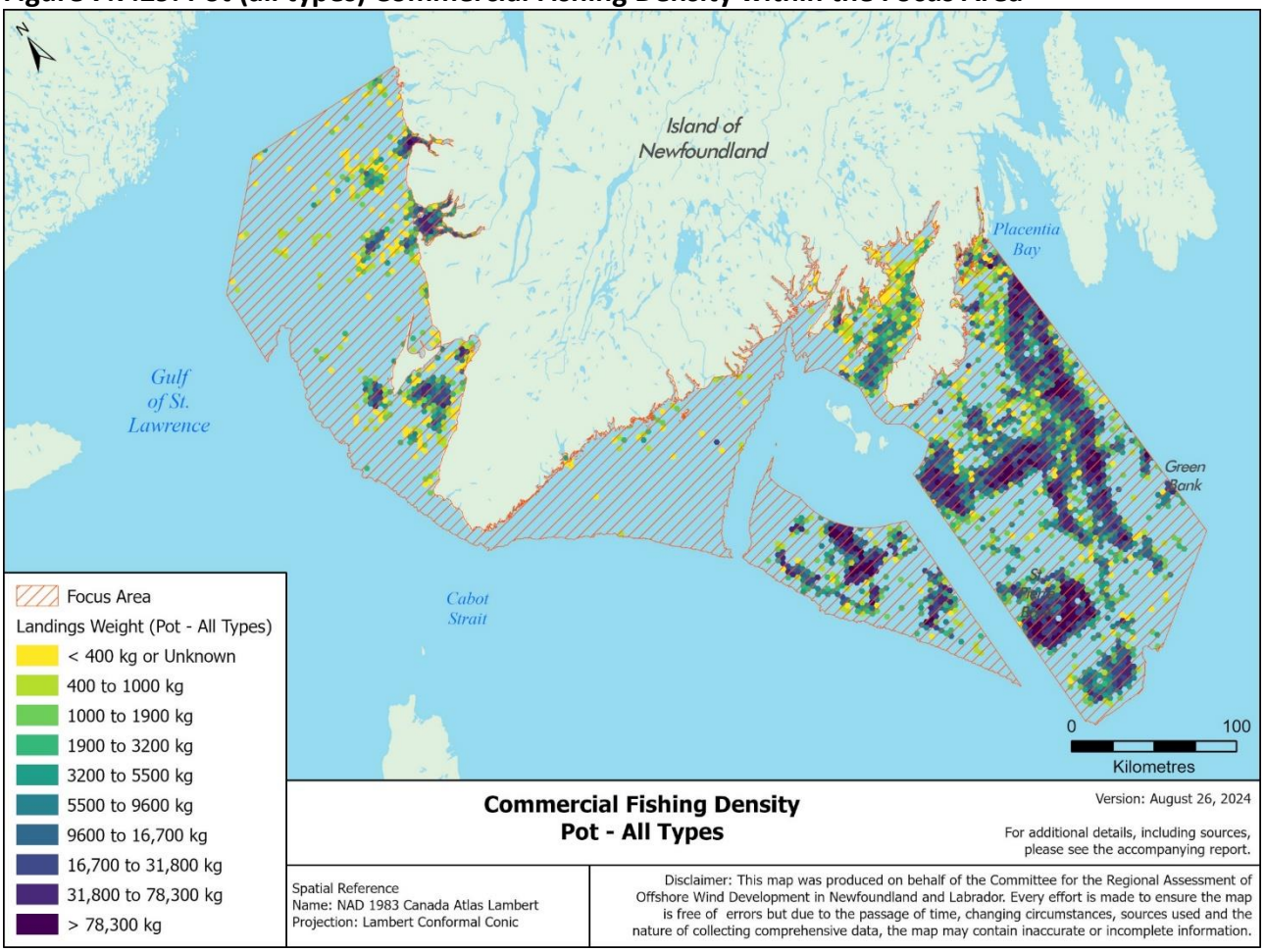
Map depicting longline (groundfish) commercial fishing density for the time period from 2012 to 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries 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.
Source: (DFO, 2024b)

Figure 7.7.28. Longline (pelagics) Commercial Fishing Density within the Focus Area



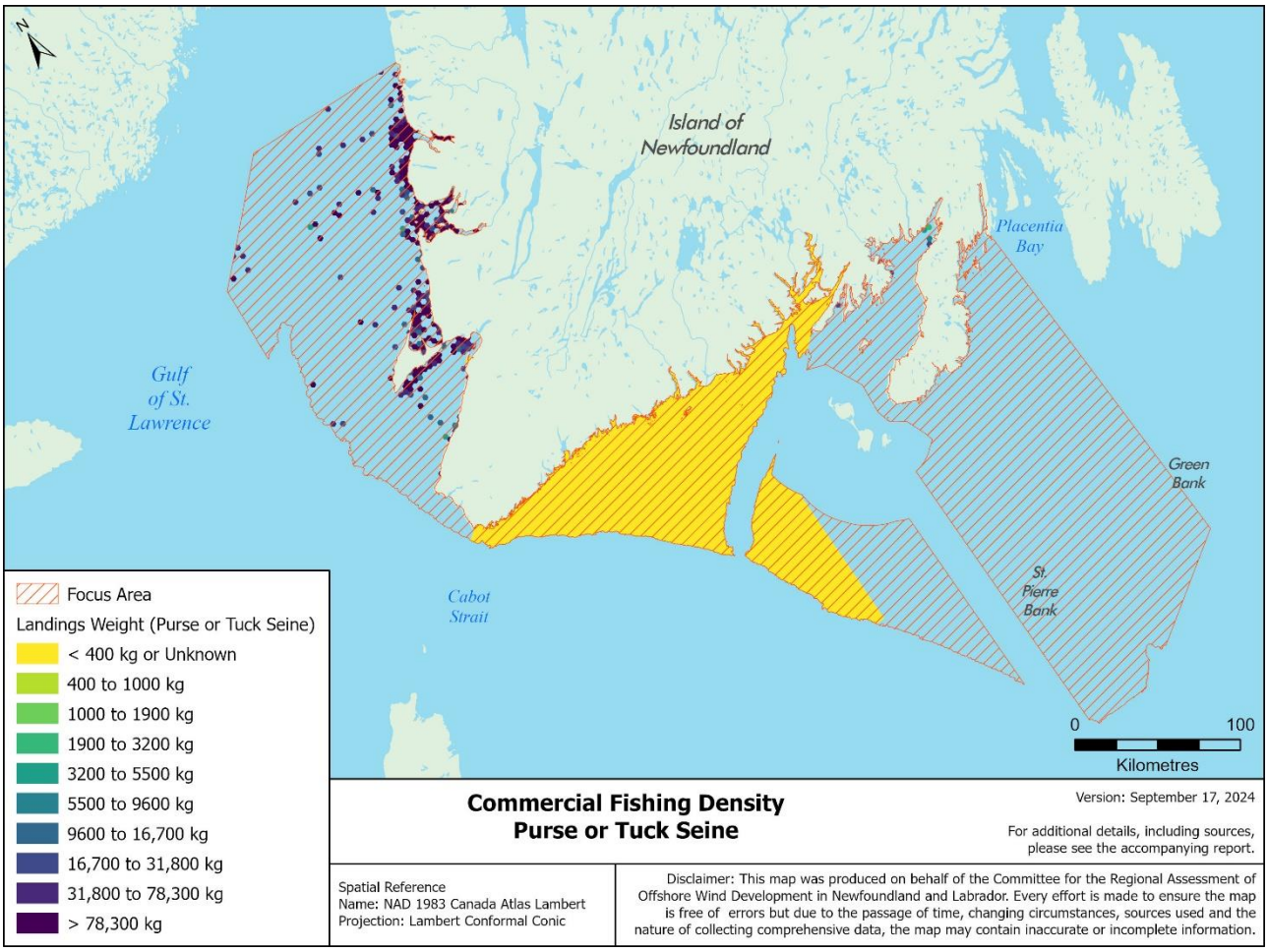
Map depicting longline (pelagics) commercial fishing density for the time period from 2012 to 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries 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.
Source: (DFO, 2024b)

Figure 7.7.29. Pot (all types) Commercial Fishing Density within the Focus Area



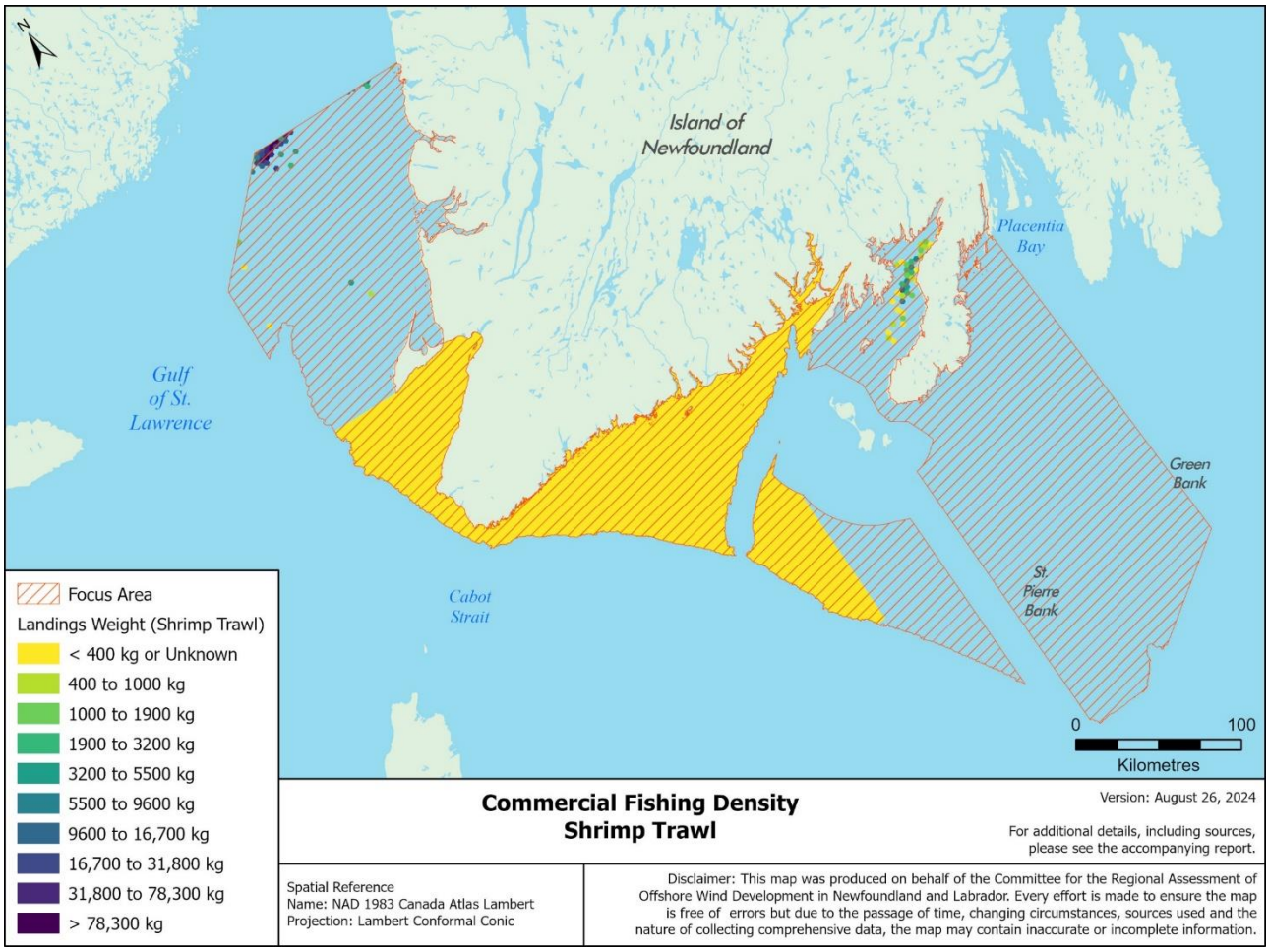
Map depicting pot (all types) commercial fishing density for the time period from 2012 to 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries 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.
Source: (DFO, 2024b)

Figure 7.7.30. Purse or Tuck Seine Commercial Fishing Density within the Focus Area



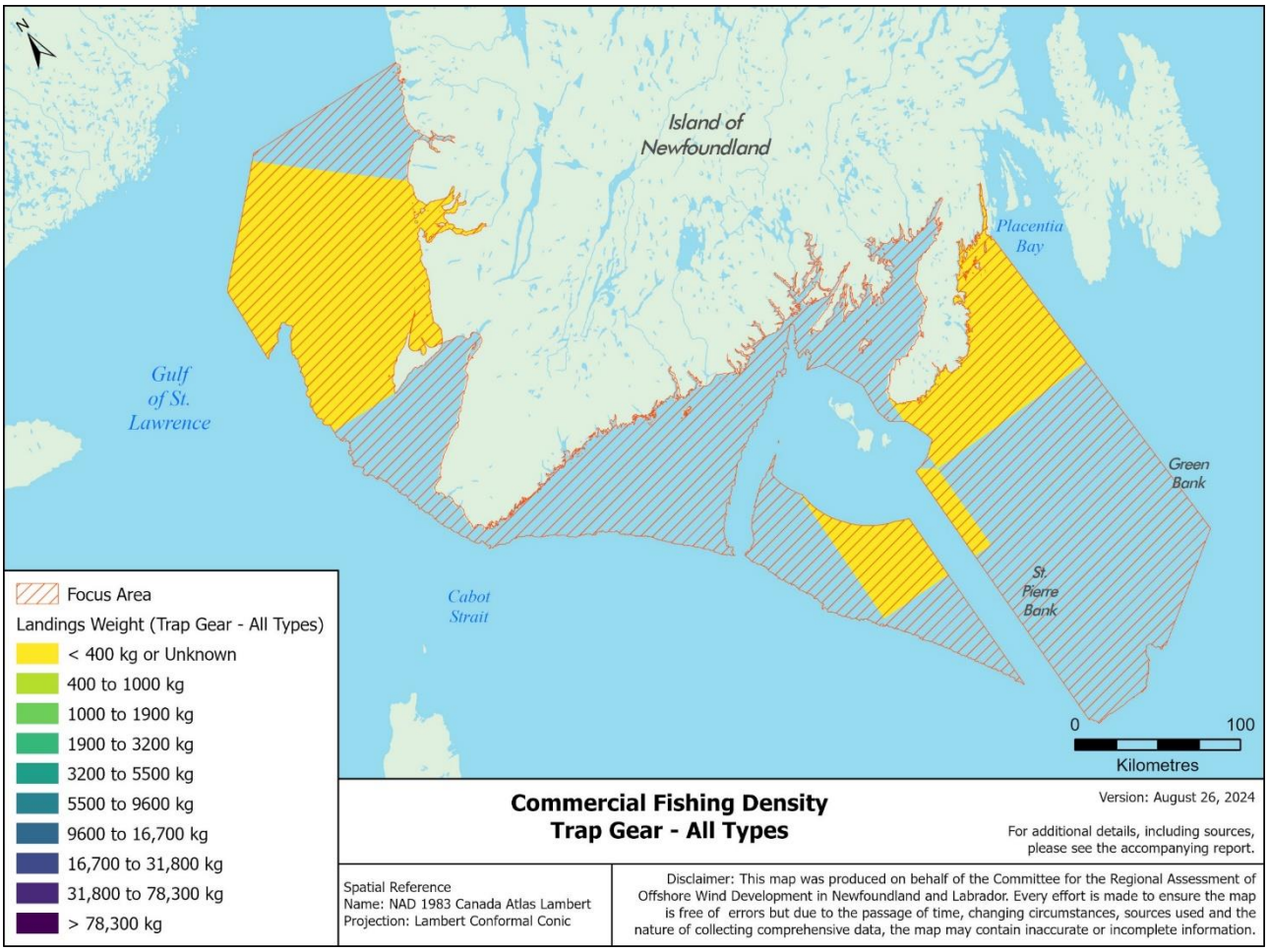
Map depicting purse or tuck seine commercial fishing density for the time period from 2012 to 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries 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.
Source: (DFO, 2024b)

Figure 7.7.31. Shrimp Trawl Commercial Fishing Density within the Focus Area



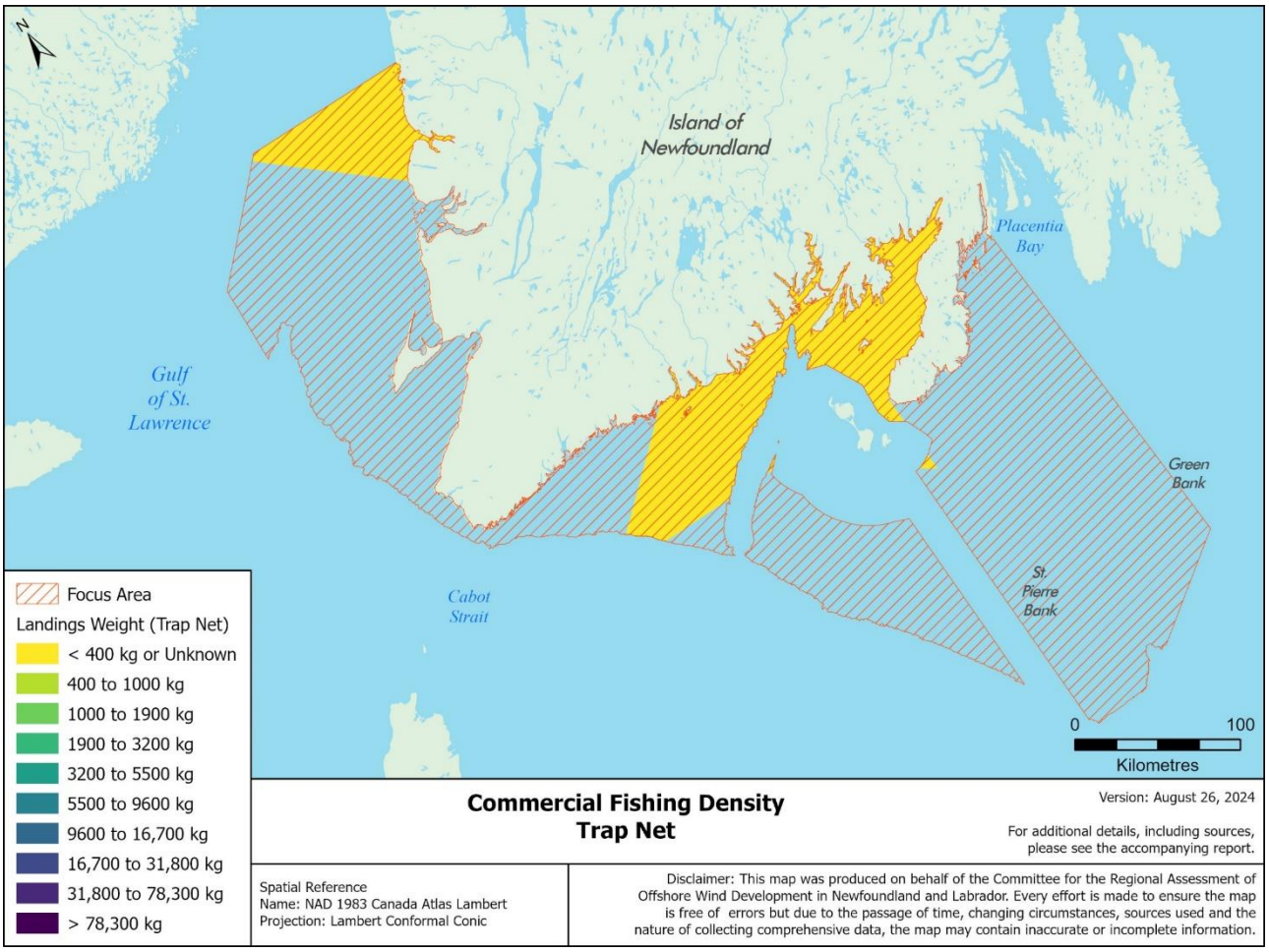
Map depicting shrimp trawl commercial fishing density for the time period from 2012 to 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries 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.
Source: (DFO, 2024b)

Figure 7.7.32. Trap Gear (all types) Commercial Fishing Density within the Focus Area



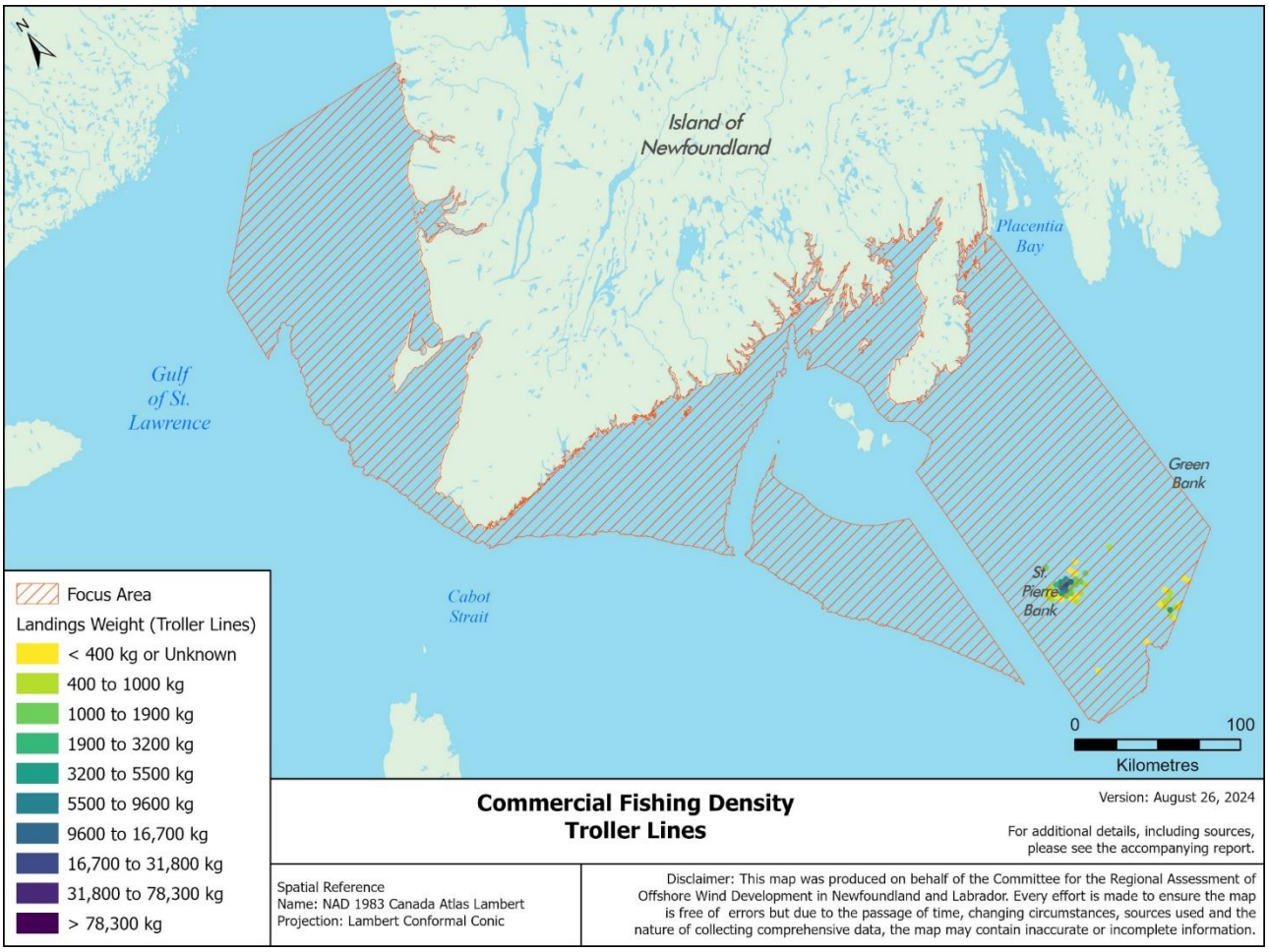
Map depicting trap gear (all types) commercial fishing density for the time period from 2012 to 2022 within the Focus Area. Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification, and only one location is given for each fishing event (i.e., fisheries 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.
Source: (DFO, 2024b)

Figure 7.7.33. Trap Net Commercial Fishing Density within the Focus Area



Map depicting trap net commercial fishing density for the time period from 2012 to 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.
Source: (DFO, 2024b)

Figure 7.7.34. Troller Lines Commercial Fishing Density within the Focus Area



Map depicting troller lines commercial fishing density for the time period from 2012 to 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.
Source: (DFO, 2024b)

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, they could have with marine development activities (see Section 7.7.2 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.

7.7.1.9 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. There is currently no georeferenced information on recreational fisheries included in the national database (DFO, 2023a). Table 7.7.14 contains information of the recreational fisheries that could occur in the Focus Area:

Table 7.7.14. 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.

Species	Licence Required	Season Dates	Authorized Gear	Limit	Other Considerations
Trout	No	Year-round in coastal waters	Angling gear	• Daily bag limit of 12 fish (combination of any of the following: Speckled, Brown, Rainbow trout, Ouananich) or 5 lbs. round weight + one fish of any of these species, whichever is reached first. • Possession limit is twice the daily bag limit.	• All incidental groundfish catch must be released in a manner that causes the least amount of harm. • 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. Consult 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. Consult 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.

Species	Licence Required	Season Dates	Authorized Gear	Limit	Other Considerations
					• Retention of Atlantic Halibut, Spotted and 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: ○ Proof of age (18 years or older). ○ A Firearms Safety/Hunter Education Certificate; and ○ Proof of successfully completing a Seal Humane Harvesting information session. • All Licence holders must follow the Marine Mammal Regulations and Conditions of licence. • All Sealing activity is monitored by Fishery Officers.

Species	Licence Required	Season Dates	Authorized Gear	Limit	Other Considerations
Scallop	Yes Recreational licence is required	Year-round	• Scuba • Drag (limited to Scallop Fishing Areas 1, 2, 3, 4, 10 & 11) • Dip-net • Hand rake	• Daily limit is 50 scallops. • Possession limit is 100 scallops.	• Use of mechanical/hydraulic devices to assist 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 describing recreational fisheries occurring within the Focus Area (DFO, 2023a; DFO, 2023l).

7.7.2 Potential Effects

The introduction of offshore wind developments within the marine environment will impact surrounding fisheries throughout all stages of development, as described in Table 7.7.15.

Table 7.7.15. Impact Pathways and Effects of Offshore Wind Development on Fisheries

Project Phase		Impact Pathway	Description of Effects
Pre-construction/Construction	• Vessel and equipment activity • Presence of Infrastructure	• 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.	

Operation and Maintenance	• Vessel and equipment activity • Presence of Infrastructure	• 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. • Exclusion zones may influence changes in seafloor communities (specifically benthic), which is also known as the fisheries exclusion effect. • 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 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. • 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.

Project Phase		Impact Pathway	Description of Effects
		• 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. • Lighting used on offshore wind turbines can affect fishing vessel navigation. • 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. • 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. • Due to additional transit time to avoid offshore wind turbines, fishers could experience an increase in fuel consumption & expenditures.	

Project Phase		Impact Pathway	Description of Effects
		• Offshore wind farms can cause fishing displacement, overcrowding in remaining areas, property loss or damage, which directly impacts fishers revenues, overall income and livelihood. • The cost of vessel insurance could increase due to the additional navigational hazards that offshore wind farms could impose.	
Malfunctions and Accidents	• Exposure to contaminates. • Vessel and equipment activity • Presence of Infrastructure	• 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. • 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	• Exposure to contaminates. • Vessel and equipment activity • Presence of Infrastructure	*See Pre-construction/Construction*	

Table depicting impact pathways and effects of offshore wind development phases and accidents on fisheries.

Source: (Andersson et al., 2017; Bat et al., 2013; BOEM, 2022a; Bonsu et al., 2024; Chaji & Werner, 2023; CSA, 2021; CSA, 2022; 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., 2020; Munroe et al., 2022; Murawski et al., 2005; NYSERDA, 2017a; NYSERDA, 2017b; NYSERDA, 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)

While it is understood that effects from offshore wind on other components have indirect effects on fisheries, those specific effects on those components can be found in Table 7.7.16 below.

Table 7.7.16. 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 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 depicting indirect effects of other components that are caused by or affect Fisheries.

7.7.3 Mitigation 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, wile 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 phases of development and the use of fisheries working groups (Whitouck et al., 2023). In the U.K., it is a legal requirement for stakeholder consultation, with fishers in Belgium, Netherlands and Britain that have indicated that they had been consulted for each individual wind farm project that were set to occur in the North Sea, North Western Water and South Western Waters (BOEM, 2022). 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 7.7.17 outlines the various mitigation measures that can be used to address various potential impacts.

Table 7.7.17. 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).cEffective 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	• Design cable layouts to accommodate fishing activities and reduce the total length of cables installed.

Mitigation/Enhancement Measure	Relevant Impact(s)	Description
	cable design on fishing vessel operators	• Avoid situating offshore wind cables in areas with heavy vessel traffic, such as high-use fishing areas. • Where feasible, bury cables to a minimum depth of 1.8 meters (6 feet) 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.

Mitigation/Enhancement Measure	Relevant Impact(s)	Description
		• Consult with experienced navigators, regulators, and other knowledgeable stakeholders to determine preferred fishing routes in the area.
Safety Measures	Effects from offshore wind developments on fishing vessel operators' safety	• Map all infrastructure and obstacles for each project phase and distribute these maps to relevant stakeholders and regulators. • 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 consultation 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	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.

Mitigation/Enhancement Measure	Relevant Impact(s)	Description

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 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 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 depicting mitigation measures for fisheries. Additional mitigation measures to indirect effects can be found in the supporting mitigation sections to those outlined in Table 7.7.17.
Sources: (Allen-Jacobson, et al., 2023; Bat et al., 2013; BOEM, 2016; BOEM, 2022; 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, 2017; NYSERDA, 2022; Pettersen et al., 2024; Rawson et al., 2015; Reilly et al., 2016; Weigell & Jahn, 2022; Withouck et al., 2023; Wright et al., 2019)

7.7.4 Engagement Outcomes

During Committee engagement sessions and activities, there was consistent attendance from fishers, but the Committee does understand that they were 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 fishing season. 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 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, to proceed.
- What are the are the positive and negative effects of offshore wind on fisheries?
- How will offshore wind 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.

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, hence not getting a full picture of where the fisheries occur. 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 they could on small vessel fisheries during their 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 consultation 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 when it comes to 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 should not be replacing the fishing industry in certain areas.[67] 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. 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 licencing areas, such that it does not impact MFN fishing activities in this area. They did indicate that the 10km 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 seaduck 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 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 consulted 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.

7.7.5 Data Gaps and Limitations

Limitations associated with fisheries include:

[67] A reference to the Registry post was not available in time for inclusion in this Report, but it should be uploaded to the Registry in the near future.

- 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, so 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 (i.e., density does not equal economic value).

7.7.6 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:

- 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 that offshore wind developers avoid peak season for fishers during construction and decommissioning to lessen the impacts of these activities. Collaboration with fishers/fishing communities will be important throughout all phases of activity.
- The Committee recommends the establishment of a MSP for the water surrounding the province, with a preliminary focus on areas of competing uses and areas in which offshore wind developers are considering.
- The Committee recommends Transport Canada (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 and engagement with fisheries should be established during a project specific environmental assessment, to avoid conflict of uses wherever possible.
- The Committee recommends consideration of compensation framework for fishers that are displaced by offshore wind or experience gear damage or loss due to entanglement or damage caused by offshore wind farms.

7.7.7 References

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7.8 Other Ocean Uses

7.8.1 Existing Conditions

In addition to fishing activities taking place in the Focus Area, Newfoundland'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 a visual aid 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 a various government agencies, non-government organizations, academic institutions, or from various industries. These research programs could include, but are not limited to:

- Summer and fall multispecies surveys conducted by DFO Newfoundland and Labrador occur Region throughout the Focus Area (DFO, 2023a).
- DFO AZMP which collects and analyzes biological, chemical and physical oceanographic field data to provide understanding to 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.).

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

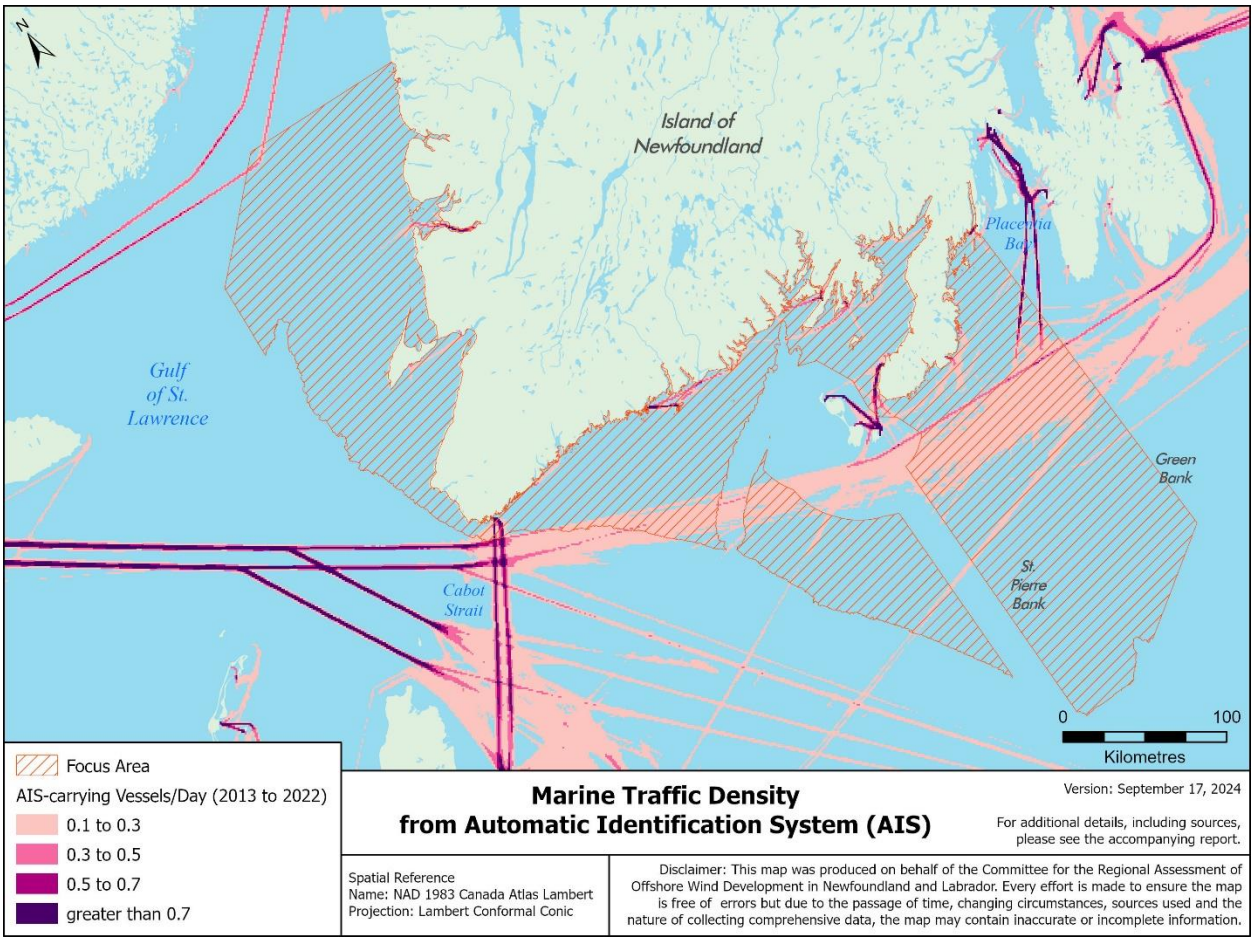
There is extensive marine vessels transit through the Focus Area throughout all seasons of the year. Marine traffic can include fisheries and research vessels; domestic activity such as cargo, cruise vessels, and passenger vessels moving to and from Canadian ports and/or between Newfoundland communities 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 houses 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 also 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 does not have AIS system on board, which can include smaller fishing, tourism or recreational vessels.

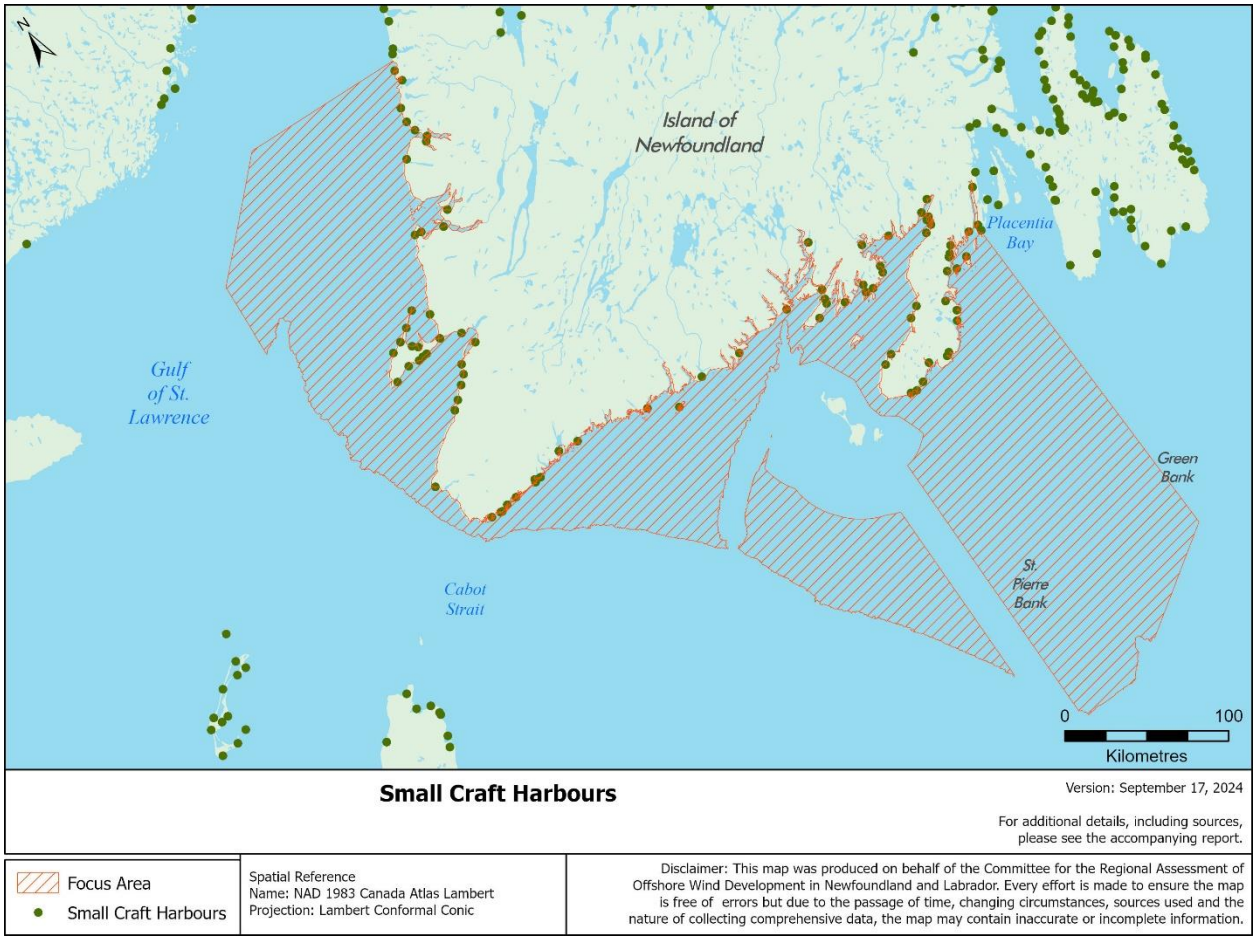
Figure 7.8.1. Vessel Density within the Focus Area



Map depicting the vessel density of AIS tracked vessels within the Focus Area.
Source: (DFO, 2024b)

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, 2024c). 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



Map depicting Small Craft harbour locations adjacent to the Focus Area.

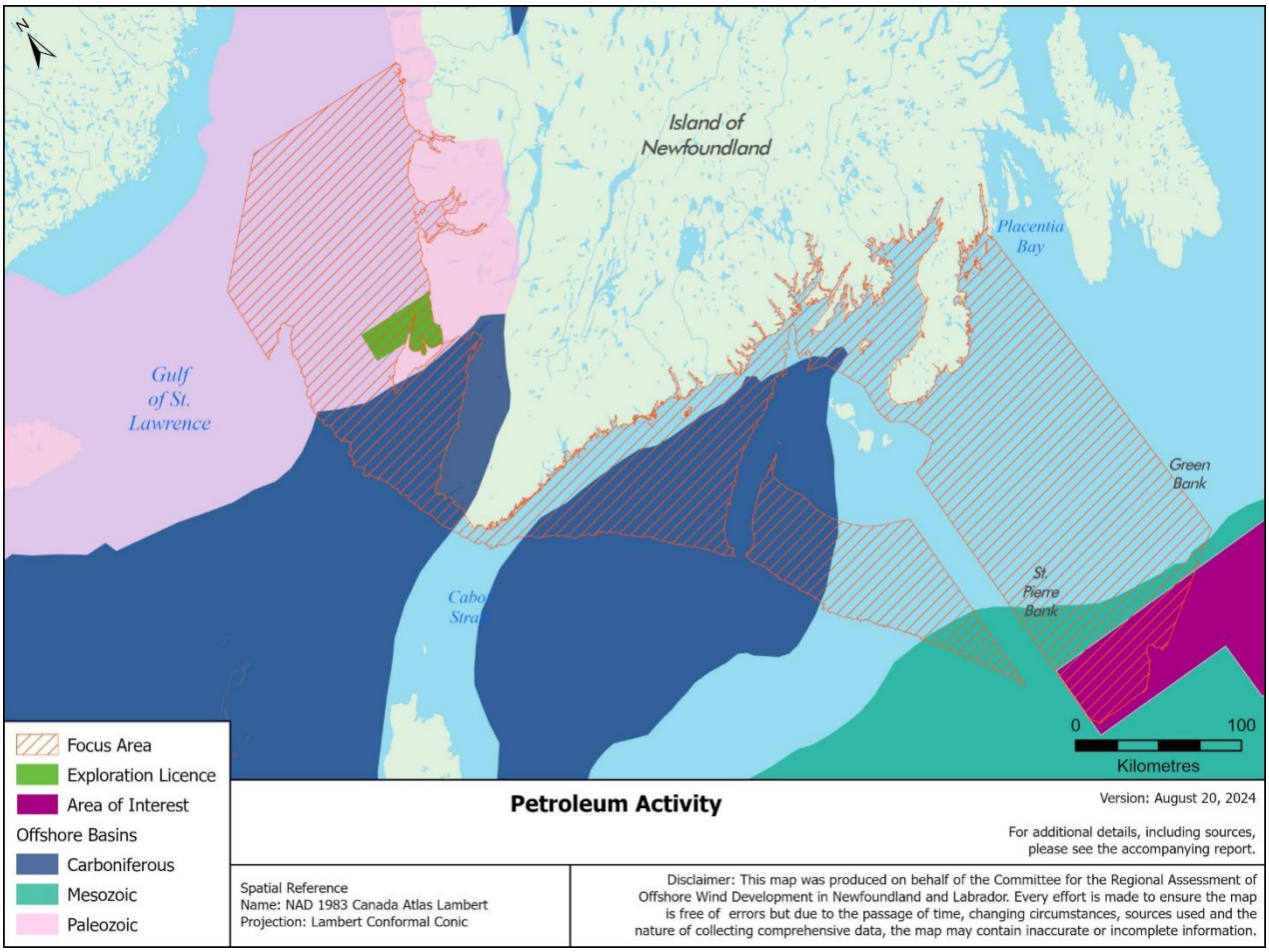
Source: (DFO, 2023b)

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 (CNLOPB, 2024).

Figure 7.8.3. Petroleum Activity in and around the Focus Area



Map depicting Exploration Licences and Offshore Basins in and around the Focus Area.
Sources:
Exploration Licences: (Department of Energy, Industry and Technology, 2024a)

Area of Interest: (Department of Energy, Industry and Technology, 2024b)

Offshore Basins: (Department of Energy, Industry and Technology, 2022)

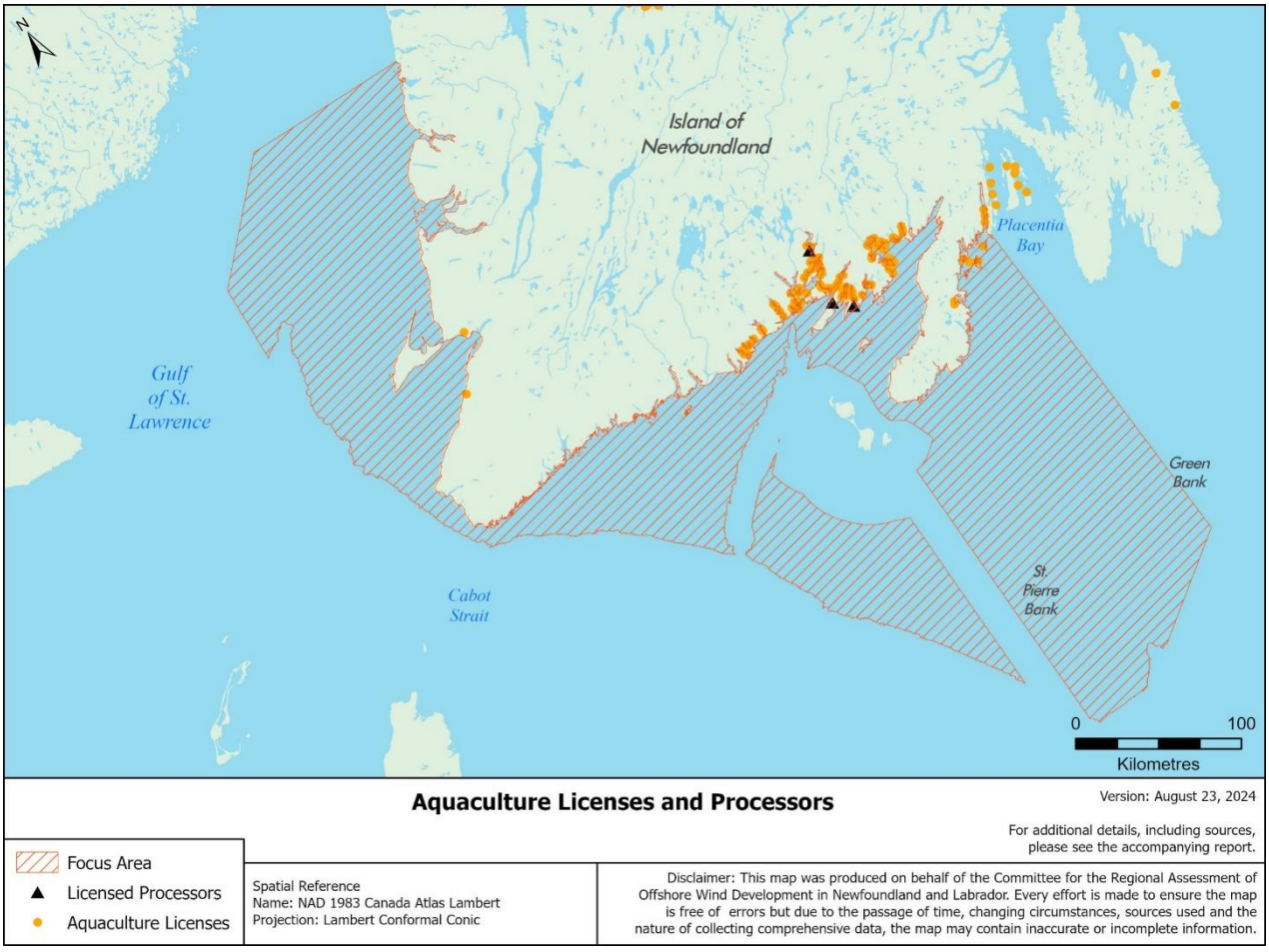
Seismic activity has and could occur within western and southern Newfoundland if the potential for hydrocarbons increases within these areas in the future. Future exploration drilling and production could also occur if hydrocarbons are discovered. During petroleum related activities, there is increased 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 (Department of Fisheries, Forestry and Aquaculture, n.d.). 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 to 523 direct employment opportunities and approximately 994 indirect opportunities (Government of Newfoundland and Labrador, 2024).

Figure 7.8.4. Aquaculture Licences and Processors within and adjacent to the Focus Area



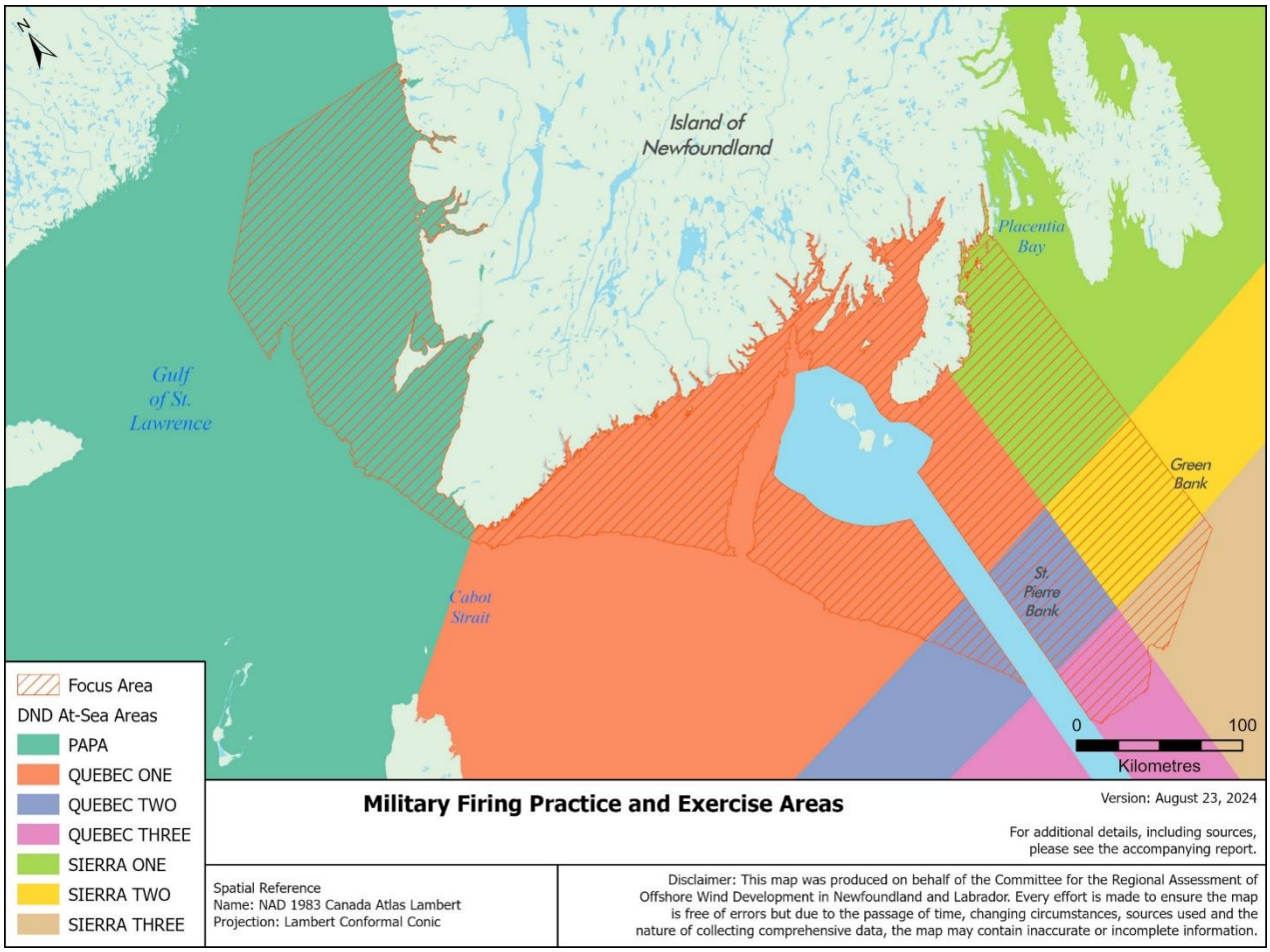
Map depicting aquaculture licences and processors within and adjacent to the Focus Area.
Source: (Fisheries, Forestry and Agriculture GeoHub, n.d.)

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). There is potential for live firing exercises 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



Map depicting military firing practice and exercise areas within and adjacent to the Focus Area.
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.

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 Study 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, 2018).

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 to 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, 2024). 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. 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 users, as seen in Table 7.8.1, while also having indirect effects shared by various other components, as seen in Table 7.8.1. For further understanding of these additional effects, please refer to the sections referenced.

Table 7.8.2. Impact Pathways and Effects of Offshore Wind Development on Other Ocean Users

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	

Project Phase		Impact Pathway	Description of Effects
		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 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 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 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.	

Project Phase		Impact Pathway	Description of Effects
		• See Pre-construction/Construction, as similar effects are observed	

Table depicting impact pathways and effects of offshore wind development phases and accidents on other ocean users.
Source: (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 Users.

Component	Indirect Effects	Section
Fisheries	Impacts to commercial fishing through changes in fishing areas that may overlap with other ocean users, as well as changes to navigational routes. Most literature combines fisheries effects along with aquaculture.	7.7.2
Physical and Cultural Heritage	Impacts to features that may draw tourism.	7.11.2
Communities and Economy	Impacts to coastal community jobs and economy.	7.13.2
Marine Fish and Fish Habitat	Impacts to fish health and ecosystem within aquaculture set ups.	7.4.2
Visual Aesthetics and Viewscapes	Impacts to viewscapes can affect tourism and coastal uses.	7.9.2

This table summarizes the potential indirect effects to other components if other ocean users are affected by offshore wind development.

7.8.3 Mitigation and Other Measures

Addressing offshore wind impact on other ocean users 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 and other ocean users.

Table 7.8.3. Mitigation measures for impacts to other ocean users

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 >5 km from a weather radar.

Stakeholder consultation & Navigational Assessments	Minimizing the potential impacts of wind turbines on Shipping & Other Marine Vessel Navigation	• Consult 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 consultation & 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 consultation & Marine Spatial Planning initiatives	Minimizing the potential impacts of wind turbines on Scientific Research and Surveys	• Consult 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
Stakeholder consultation & 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 consult with affected parties

Table depicting mitigation measures for other ocean users. Additional mitigation measures to indirect effects can be found in the supporting mitigation sections to those outlined in Table 7.8.2.
Source: (BOEM 2022; NYERSDA 2017; Wetra Lights n.d.)

7.8.4 Engagement Outcomes

Throughout the Committee's engagement activities, the Committee received feedback from the public highlighting the need for the effects of offshore wind 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 stated within their response to the Committee's Request for Advice #2, that since the tourism industry focuses heavily on natural areas, and markets these places to people living in places where these natural areas are being lost, therefore these natural areas are 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 consulted on potential offshore wind developments if within areas suitable to aquaculture (Government of Newfoundland, 2024). 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.

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 users:

- 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 consult with DND to ensure there no conflicts with planned or future exercises, or UXO sites. The Committee notes a pre-development survey would identify UXO hazards to be avoided or removed when siting a project.

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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.

7.9.1 Existing Conditions

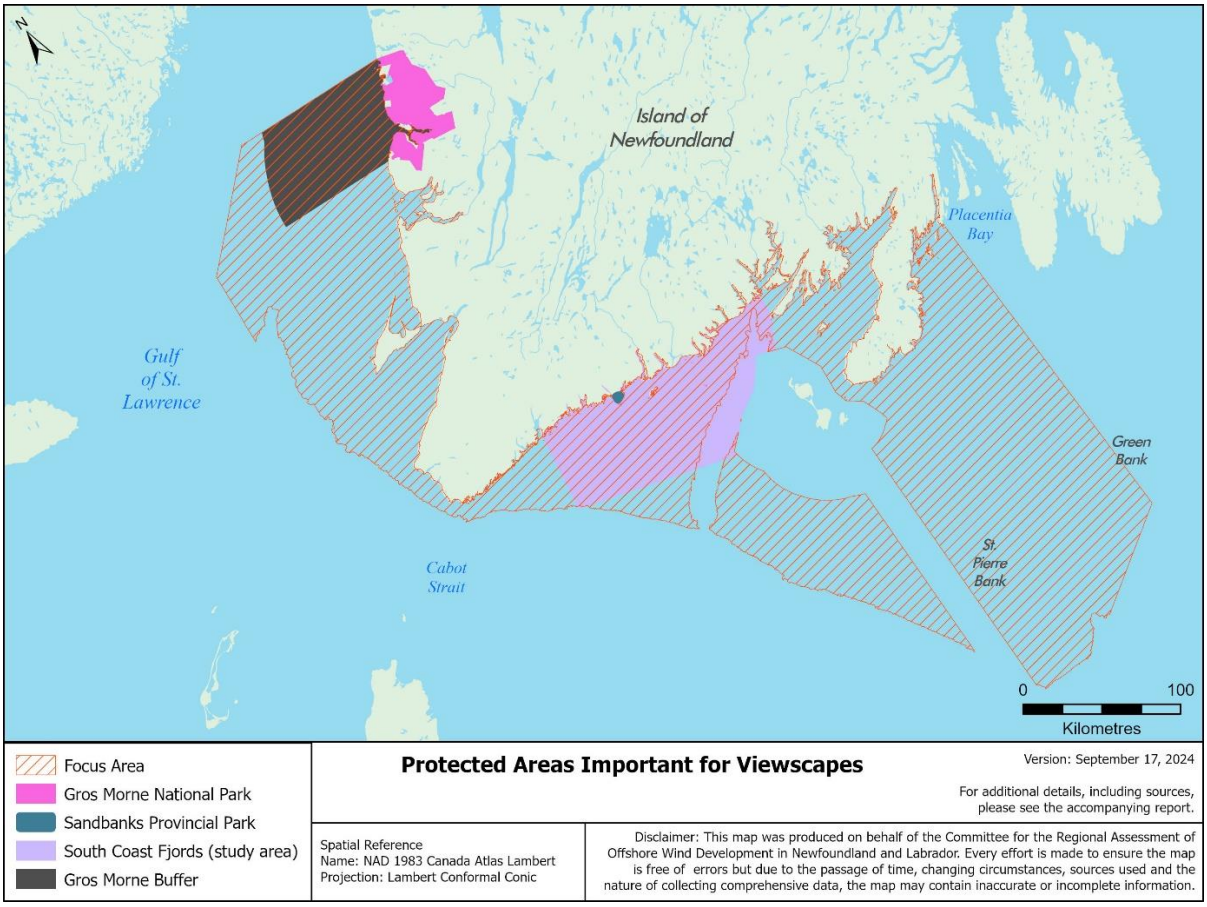
Rugged wilderness is an important aspect of Newfoundland and Labrador culture and for commercial tourism. Particularly sensitive viewscapes within the Focus Area (e.g., areas with rare or high scenic quality, popular tourist areas, and natural or wilderness areas) include nationally and provincially 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* 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 (Newfoundland and Labrador Department of Environment and Climate Change, 2020). Furthermore, the province recognizes the benefits of provincially protected areas include providing for the enjoyment and appreciation of outstanding scenery, landscape, and wildlife (Newfoundland and Labrador Department of Environment and Climate Change, 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 when identifying offshore wind licencing areas. This buffer is shown on the map. The Committee also removed the South Coast Fjords study area when identifying offshore wind licencing areas. Avoiding development there could protect viewscapes at 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



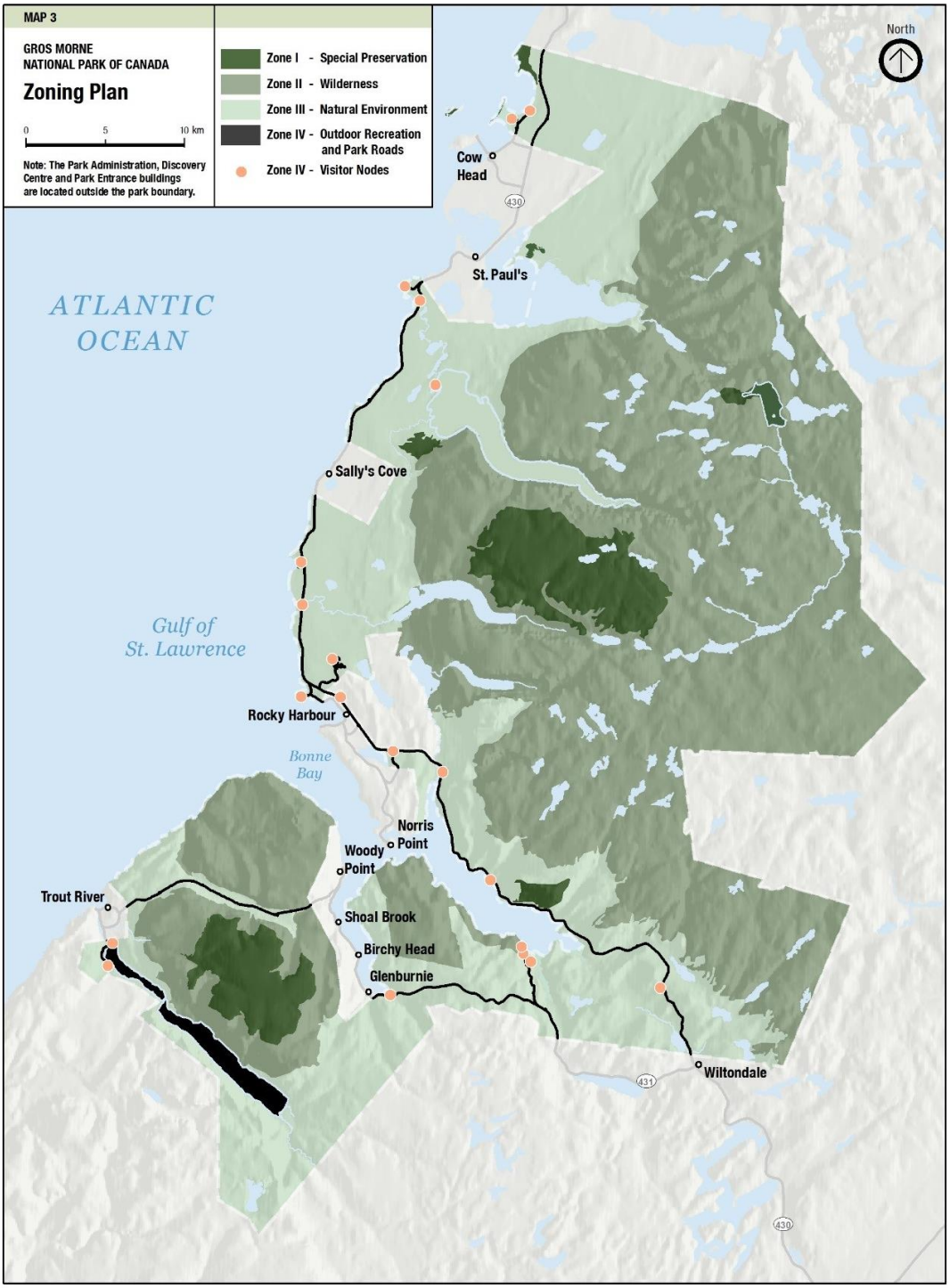
This map shows locations of existing and proposed federally protected areas along the coastal boundaries of the Focus Area, and the Committee's approach to avoiding important viewscapes from those areas. The protected areas shown are GMNP and Sandbanks Provincial Park. An 80 km buffer perpendicular to 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 in the Focus Area. Further work needs to be carried out during project-level impact assessments.
Sources: Committee for the Regional Assessment of Offshore wind Development in Newfoundland and Labrador, 2024; Environment and Climate Change Newfoundland and Labrador, 2022; IAAC, 2023; NRCan, 2022; Parks Canada, 2024.

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 has 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 Agency, 2020).

The majority of Gros Morne is designated Zone II: Wilderness (60%) or Zone III: Natural Environment (33%) (Figure 7.9.2). (Parks Canada Agency, 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



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%).
Map From: Parks Canada Agency, G. of C. (2020). *Gros Morne National Park of Canada Management Plan*. https://parks.canada.ca/pn-np/nl/grosmorne/info/plan/gestion-management-2019

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.[68] 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 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 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 also offer coastal views around the park (Parks Canada Agency, 2023). 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 Agency, 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 sediments. The park also presents an outstanding demonstration of glaciation in an

[68] The Parks Canada Agency Recommendation Report to the Committee is available on the Registry Page under document reference 182.

> 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 & UN EWCMC, 2011).

In March 2023, UNESCO published Guidance for Wind Energy Projects in a World Heritage Context. 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 province 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. In May 2023, the Newfoundland and Labrador Department of Environment and Climate Change asked WERAC to move forward with consultations on these priority sites (Environment and Climate Change Newfoundland and Labrador, 2024). 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.[69] 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 a strong seasonal and geographic trend. 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.

Fog at GMNP and south towards St. George's Bay is relatively low. Based on fog climatology analysis, fog is highest during the months of April, May, June and July. It occurs less than 5% of the time at GMNP during the months of October to 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 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.

[69] The ECCC (Meteorological Service of Canada) Response to the Committee's Request for Advice is available on the Registry Page under document reference 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. • 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.

This table summarizes potential effects of offshore wind development on visual aesthetics and viewscapes.
Sources: BIS, 2018; Ecogain AB, 2021; Kaldellis et al., 2016; NYSERDA, 2017a; Public Institution Coastal Research and Planning Institute, 2023; White Consultants, 2019; Wind Sweden & Simply Blue Group, 2022a, 2022b.

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 (Divine-Wright & Howes 2010; Landry et al., 2012; Smyth et al., 2020; Wind Sweden & Simply Blue Group, 2022a, 2022b).

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 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, 2010; 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 development tends 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. They report found four projects 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 (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 2017b; Sullivan *et al.* 2013; Wieduwilt & Wirth, 2018; White Consultants, 2020; Wratten, 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.[70] 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 1:100 for average medium magnitude effect. 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

[70] Section 4 of this Report includes information on current and projected turbine size. In 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).

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 7.9.3 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
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

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)
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

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, 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 visible at 70 km from a cliff and at 45 km from a beach • Only tops of turbine tips visible at 55 km from the beach • Minor visual effects of red light at 24 km
NYSERDA, 2017b	
Project / Site Conditions	• Hypothetical project along the coast of Long Island (photorealistic visual simulations) • 100-turbine project with 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 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 this 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 3.6MW 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

This table summarizes findings on visibility threshold for offshore wind farms with different project and site conditions.
Sources: NYSERDA, 2017b; Sullivan et al., 2013; Wratten, 2005; Wieduwilt & Wirth, 2018.

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. (Ecogain AB, 2021; Moray Offshore Windfarm (West) Limited, 2018; Sullivan, 2021; Sweden Offshore Wind AB & Vatenfall, 2007; White Consultants, 2020; Wind Sweden & Simply Blue Group, 2022a; USDI 2013).

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
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 aircraft is within a specified distance of the offshore wind facility; otherwise, the AOL is not on

Mitigation Measures	Description
"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

This table summarizes common measures used to mitigate the effects of offshore wind development on visual aesthetics and viewscapes.
Sources: BIS 2008; Cléirigh 2000; Orr et al. 2013; Public Institution Coastal Research and Planning Institute, 2023; Sullivan 2021; Sweden Offshore Wind AB & Vatenfall, 2007; USDI 2013.

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 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 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 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 (Bureau of Land Management, 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, the Parks Canada Agency provided the Committee with expert advice about potential visual impacts of offshore wind development on the protected sites they manage. The Committee's Licencing Area Recommendations took this advice into account, and a precautionary approach was taken to avoid visual impacts to any location in GMNP and Sandbanks Provincial Park (see Section 8 of this Report, Identifying Recommended Offshore Wind Licencing Areas). 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 province 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 province 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 consultation with federal and provincial authorities, complete visual assessments to identify sensitive viewscapes that could be impacted by 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 effects of offshore wind development projects on sensitive viewscapes, and
  - consult Parks Canada and the Newfoundland and Labrador Department of Environment and Climate Change; 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

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7.10 Acoustic Environment

7.10.1 Existing Conditions

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 (such as 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 (i.e., species and their status/vulnerability to offshore wind development activities).

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.

A thorough understanding of baseline ambient noise in the marine environment goes beyond considering the sources. It also requires consideration of how oceanographic characteristics (such as 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., 1995b). Such a description of the marine acoustic environment is beyond the scope of this Regional Assessment.

7.10.2Potential Effects

Offshore wind development activities can have significant effects on the acoustic environment, and 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, 2022).

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, 2022).
Despite its shorter timeframe, construction activities have the potential to generate high intensity noise (Mooney et al., 2020; SEER, 2022). 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 & Howel (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, 2022; 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, 2022).

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, 2022). 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 and seafloor, and on the sea surface, underwater noise decreases with distance from the source (SEER 2022). 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 for how long (Bailey et al., 2010; Richardson et al., 1995b).

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 describes 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 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 has been described extensively 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

Tabel description: This table provides a summary of potential indirect effects of noise associated with offshore wind development activities on marine mammals, fish, invertebrates, Aerofauna and humans.
Sources: (Mooney et al., 2020; Thomsen et al., 2006)

7.10.3Mitigation 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 mitigations 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 to 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, 2022).

7.10.4Engagement 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.

7.10.5Data 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. Majority of studies focuses 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, 2022).
- **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).

7.10.6Committee 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.

The Committee recommends collaboration amongst government of Canada and regulatory authorities, 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.

7.10.7References

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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 to both 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 a navigational beacon for mariners and sometimes provided communication links between the ships and the shore (DFO, 2019). 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 incredibly view 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.

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*, and the Archaeological Investigation Permit Regulations under the Act, due to their historical or architectural significance (Tourism, Culture, Arts, and Recreation, n.d.a). 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 itself.

In addition to historic sites, Newfoundland and Labrador has over 5,200 registered archaeological sites, which are protected under the *Historic Resources Act*. 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 (Tourism, Culture, Arts and Recreation, n.d.b). 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 was 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, 2024).

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 depicting locations of archeological sites situated on islands within the Focus Area, 1km or more from shore.

Source: Government of Newfoundland and Labrador, 2024

Within the Focus Area, there are also numerous Indigenous historical & culturally significant sites. 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 may be identified in this Report, and further consultation 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 is 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 of St. Lawrence, the SS Ethie in GMNP, and the Despatch off of Isle aux Morts are all located within the Focus Area.

Table 7.11.2. Shipwrecks within 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*

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 (2024).
Source: Government of Newfoundland and Labrador, 2024

7.11.1.1.4 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.

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 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 (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 describing the potential effects of offshore wind on areas of physical and cultural heritage.

Sources: NYSERDA, 2017

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 users	Impacts to tourism economy and location as well as recreation locations and opportunities.	7.7.2
Communities and Economy	Impacts to surrounding communities, involving their heritage or economy.	7.13.2

Table summarizes potential indirect effects to other components if physical and cultural heritage sites and features are affected by offshore wind development.

7.11.3Mitigation 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 principle. This along with strong legislation framework in place to guide developers in how to handle areas where physical and cultural heritage areas or structures are 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 they are in compliance of their *National Historic Preservation Act*. BOEM also references guidance to be followed on archeological and historic property, that 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, 2017). 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.
Ensure qualified professionals in suitable fields are involved in the	• Having underwater archaeology and architectural history or historic architecture professionals involved in the pre-

Mitigation/Enhancement Measure	Description
surveying and pre-construction assessment process.	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 outlining mitigation measures in relation to physical and cultural significant areas.
Sources: (ACTEON, n.d.; NYSERDA, 2017)

7.11.4Engagement 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.

7.11.5Data 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 this dataset would not preclude the need for site surveys pre-construction. 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 preconstruction surveys be conducted to accurately identify these features, so that project proponents can avoid these areas.

- 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 on these features and areas, as well as additional mitigations.

7.11.7 References

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7.12Human 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 effect. 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.

7.12.1Existing 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 (Health Accord NL, 2022). 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 (Newfoundland and Labrador profile – Community Account, 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; 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, the new mental health and addictions facility.

In June 2022, the co-chairs issued an implementation document (Health Accord NL, 2022a). 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, 2023). 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, 2024).

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, ongoing consolidation of the 60 separate ambulance services. In their advice to the Committee regarding progress on the Health Accord implementation[72] the Government of Newfoundland and Labrador indicated the following:

- Recruitment and retention of health care professionals has 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 NL Health Services 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 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

[72] The Government of Newfoundland and Labrador advice to the Committee regarding progress on the Health Accord implementation is available on the Registry Page under document reference number: 271

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/.

7.12.2Potential 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 on land 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. [73] 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 consultation) 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; Knopper et al., 2014; Knopper & Ollson, 2011). [74] Therefore, it is possible that a section of the population may remain annoyed and/or report other health impacts based on

[73] 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 Page under document reference number: 270

[74] A situation where a negative outcome occurs due to a belief that an intervention will cause harm

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 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 to 50 dB(A) which is comparable to indoor background sound at 300 to 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 550 m 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).

The primary considerations for offshore wind setbacks relate to maritime navigation, environmental protection, and the efficiency of wind farm layouts (NYSERDA, 2018). 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 proposed offshore wind 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 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 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 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 temporary 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 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 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:

- 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, and 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:

- 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 (Duff, 2010; European Agency for Safety and Health at Work [EU-OSHA], 2013)

7.12.3Mitigation and Other Measures

Proper siting: 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 proposed offshore wind 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 proposed 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 to 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 consultations during construction and 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.	• 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.

This table summarizes the health hazards/concerns associated with offshore wind development, their possible sources, evidence associated with the hazards, and possible mitigation measures.
Adapted from (Fortin et al., 2013)

7.12.4Engagement 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 impact on human health, associated with the extraction, refinement of, and final 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**: 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 Health 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 are also assessed for project related effects.

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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 economies are, therefore, discussed as they relate to things like turbine design, fabrication, installation, operation and maintenance, and eventually decommissioning of wind power generation facilities.

Through 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 opted to consider "Communities and Economy" as a single component to more clearly examine broader economic impacts in the context of local realities.

7.13.1 Existing Conditions

7.13.1.1 Provincial Economy

Newfoundland and Labrador's economy is resource-based, relying primarily on the extraction and processing of oil, minerals, fish, and forest resources. The province's economic history changed as the fishery declined, culminating in the declaration of the cod moratorium in 1992. In 2024, 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.

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.

7.13.1.1.1 The Big Reset

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

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 gross domestic product (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 2020-21 to $152 million estimated in 2024-25.
- 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 PERT 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. 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. The current Future Fund is $358.8 million.

Green Energy and Technology

The PERT report's emphasis on building a greener, technologically advanced, economy strongly encouraged the province to take advantage of its natural resources. 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 land. At present, five onshore

wind energy projects are under consideration, four accessing crown land 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 $3.5B in taxes, royalties and fees (Government of Newfoundland & Labrador, 2023).

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, 2022). This 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, 2024). 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 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.

7.13.1.1.2 Provincial Revenues

The provincial government revenues in 2023 were mainly from taxation (43%), offshore royalties (15%) and federal sources (14%) (Table 7.13.1).

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%

This table shows percentage of provincial revenues from various sources in 2023.
Source: Government of Newfoundland & Labrador, Department of Finance, 2024a.

7.13.1.2 Key Sectors

Tables and figures at the end of this section outline data on provincial:

- GDP (Tables 7.13.2 to 7.13.4),
- fixed capital flow and stocks (Table 7.13.5),
- residential investment (Table 7.13.6),
- consumer price index (CPI) (Table 7.13.7), and
- CPI rate of inflation (Table 7.13.8).

Data was provided to the Committee by the Province of Newfoundland and Labrador.

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*.

7.13.1.2.1 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 FPSO 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.

7.13.1.2.2 Mining

Both mineral production and exploration are expected to increase in 2024. Iron ore prices are anticipated to rise due to demand in China. And 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 7 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, 2023), encourage exploration.

7.13.1.2.3 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) 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.

7.13.1.2.4 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 have 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 if the Bay d'Espoir region through the Bays West Aquaculture Development Project announced in 2022.

7.13.1.2.5 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, 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.

7.13.1.2.6 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.

7.13.1.2.7 Real Estate

Residential construction (housing starts) is anticipated to increase by 33% in 2024, as interest rates drop.

7.13.1.2.8 Tourism

In 2023 there were 20 000 people working in tourism related jobs (Hospitality NL, 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.

Table 7.13.2. 1997-2005 Provincial Gross Domestic Product at Basic Prices by Industry

1997	1998	1999	2000	2001	2002	2003	2004	2005
All Industry								
18,295.50	19,182.90	20,343.20	21,480.60	21,954.30	25,467.80	27,164.90	26,902.50	27,588.50
Agriculture, Forestry, Fishing & Hunting								
755.8	782.9	900.2	862.4	825.2	841.1	882.8	964.2	808.6
Mining and Oil Extraction								
1,116.10	1,735.40	2,323.40	3,360.90	3,606.90	6,523.50	7,686.30	7,177.80	7,426.70
Utilities								
422.4	448.6	446.3	414.4	405.3	434.9	441.4	452.9	492.8
Construction								
1,621.80	1,527.80	1,715.30	1,488.50	1,768.90	1,617.20	1,565.40	1,711.60	1,809.00
Manufacturing								
1,200.60	1,303.30	1,423.20	1,428.00	1,249.10	1,353.20	1,570.70	1,562.00	1,488.60
Seafood Product Prep and Packaging								
195.5	249.7	312.9	259.5	250.6	315.9	372.2	397.7	318
Other Manufacturing								
1,005.10	1,053.60	1,110.30	1,168.50	998.5	1,037.30	1,198.50	1,164.30	1,170.60
Wholesale Trade								
334.7	350.1	383.3	391.5	394.6	404.9	417	431.3	443.4
Retail Trade								
823.1	849.6	910.4	969.9	1,015.80	1,075.00	1,104.50	1,136.70	1,175.00
Transportation and Warehousing								
700.7	633.2	636.3	636	632.9	636.9	689.3	659.3	723.2
Information and Cultural Industries								
391	427.8	463.5	526.2	515.1	597.8	590.4	589.6	578
Finance & Insurance								
831.1	832.8	838.2	798.1	773.6	788.1	768.7	784.8	816.4
Real Estate and Rental and Leasing								
1,727.60	1,770.40	1,807.50	1,835.50	1,859.10	1,890.50	1,960.60	1,985.00	2,099.50
Professional, Scientific and Technical Services								
592.1	655.9	712.9	756.7	787.5	818.8	819.2	813.6	877.6
Management of Companies and Enterprises								
84.9	90.7	78.5	93	116	129.7	134.6	136	98
Administrative and Support, Waste Management and Remediation Services								
205.7	242.4	275.3	268.8	298.7	307.3	313.9	341.5	375.1
Education Services								
1,561.30	1,504.20	1,497.70	1,542.60	1,549.10	1,598.30	1,629.70	1,649.20	1,683.00
Health Care and Social Assistance								
1,877.10	1,941.60	2,004.90	2,083.50	2,141.90	2,209.30	2,294.60	2,268.50	2,291.40
Arts, Entertainment and Recreation								
108.1	96.9	88.7	95.6	92.7	96.4	87.2	95.1	88.2
Accommodation and Food Services								
358.3	392.1	398.8	395.3	415.3	435.5	457.1	460.1	463
Other Service (Except Public Administration)								
345.2	363.9	370.3	364.5	361.7	392.3	399.4	414.4	412.5
Public Administration								
1,895.70	1,928.60	1,904.10	1,911.80	1,947.40	1,997.60	2,008.20	2,003.40	2,058.30

This table shows provincial GDP at basic prices by industry over time. Prices are in millions of chained 2017 dollars.
Note: Industry categories do not add to industry totals due to chain fisher volume index methodology.
Adapted from tables provided to the Committee by the Government of Newfoundland and Labrador August 2024 and prepared May 2024.
Source: Statistics Canada, Provincial Economic Accounts; Table 36-10-0402-01.

Table 7.13.3. 2006-2014 Provincial Gross Domestic Product at Basic Prices by Industry

2006	2007	2008	2009	2010	2011	2012	2013	2014
All Industry								
28,601.50	31,847.00	31,270.70	28,330.60	29,828.50	30,710.50	29,341.80	30,819.00	30,483.20
Agriculture, Forestry, Fishing & Hunting								
838.4	848.7	892.3	876.8	918.4	905.1	897.2	896.8	769.2
Mining and Oil Extraction								
8,014.10	10,174.60	9,337.40	7,232.40	7,805.80	7,890.30	6,310.80	6,962.10	6,397.40
Utilities								
513.2	506.6	521.5	474.5	529.3	539.3	535.2	516	508.9
Construction								
1,557.80	1,507.40	1,827.20	1,965.90	2,212.90	2,579.80	3,215.40	3,678.90	4,088.30
Manufacturing								
1,473.80	1,513.50	1,590.20	1,377.00	1,374.00	1,340.80	1,506.60	1,477.60	1,409.40
Seafood Product Prep and Packaging								
319.7	343.7	389.9	303.4	332.4	369.7	376.2	350.5	345.1
Other Manufacturing								
1,154.10	1,169.80	1,200.30	1,073.60	1,041.60	971.1	1,130.40	1,127.10	1,064.30
Wholesale Trade								
461	493.4	518.3	486.2	545.2	660.1	706.1	752.2	757.8
Retail Trade								
1,223.00	1,294.80	1,360.60	1,382.90	1,437.50	1,472.10	1,515.90	1,626.90	1,660.10
Transportation and Warehousing								
745.4	736.8	751.4	691.8	721.3	745.9	793.6	807.6	885.4
Information and Cultural Industries								
629.7	583.1	584.7	611.9	648.4	659	655.2	630	645
Finance & Insurance								
862.2	869.2	889.7	865.7	883.8	917.2	935.4	948.2	939.3
Real Estate and Rental and Leasing								
2,146.60	2,181.30	2,246.50	2,305.90	2,374.00	2,469.00	2,565.60	2,691.10	2,822.50
Professional, Scientific and Technical Services								
888.7	885.4	933.7	891.4	900.1	953.9	998	983.1	1,047.80
Management of Companies and Enterprises								
97.9	105.9	110.9	115.5	106.5	115.3	124.3	120.7	110.8
Administrative and Support, Waste Management and Remediation Services								
398.5	432.9	401.4	398	414.1	424.5	444.8	436.2	449.4
Education Services								
1,619.00	1,671.30	1,717.60	1,731.10	1,745.00	1,749.80	1,775.10	1,769.70	1,763.50
Health Care and Social Assistance								
2,347.60	2,289.60	2,358.60	2,445.50	2,537.00	2,610.60	2,611.10	2,552.20	2,545.70
Arts, Entertainment and Recreation								

2006	2007	2008	2009	2010	2011	2012	2013	2014
84.1	87.2	85.4	87.3	91.5	92.4	94.2	93.9	92.4
Accommodation and Food Services								
453.2	459.7	461.1	481.9	495	522.1	538.1	564.6	586
Other Service (Except Public Administration)								
410.9	414.8	436.9	441	465.7	470.7	488.4	508.9	512.4
Public Administration								
2,115.60	2,043.80	2,124.40	2,208.40	2,236.10	2,283.70	2,280.70	2,260.80	2,241.60

This table shows provincial GDP at basic prices by industry over time. Prices are in millions of chained 2017 dollars.
Note: Industry categories do not add to industry totals due to chain fisher volume index methodology.
Adapted from tables provided to the Committee by the Government of Newfoundland and Labrador August 2024 and prepared May 2024.
Source: Statistics Canada, Provincial Economic Accounts; Table 36-10-0402-01.

Table 7.13.4. 2015-2023 Provincial Gross Domestic Product at Basic Prices by Industry

2015	2016	2017	2018	2019	2020	2021	2022	2023
All Industry								
30,153.10	30,619.00	31,002.60	30,128.60	31,306.80	29,848.00	30,128.00	29,690.10	28,950.20
Agriculture, Forestry, Fishing & Hunting								
753.3	686.3	596.9	557.3	509.1	461.8	554.3	560.1	538.2
Mining and Oil Extraction								
5,815.70	6,672.60	7,311.50	7,082.60	8,087.60	8,389.80	8,070.70	7,432.20	6,544.50
Utilities								
556.8	569.7	580.3	598.7	635.2	620.5	640.1	642.3	706
Construction								
4,225.00	4,032.70	3,828.00	2,833.90	2,818.10	2,461.10	2,158.30	2,141.10	2,365.80
Manufacturing								
1,517.40	1,330.70	1,285.10	1,335.70	1,301.30	992.8	1,064.50	993.2	918.5
Seafood Product Prep and Packaging								
365.1	373.2	331.7	300	283.4	284	393.9	334.5	301.2
Other Manufacturing								
1,152.30	957.5	953.4	1,035.70	1,017.90	708.8	670.6	658.7	617.3
Wholesale Trade								
734.7	702.3	687.8	676.9	688	664.6	681.3	646.8	657.4
Retail Trade								
1,625.60	1,630.50	1,629.40	1,621.60	1,647.10	1,591.20	1,682.50	1,697.40	1,726.10
Transportation and Warehousing								
917.4	955.2	1,007.30	995.6	1,002.10	795.1	767.2	881.1	854.6
Information and Cultural Industries								
678.3	703.6	706.9	742.1	769.4	706.7	704.5	711.9	716.4
Finance & Insurance								
960.5	974.3	979.3	974.9	935.6	950.8	1,018.00	1,035.50	1,036.90
Real Estate and Rental and Leasing								
2,897.30	2,931.30	2,967.40	3,022.20	3,018.60	2,979.40	3,023.80	3,042.50	3,062.40
Professional, Scientific and Technical Services								
1,009.80	1,002.40	1,009.50	1,087.40	1,156.10	1,085.90	1,132.70	1,244.80	1,259.80
Management of Companies and Enterprises								

2015	2016	2017	2018	2019	2020	2021	2022	2023
108.3	91.4	84.1	66.2	51.9	37.6	27.3	19.2	12.9
Administrative and Support, Waste Management and Remediation Services								
424.2	446.1	436.3	425	432.9	361.8	375.8	405.8	413.6
Education Services								
1,756.90	1,751.90	1,741.80	1,800.60	1,770.00	1,686.90	1,758.70	1,779.80	1,798.00
Health Care and Social Assistance								
2,581.30	2,617.40	2,617.50	2,685.20	2,702.60	2,687.70	2,836.00	2,849.70	2,890.40
Arts, Entertainment and Recreation								
88.4	93.2	99.4	93.9	92.3	62.4	68.3	81.3	88.9
Accommodation and Food Services								
591.5	593.9	594.2	581.9	605.5	394.3	451.2	518.2	552.4
Other Service (Except Public Administration)								
519.1	514.2	518.2	526.3	514.5	439.6	472.7	494	496.3
Public Administration								
2,274.60	2,269.90	2,321.80	2,422.10	2,449.00	2,365.10	2,543.70	2,557.80	2,584.40

This table shows provincial GDP at basic prices by industry over time. Prices are in millions of chained 2017 dollars.

Note: Industry categories do not add to industry totals due to chain fisher volume index methodology.

Adapted from tables provided to the Committee by the Government of Newfoundland and Labrador August 2024 and prepared May 2024.

Source: Statistics Canada, Provincial Economic Accounts; Table 36-10-0402-01.

Table 7.13.5. Newfoundland and Labrador Flows and Stocks of Fixed Non-Residential Capital

Assets	2018	2019	2020	2021	2022		Assets	2018	2019	2020	2021	2022
	Dollars							Dollars				
Total all industries							**Fishing, hunting and trapping**					
Total non-residential	7,461	7,960	6,973	6,352	6,407		Total non-residential	20	34	25	41	51
Non-residential buildings	769	871	778	692	667		Non-residential buildings	3	1	4	0	0
Engineering construction	4,139	4,198	3,110	2,436	2,387		Engineering construction	0	1	0	0	0
Machinery and equipment	1,513	1,783	2,035	2,151	1,950		Machinery and equipment	17	32	20	41	50
Intellectual property products	1,041	1,109	1,050	1,072	1,402		Intellectual property products	0	0	1	1	1
Agriculture, forestry, fishing and hunting							**Support activities for agriculture and forestry**					
Total non-residential	110	152	109	99	131		Total non-residential	0	1	0	1	1
Non-residential buildings	76	105	73	26	40		Non-residential buildings	0	0	0	0	0
Engineering construction	1	2	1	12	20		Engineering construction	..	..	..	..	..
Machinery and equipment	32	45	34	60	71		Machinery and equipment	0	1	0	1	1
Intellectual property products	1	1	1	1	1		Intellectual property products	0	0	0	0	0
Crop production							**Mining, quarrying and oil and gas extraction**					
Total non-residential	59	59	25	6	6		Total non-residential	2,875	3,317	3,077	2,651	2,989
Non-residential buildings	55	55	24	1	1		Non-residential buildings	1	15	0	0	1
Engineering construction	1	1	0	1	1		Engineering construction	2,241	2,446	1,833	1,610	1,798
Machinery and equipment	3	4	1	4	4		Machinery and equipment	116	344	774	578	411
Intellectual property products	0	0	..	..	..		Intellectual property products	518	511	469	462	779
Animal production							**Conventional oil and gas extraction**					
Total non-residential	29	57	56	49	70		Total non-residential	2,238	2,421	1,461	721	1,468
Non-residential buildings	18	49	45	24	38		Non-residential buildings	..	..	0	..	..
Engineering construction	0	0	0	11	19		Engineering construction	1,784	1,976	1,084	456	928
Machinery and equipment	11	7	10	13	13		Machinery and equipment	13	10	15	0	36
Intellectual property products	0	0	0	0	0		Intellectual property products	441	435	363	265	504
Forestry and logging							**Non-conventional oil extraction**					
Total non-residential	2	1	3	2	3		Total non-residential	..	..	..	456	0
Non-residential buildings	0	0	0	0	0		Non-residential buildings	..	..	..	..	..
Engineering construction	0	0	0	0	0		Engineering construction	..	..	..	456	0
Machinery and equipment	1	1	3	2	3		Machinery and equipment	..	..	..	..	..
Intellectual property products	0	0	0	0	0		Intellectual property products	..	..	..	..	..
Mining and quarrying (except oil and gas)							**Beverage and tobacco products manufacturing**					

Assets	2018	2019	2020	2021	2022
	Dollars				
Total non-residential	567	826	831	1,289	1,299
Non-residential buildings	0	15	0	0	0
Engineering construction	457	469	748	699	867
Machinery and equipment	74	308	45	542	369
Intellectual property products	37	33	38	47	63
Support activities for mining and oil and gas extraction					
Total non-residential	69	70	784	186	222
Non-residential buildings	0	0	0	0	1
Engineering construction	0	0	0	0	3
Machinery and equipment	29	26	714	36	7
Intellectual property products	40	44	69	150	211
Utilities					
Total non-residential	1,455	1,296	954	699	431
Non-residential buildings	20	14	14	9	6
Engineering construction	1,304	1,146	851	458	192
Machinery and equipment	122	126	79	222	222
Intellectual property products	10	10	10	11	11
Construction					
Total non-residential	83	68	59	144	157
Non-residential buildings	12	10	9	9	10
Engineering construction	..	..	..	..	..
Machinery and equipment	67	55	47	132	144
Intellectual property products	3	3	3	3	3
Manufacturing					
Total non-residential	192	217	162	123	133
Non-residential buildings	34	15	14	9	11
Engineering construction	1	2	1	1	1
Machinery and equipment	140	183	128	93	101
Intellectual property products	17	17	19	20	20
Food manufacturing					
Total non-residential	38	43	32	43	40
Non-residential buildings	7	10	11	5	7
Engineering construction	0	1	1	1	1
Machinery and equipment	30	31	20	36	32

Assets	2018	2019	2020	2021	2022
	Dollars				
Total non-residential	7	7	9	22	29
Non-residential buildings	1	1	1	1	1
Engineering construction	0	0	0	0	0
Machinery and equipment	6	5	7	21	27
Intellectual property products	0	0	0	1	1
Textile and textile product mills					
Total non-residential	0	0	0	0	0
Non-residential buildings	0	0	0	0	0
Engineering construction	..	..	..	..	..
Machinery and equipment	0	0	0	0	0
Intellectual property products	0	0	0	0	0
Clothing and leather and allied product manufacturing					
Total non-residential	1	1	1	1	1
Non-residential buildings	0	0	0	0	0
Engineering construction	0	..	..	..	..
Machinery and equipment	0	0	0	0	0
Intellectual property products	0	1	0	1	1
Wood product manufacturing					
Total non-residential	3	4	2	8	8
Non-residential buildings	0	0	0	1	1
Engineering construction	0	0	0	..	..
Machinery and equipment	3	3	2	7	7
Intellectual property products	0	0	0	0	0
Paper manufacturing					
Total non-residential	11	12	12	18	22
Non-residential buildings	1	1	1	1	2
Engineering construction	1	0	0	0	0
Machinery and equipment	3	5	2	8	10
Intellectual property products	6	7	9	10	9
Printing and related support activities					
Total non-residential	1	0	0	0	0
Non-residential buildings	0	0	0	0	0
Engineering construction	..	..	..	..	..
Machinery and equipment	0	0	0	0	0

Assets	2018	2019	2020	2021	2022
	Dollars				
Intellectual property products	1	1	1	1	1
Petroleum and coal products manufacturing					
Total non-residential	87	86	9	1	14
Non-residential buildings	..	..	..	..	..
Engineering construction	..	..	..	..	..
Machinery and equipment	84	84	8	0	13
Intellectual property products	3	2	1	1	1
Chemical manufacturing					
Total non-residential	2	2	2	4	1
Non-residential buildings	0	0	0	1	0
Engineering construction	0	1	0	0	0
Machinery and equipment	2	1	2	3	0
Intellectual property products	0	0	0	0	0
Plastics and rubber products manufacturing					
Total non-residential	1	1	1	1	1
Non-residential buildings	0	0	0	0	0
Engineering construction	..	..	..	..	..
Machinery and equipment	0	0	0	1	0
Intellectual property products	1	1	0	0	0
Non-metallic mineral product manufacturing					
Total non-residential	3	4	4	5	5
Non-residential buildings	0	0	0	0	0
Engineering construction	0	0	0	0	0
Machinery and equipment	2	3	4	5	4
Intellectual property products	0	0	0	0	0
Primary metal manufacturing					
Total non-residential	24	46	78	0	0
Non-residential buildings	19	0	..	..	..
Engineering construction	..	..	..	..	..
Machinery and equipment	4	46	78	..	..
Intellectual property products	0	0	0	0	0
Fabricated metal product manufacturing					
Total non-residential	1	1	1	1	2
Non-residential buildings	0	0	0	0	0

Assets	2018	2019	2020	2021	2022
	Dollars				
Intellectual property products	0	0	0	0	0
Machinery manufacturing					
Total non-residential	1	1	1	2	1
Non-residential buildings	0	0	0	0	0
Engineering construction	0	0	..	..	..
Machinery and equipment	1	1	1	1	1
Intellectual property products	0	0	0	0	0
Computer and electronic product manufacturing					
Total non-residential	2	2	3	5	1
Non-residential buildings	0	0	0	0	0
Engineering construction	..	..	..	..	..
Machinery and equipment	1	1	2	4	0
Intellectual property products	1	1	1	1	1
Electrical equipment, appliance and component manufacturing					
Total non-residential	0	0	0	0	0
Non-residential buildings	..	0	..	..	..
Engineering construction	..	..	..	..	..
Machinery and equipment	0	0	0	0	0
Intellectual property products	0	0	0	0	0
Transportation equipment manufacturing					
Total non-residential	10	3	3	4	3
Non-residential buildings	4	1	0	1	0
Engineering construction	0	0	0	0	0
Machinery and equipment	3	1	1	2	1
Intellectual property products	3	2	2	2	2
Furniture and related product manufacturing					
Total non-residential	0	0	1	3	1
Non-residential buildings	0	0	0	0	0
Engineering construction	..	..	..	..	..
Machinery and equipment	0	0	0	2	1
Intellectual property products	0	0	0	0	0
Miscellaneous manufacturing					
Total non-residential	1	3	3	4	4
Non-residential buildings	0	0	0	0	0

Assets	2018	2019	2020	2021	2022
	Dollars				
Engineering construction	..	..	..	..	..
Machinery and equipment	1	1	1	1	1
Intellectual property products	0	0	0	0	0
Wholesale trade					
Total non-residential	62	51	55	68	79
Non-residential buildings	6	5	6	9	4
Engineering construction	0	5	0	0	0
Machinery and equipment	35	22	28	34	49
Intellectual property products	21	20	22	25	26
Retail trade					
Total non-residential	131	133	111	117	113
Non-residential buildings	67	75	53	25	27
Engineering construction	6	2	1	0	1
Machinery and equipment	48	42	39	72	64
Intellectual property products	11	15	18	20	21
Transportation and warehousing					
Total non-residential	512	516	446	295	263
Non-residential buildings	72	40	25	25	29
Engineering construction	28	26	12	3	9
Machinery and equipment	382	426	386	242	198
Intellectual property products	30	25	23	26	27
Information and cultural industries					
Total non-residential	190	166	174	230	255
Non-residential buildings	19	4	6	3	4
Engineering construction	84	66	95	70	77
Machinery and equipment	63	72	47	128	143
Intellectual property products	24	24	27	29	31
Finance, insurance, real estate, rental and leasing					
Total non-residential	173	253	180	212	181
Non-residential buildings	59	105	114	32	22
Engineering construction	0	0	0	0	0
Machinery and equipment	79	116	32	143	120
Intellectual property products	35	31	34	37	39
Finance and insurance					

Assets	2018	2019	2020	2021	2022
	Dollars				
Engineering construction	0	0	0	..	..
Machinery and equipment	0	0	0	1	1
Intellectual property products	0	2	3	3	3
Real estate and rental and leasing					
Total non-residential	130	192	131	163	129
Non-residential buildings	49	97	103	27	18
Engineering construction	0	0	0	0	0
Machinery and equipment	72	91	25	133	107
Intellectual property products	9	3	3	4	4
Holding companies					
Total non-residential	7	20	2	6	6
Non-residential buildings	4	1	0	1	0
Engineering construction	0	0	0	0	0
Machinery and equipment	1	17	0	4	4
Intellectual property products	2	2	1	1	2
Professional, scientific and technical services					
Total non-residential	59	89	77	99	97
Non-residential buildings	9	4	5	2	3
Engineering construction	0	0	0	0	1
Machinery and equipment	17	17	11	32	30
Intellectual property products	34	68	60	65	64
Administrative and support, waste management and remediation services					
Total non-residential	15	10	15	23	22
Non-residential buildings	1	1	1	1	1
Engineering construction	5	0	0	0	0
Machinery and equipment	7	7	12	21	19
Intellectual property products	2	2	1	2	2
Educational services					
Total non-residential	3	3	2	3	3
Non-residential buildings	1	2	0	0	1
Engineering construction	0	..	..	..	0
Machinery and equipment	1	0	1	1	1
Intellectual property products	1	1	1	1	1
Health care and social assistance					

Assets	2018	2019	2020	2021	2022		Assets	2018	2019	2020	2021	2022
	Dollars							Dollars				
Total non-residential	35	41	47	42	46		Total non-residential	39	45	53	36	28
Non-residential buildings	5	7	11	5	4		Non-residential buildings	23	11	24	16	11
Engineering construction	..	..	..	..	..		Engineering construction	0	2	0	0	0
Machinery and equipment	6	8	7	6	8		Machinery and equipment	15	28	25	16	13
Intellectual property products	24	26	29	32	34		Intellectual property products	2	4	3	3	4
Arts, entertainment and recreation							**Hospitals**					
Total non-residential	43	38	9	20	31		Total non-residential	67	190	271	324	347
Non-residential buildings	25	13	3	4	15		Non-residential buildings	33	147	212	287	308
Engineering construction	6	8	1	4	7		Engineering construction	..	..	..	..	..
Machinery and equipment	8	14	2	10	5		Machinery and equipment	28	36	49	26	28
Intellectual property products	4	3	3	3	3		Intellectual property products	6	7	10	11	11
Accommodation and food services							**Nursing and residential care facilities**					
Total non-residential	85	57	38	50	53		Total non-residential	7	81	3	47	5
Non-residential buildings	64	40	25	26	32		Non-residential buildings	6	78	2	47	4
Engineering construction	1	0	1	0	1		Engineering construction	..	..	..	..	..
Machinery and equipment	17	15	11	22	19		Machinery and equipment	1	2	0	0	0
Intellectual property products	2	2	2	2	2		Intellectual property products	1	0	0	0	0
Other services (except public administration)							**Defence services**					
Total non-residential	17	7	9	21	25		Total non-residential	12	10	13	15	12
Non-residential buildings	5	3	3	5	7		Non-residential buildings	1	1	2	2	1
Engineering construction	0	0	0	0	0		Engineering construction	5	3	7	8	6
Machinery and equipment	11	4	5	14	16		Machinery and equipment	6	4	4	4	3
Intellectual property products	1	1	1	1	2		Intellectual property products	1	2	1	1	1
Non-profit institutions serving households							**Other federal government services**					
Total non-residential	10	9	9	9	8		Total non-residential	410	333	409	383	378
Non-residential buildings	6	5	5	5	4		Non-residential buildings	22	19	12	11	9
Engineering construction	..	..	..	..	..		Engineering construction	99	115	77	62	59
Machinery and equipment	3	3	3	3	3		Machinery and equipment	256	169	284	271	271
Intellectual property products	1	1	1	1	1		Intellectual property products	34	30	36	39	39
Government sector							**Other provincial and territorial government services**					
Total non-residential	1,406	1,532	1,434	1,454	1,410		Total non-residential	147	173	145	145	158
Non-residential buildings	270	404	397	488	441		Non-residential buildings	4	13	12	12	14
Engineering construction	461	492	314	278	281		Engineering construction	118	135	108	105	122
Machinery and equipment	349	265	370	327	323		Machinery and equipment	5	6	6	6	0

Assets	2018	2019	2020	2021	2022
	Dollars				
Intellectual property products	325	370	352	361	364
Educational services					
Total non-residential	444	434	419	389	373
Non-residential buildings	162	112	121	96	76
Engineering construction	2	1	2	1	1
Machinery and equipment	18	12	13	7	7
Intellectual property products	261	309	284	285	288
Other Indigenous government services					
Total non-residential	19	16	16	17	17
Non-residential buildings	5	4	3	3	3
Engineering construction	8	6	5	5	5
Machinery and equipment	5	5	7	8	9
Intellectual property products	1	1	1	1	1

Assets	2018	2019	2020	2021	2022
	Dollars				
Intellectual property products	20	19	20	22	22
Other municipal government services					
Total non-residential	300	295	158	134	120
Non-residential buildings	37	30	33	30	25
Engineering construction	230	232	116	97	87
Machinery and equipment	31	32	7	5	5
Intellectual property products	2	1	2	2	2

This table shows provincial non-residential fixed capital flow and stocks overtime, with 207 constant prices, in millions of chained 2017 dollars.
Symbol legend:
.. not available for specific reference period
Source: Statistics Canada. Table 36-10-0096-01.

Table 7.13.6. Newfoundland and Labrador Flows and Stocks of Fixed Residential Capital

Flows and stocks	Assets	2018	2019	2020	2021	2022
		Dollars				
Investment	Total residential	1,271	1,198	1,208	1,376	1,499
	New construction	337	278	227	273	377
	Renovations	817	790	839	881	922
	Ownership transfer costs	117	130	143	222	200
Demolitions	Total residential	29	22	20	15	16
	New construction	29	22	20	15	16
	Renovations	..	..	..	..	..
	Ownership transfer costs	..	..	..	..	..
Geometric depreciation	Total residential	1,050	1,066	1,084	1,176	1,175
	New construction	398	396	385	382	381
	Renovations	533	544	563	576	589
	Ownership transfer costs	119	127	135	218	205
Geometric end-year net stock	Total residential	32,767	32,886	32,991	33,177	33,485
	New construction	19,318	19,183	19,004	18,880	18,860
	Renovations	13,434	13,687	13,962	14,268	14,601
	Ownership transfer costs	15	17	24	29	24

This table shows provincial residential investment overtime with 2017 constant prices, in millions of chained 2017 dollars.
Symbol legend:
.. not available for specific reference period
Source: Statistics Canada. Table 36-10-0099-01

Table 7.13.7. 1979-2023 Annual Average Consumer Price Index by Major Component

Year	All-items	Food	Shelter	Household operations, furnishings and equipment	Clothing and footwear	Transportation	Health and personal care	Recreation, education and reading	Alcoholic beverages and tobacco products	All-items excluding food and energy	Energy	Goods	Services
1979	42	50.4	42.2	54.4	50.1	34.2	46.4	40.7	24.9	41.6	33.8	44.6	38.1
1980	46.9	56.8	46.9	58.4	55.5	38.9	51.7	44.1	28.4	45.9	39.6	50.2	41.8
1981	53.1	62.7	55.2	64	59.6	45.6	56.4	48.4	32.6	50.9	52.1	57.2	46.9
1982	58.5	66.1	62.5	71	62.8	51	60.6	52	38	55.9	62	62.6	52.2
1983	62.4	66.8	67.1	74.1	70.3	54.3	66.2	55.2	45.5	60.5	67.9	66.8	55.9
1984	65.2	69.3	71.2	75.8	71.9	56.5	68.8	57.5	49	63.1	72	69.7	58.4
1985	67.9	70.6	75.1	78.3	73.7	59.5	71.2	59.8	52.3	65.5	79	72.8	60.5
1986	69.9	74	74.4	80.5	75.2	61.5	74	62.3	56.9	68.3	73.4	74.6	62.8
1987	71.9	77	75.3	82.3	78	62.2	77.7	65.8	58.9	70.6	71.1	76.4	65.1
1988	73.5	77.8	77	85.3	80.8	62.5	80.2	69	61.3	72.9	70.2	77.9	67
1989	76.2	80.2	78.5	87.2	84.1	65.5	83	72	65.8	76	70.1	80.8	69.3
1990	79.5	83	83.4	87.8	87.1	69.2	85.9	74.7	69.3	78.8	78.5	84.2	72.5
1991	84.4	87.5	88.9	90.3	95.5	71.1	92.6	79.2	78.4	83.7	84.6	89.1	77.4
1992	85.3	85.5	89.5	90.2	97.8	72.6	93.9	81.1	82.4	85.5	83.6	89.7	78.6
1993	86.7	87.1	89.7	90.5	99.6	74.2	95.2	82.6	87	87.4	82	91.1	80.1
1994	87.8	88.7	88.8	91.4	100.4	79	94.6	85.8	84	88.5	81.4	91.7	81.9
1995	89	89.9	89.6	92.2	98.5	82.9	92.9	88.2	84.1	89.7	83.5	92.4	83.8
1996	90.4	91.7	90.3	94.5	97.9	85.4	92.2	90.3	84.5	91	84.4	93.7	85.5
1997	92.3	92.9	92.7	94.6	99.3	88.7	92.8	93.5	84.6	92.2	91.6	95.3	87.7
1998	92.5	94	91	95.7	99.9	88.1	94.5	95.5	85.5	93	86.9	94.4	89.7
1999	93.8	94.8	92.7	96.5	101.9	89.6	95.8	97.2	85.9	94.3	89.3	95.6	91.2
2000	96.6	95.1	98.4	97.3	101.1	95.4	97.4	98.4	87.2	95.4	105.7	99.1	93.1
2001	97.7	97.8	99.4	98.8	103.6	94.1	99.2	99.2	90	96.8	102.4	99.4	95.2
2002	100	100	100	100	100	100	100	100	100	100	100	100	100
2003	102.9	100.8	103.3	99.8	99.3	107.8	101.2	99.9	110.6	103	106	101.6	104.7
2004	104.8	102.5	106.8	99.7	99	110.9	101.6	99.8	116.5	103.7	115.8	103.8	106.2
2005	107.6	105	112.4	100.7	100.1	114.6	102.1	99.6	120.4	104.8	129.5	107.3	107.9
2006	109.5	107.2	116.2	100.9	99.8	117.1	103	99.2	125.3	105.9	136.6	109.6	109.5
2007	111.1	109.7	118.9	100.8	99	118.4	103.7	100	129.5	107	139.6	110.6	111.8
2008	114.3	114.4	128.7	101.5	97.3	119.2	105.9	100.4	130.4	108.1	154.8	112.9	116.3
2009	114.6	121.2	128.2	105	93.4	111.3	111	101.6	132.3	109.7	133.9	111	120
2010	117.4	123.6	132.2	107	93.7	115.4	112.7	103.4	134.7	111.7	142.9	113.4	123.2
2011	121.4	128.1	139.9	107.7	94.6	121.8	114.6	103.6	137.8	113.4	161.7	117.6	126.9
2012	123.9	132.6	144.8	109.9	91.4	124.7	115.8	104.1	139.1	114.9	169.1	119.5	130.5
2013	126	134.5	147.7	112.6	94.1	126.7	113.7	103.6	142.8	117.2	169.4	120.6	134.2
2014	128.4	137.7	150	114.9	94.9	129	113.4	104.8	153.1	119.5	170.6	122.5	137.3
2015	129	142.9	150.1	117.1	96.5	124.1	114.5	105.6	158.7	121.4	152.7	121.9	139.8
2016	132.5	146.4	152.2	122.7	95.2	129.5	117	108	166.2	125.2	154.1	124.5	144.7

Year	All-items	Food	Shelter	Household operations, furnishings and equipment	Clothing and footwear	Transportation	Health and personal care	Recreation, education and reading	Alcoholic beverages and tobacco products	All-items excluding food and energy	Energy	Goods	Services
2017	135.7	145	155.7	124.3	96.4	136.7	119.6	111.5	172	128.2	165.2	127	149
2018	137.9	145.5	161	124.3	97.4	141.3	120.2	110.7	178.1	129.8	176	129.1	151.6
2019	139.3	148.2	163.4	122.5	98	144	121.6	110.5	182.7	131.2	174.7	130.3	152.9
2020	139.6	150.8	165.2	122.3	95	141.6	124.5	110.2	189.9	132.3	162.9	129.8	154.3
2021	144.7	154.7	169.3	120.3	94.2	155.9	126.5	112.9	206.5	134.6	195.2	138.1	155
2022	153.9	169	180.2	123.1	95	173.2	128.9	116.8	214.2	138.8	238.3	150.5	158.6
2023	159	182.2	189.1	124.6	94.4	172.7	138.2	118.7	223.4	143.3	228.3	154.6	165

This table shows annual average consumer price index overtime with 2011 basket content, 2022 = 100.
Adapted from tables provided to the Committee by the Government of Newfoundland and Labrador August 2024 and prepared January 16, 2024.
Source: Statistics Canada, Consumer Price Index, Table 18-10-0005-01.

Table 7.13.8. 1980-2023 Consumer Price Index Percent Change (Rate of Inflation) by Major Component (2011 Basket Content, 2002=100)

Year	All-items	Food	Shelter	Household operations, furnishings and equipment	Clothing and footwear	Transportation	Health and personal care	Recreation, education and reading	Alcoholic beverages and tobacco products	All-items excluding food and energy	Energy	Goods	Services
1980	11.7	12.7	11.1	7.4	10.8	13.7	11.4	8.4	14.1	10.3	17.2	12.6	9.7
1981	13.2	10.4	17.7	9.6	7.4	17.2	9.1	9.8	14.8	10.9	31.6	13.9	12.2
1982	10.2	5.4	13.2	10.9	5.4	11.8	7.4	7.4	16.6	9.8	19	9.4	11.3
1983	6.7	1.1	7.4	4.4	11.9	6.5	9.2	6.2	19.7	8.2	9.5	6.7	7.1
1984	4.5	3.7	6.1	2.3	2.3	4.1	3.9	4.2	7.7	4.3	6	4.3	4.5
1985	4.1	1.9	5.5	3.3	2.5	5.3	3.5	4	6.7	3.8	9.7	4.4	3.6
1986	2.9	4.8	-0.9	2.8	2	3.4	3.9	4.2	8.8	4.3	-7.1	2.5	3.8
1987	2.9	4.1	1.2	2.2	3.7	1.1	5	5.6	3.5	3.4	-3.1	2.4	3.7
1988	2.2	1	2.3	3.6	3.6	0.5	3.2	4.9	4.1	3.3	-1.3	2	2.9
1989	3.7	3.1	1.9	2.2	4.1	4.8	3.5	4.3	7.3	4.3	-0.1	3.7	3.4
1990	4.3	3.5	6.2	0.7	3.6	5.6	3.5	3.8	5.3	3.7	12	4.2	4.6
1991	6.2	5.4	6.6	2.8	9.6	2.7	7.8	6	13.1	6.2	7.8	5.8	6.8
1992	1.1	-2.3	0.7	-0.1	2.4	2.1	1.4	2.4	5.1	2.2	-1.2	0.7	1.6
1993	1.6	1.9	0.2	0.3	1.8	2.2	1.4	1.8	5.6	2.2	-1.9	1.6	1.9
1994	1.3	1.8	-1	1	0.8	6.5	-0.6	3.9	-3.4	1.3	-0.7	0.7	2.2
1995	1.4	1.4	0.9	0.9	-1.9	4.9	-1.8	2.8	0.1	1.4	2.6	0.8	2.3
1996	1.6	2	0.8	2.5	-0.6	3	-0.8	2.4	0.5	1.4	1.1	1.4	2
1997	2.1	1.3	2.7	0.1	1.4	3.9	0.7	3.5	0.1	1.3	8.5	1.7	2.6
1998	0.2	1.2	-1.8	1.2	0.6	-0.7	1.8	2.1	1.1	0.9	-5.1	-0.9	2.3
1999	1.4	0.9	1.9	0.8	2	1.7	1.4	1.8	0.5	1.4	2.8	1.3	1.7
2000	3	0.3	6.1	0.8	-0.8	6.5	1.7	1.2	1.5	1.2	18.4	3.7	2.1
2001	1.1	2.8	1	1.5	2.5	-1.4	1.8	0.8	3.2	1.5	-3.1	0.3	2.3
2002	2.4	2.2	0.6	1.2	-3.5	6.3	0.8	0.8	11.1	3.3	-2.3	0.6	5
2003	2.9	0.8	3.3	-0.2	-0.7	7.8	1.2	-0.1	10.6	3	6	1.6	4.7
2004	1.8	1.7	3.4	-0.1	-0.3	2.9	0.4	-0.1	5.3	0.7	9.2	2.2	1.4
2005	2.7	2.4	5.2	1	1.1	3.3	0.5	-0.2	3.3	1.1	11.8	3.4	1.6
2006	1.8	2.1	3.4	0.2	-0.3	2.2	0.9	-0.4	4.1	1	5.5	2.1	1.5
2007	1.5	2.3	2.3	-0.1	-0.8	1.1	0.7	0.8	3.4	1	2.2	0.9	2.1
2008	2.9	4.3	8.2	0.7	-1.7	0.7	2.1	0.4	0.7	1	10.9	2.1	4
2009	0.3	5.9	-0.4	3.4	-4	-6.6	4.8	1.2	1.5	1.5	-13.5	-1.7	3.2
2010	2.4	2	3.1	1.9	0.3	3.7	1.5	1.8	1.8	1.8	6.7	2.2	2.7
2011	3.4	3.6	5.8	0.7	1	5.5	1.7	0.2	2.3	1.5	13.2	3.7	3
2012	2.1	3.5	3.5	2	-3.4	2.4	1	0.5	0.9	1.3	4.6	1.6	2.8
2013	1.7	1.4	2	2.5	3	1.6	-1.8	-0.5	2.7	2	0.2	0.9	2.8
2014	1.9	2.4	1.6	2	0.9	1.8	-0.3	1.2	7.2	2	0.7	1.6	2.3

Year	All-items	Food	Shelter	Household operations, furnishings and equipment	Clothing and footwear	Transportation	Health and personal care	Recreation, education and reading	Alcoholic beverages and tobacco products	All-items excluding food and energy	Energy	Goods	Services
2015	0.5	3.8	0.1	1.9	1.7	-3.8	1	0.8	3.7	1.6	-10.5	-0.5	1.8
2016	2.7	2.4	1.4	4.8	-1.3	4.4	2.2	2.3	4.7	3.1	0.9	2.1	3.5
2017	2.4	-1	2.3	1.3	1.3	5.6	2.2	3.2	3.5	2.4	7.2	2	3
2018	1.6	0.3	3.4	0	1	3.4	0.5	-0.7	3.5	1.2	6.5	1.7	1.7
2019	1	1.9	1.5	-1.4	0.6	1.9	1.2	-0.2	2.6	1.1	-0.7	0.9	0.9
2020	0.2	1.8	1.1	-0.2	-3.1	-1.7	2.4	-0.3	3.9	0.8	-6.8	-0.4	0.9
2021	3.7	2.6	2.5	-1.6	-0.8	10.1	1.6	2.5	8.7	1.7	19.8	6.4	0.5
2022	6.4	9.2	6.4	2.3	0.8	11.1	1.9	3.5	3.7	3.1	22.1	9	2.3
2023	3.3	7.8	4.9	1.2	-0.6	-0.3	7.2	1.6	4.3	3.2	-4.2	2.7	4

This table shows consumer price index rate of inflation overtime with 2011 basket content, 2022 = 100. Values reported are percentages (%).
Adapted from table provided to the Committee by the Government of Newfoundland and Labrador August 2024 and prepared by Newfoundland and Labrador Statistics Agency, January 16, 2024.
Source: Statistics Canada, Consumer Price Index, Table 18-10-0005-01.

7.13.1.3 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% (Government of Newfoundland & Labrador, Department of Finance, 2024b). The median age is 48 years, with 16% of the population 17 years and younger. Table 7.13.9 includes a summary of demographics by region and gender based on 2021 census data, including information on identity factors available and potentially relevant to the establishment of a new industry.

Population on the Island is concentrated on the Avalon Peninsula, primarily in the St. John's greater metro 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, and Grand Falls-Winsor. 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 or Labrador City.

The larger communities within the Focus Area include Marystown, Burin, St. Lawrence, Grand Bank and Fortune, Harbour Breton, St. Albans, Burgeo, Port aux Basques, Stephenville, and Corner Brook. Brief descriptions of the Focus Area communities are given below. While not within the Focus Area, the town and port of Argentia, facing onto outer Placentia Bay, are already engaged in offshore wind related activities. Arnold's Cove and come by 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.

Table 7.13.9. Demographics by Region and Gender Based on 2021 Census Data

	Total Population	Growth /Decay	Median Age	Population in Working Age (18-64)	Age Dependency Ratio (65+/15-64)	Couples with Children at Home	Lone Parents in Workforce*	Lone Parents, Single*	Indigenous Identity	Indigenous Ancestry
Burin Peninsula										
Male	9,305	-5.10%	54	55.40%	50.20%				140	85
Female	9,575	-4.30%	54	56.80%	49.40%				120	120
Total	18,880	-4.70%	54	56.10%	49.80%	4,795			260	200
Corner Brook - Rocky Harbour										
Male	21,545	-4.10%	50	57.40%	43.40%				5,045	3,315
Female	22,755	-4.60%	52	58.40%	44.90%				5,585	3,675
Total	44,300	-4.30%	51	57.90%	44.20%	4,440			10,635	6,985
Geography: Grand Falls-Windsor - Baie Verte - Harbour Breton										
Male	21,680	-4.60%	53	57.10%	46.10%				1,495	1,245
Female	22,605	-5.10%	54	57.20%	48.10%				1,680	1,240
Total	44,285	-4.90%	54	57.20%	47.10%	4,365			3,170	2,485
Stephenville - Port aux Basques										
Male	13,180	-6.50%	55	55.80%	50.40%				4,385	2,940
Female	13,605	-8.60%	56	56.20%	52.60%				4,450	3,050
Total	26,790	-7.60%	55	56.00%	51.50%	2,240			8,840	5,985
Clarenville - Bonavista										
Male	13,160	-2.60%	54	56.00%	49.60%				310	230
Female	13,620	-2.10%	54	56.60%	50.70%				370	230
Total	26,775	-2.40%	54	56.40%	50.10%	2,590			680	465
Avalon Peninsula										
Male	130,665	1.0%	44	19.20%	29.20%				3,860	1,930
Female	137,200	0.3%	46	61.90%	33.50%				4,285	2,255
Total	267,870	0.6%	45	62.30%	31.40%	30,080			8,145	4,185
Newfoundland and Labrador										
Male	250,075	-1.50%	48	60.10%	35.80%		3,055	4,465	22,520	15,325
Female	260,475	-2.00%	49	59.90%	39.10%		10,890	19,205	24,030	16,515
Total	510,550	-1.80%	48	60.00%	37.50%	116,700	13, 945	23, 850	46,545	31,840

This table shows select demographics for Rural Secretariat Regions adjacent to the Focus Area or with communities in proximity to the Focus Area, and within which there are existing industrial facilities. Disaggregated data was provided where available.

Growth/Decay means percent increase or decrease of the population over a 5-year span. 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. Stats are for population in private households.

Data on lone parents is not available by rural secretariat region. More specific community breakdowns are available through Newfoundland and Labrador Community Accounts.
*Data from Census 2016.

Sources: Newfoundland & Labrador Statistics Agency, 2019a; 2019b; 2022a; 2022f; 2024b

7.13.1.3.1 Communities within the Focus Areas

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).

Stephenville

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, 2022c). 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: 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 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.)

Channel - Port aux Basques

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 7000 area residents.

The harbour offers 10 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. (Town of Channel Port aux Basques, 2020).

Burgeo

The town of Burgeo, population 1100, is located on the south coast of the Island and since 1979 is connected by a single secondary highway to the main TransCanada Highway. The

town supports the ferry service between Burgeo and Ramea, 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 plant. Adjacent to the town is a provincial park, Sandbanks Provincial Park. Burgeo along with partners Parks Canada and Miawpukek First Nation and the Government of Newfoundland and Labrador have initiated recently, an investigation into a NMCA on the south coast (Parks Canada, 2023).

Connaigre Peninsula – Harbour Breton, Hermitage Harbour, St. Alban's, Conne River

The Connaigre Peninsula area is connected to the main 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, with Hermitage on the Hermitage Bay side, Sandyville 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 and aquaculture – and increasingly, tourism. The coast is included in the feasibility study of a new NMCA, around the deep fjords of the coast (Parks Canada, 2023)

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 naturally 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 tourist industries. (Harbour Authority of Hermitage, 2016).

St. Alban's is a town of approximately 1,200 located in the Bay d'Espoir estuary on the south coast of Newfoundland, about 180 kilometers (110 mi) 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 on the south coast of the island of Newfoundland. Approximately 850 members of MFN live at Conne River, with an additional 2,000 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, 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 a NMCA along the south coast of the province (Parks Canada, 2023).

Burin Peninsula – Grand Bank, Fortune, St. Lawrence, Burin, Marystown

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.

Communities on the Burin Peninsula have established several regional collaborations to be able to provide a range of services – examples are the Heritage Run Tourism Association, the Burin Chamber of Commerce, 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 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 2285 persons, has a centuries' long history in the fishery that is featured in the Provincial Seamen's Museum in the town. In Fortune, population 1280 people, the fishery is the main employer. Fortune is also the ferry link with the French Islands of St. Pierre and 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 2021: the company 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 Incorporated, 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 meters.

Both fishing and mining (fluorspar) have been the economic mainstays of the town, although both the mine and the fish plant are presently idled. 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 3275 in the 2021 census (Newfoundland & Labrador Statistics Agency, 2022d) reflects the communities of Burin, Epworth-Great Salmonier, Lewis Cove and Fox Cove Mortier.

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 the community.

Marystown, with a population of over 6 000 people (Newfoundland & Labrador Statistics Agency, 2022e), is the regional location for many government services, such as housing, health, social services and is active in the various regional associations on the Peninsula. Public consultation 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 was 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 harbor has supported a fish plant, a ship building facility and, from the 1990s, fabrication facilities associated with the offshore petroleum industry (Marystown, 2024). The harbor has also sheltered and serviced offshore drill rigs. There is still active use of the harbor by fishing vessels. Recently, Marystown has become the centre 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).

7.13.1.3.2 Communities with industrial facilities adjacent to focus areas

While not within the Focus Area, the Port of Argentia, facing onto outer 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, 2022a)

In August 2022, the Port of Argentia CEO announced a second, separate significant contract to support the development of clean energy projects in the Northeastern U.S. The initial work will be to provide a temporary storage site for monopoles before they are needed at the offshore windfarm., Port CEO Scott Penney 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, 2022b). 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 areas per se, 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 Offshore Production and Storage 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, wharfside 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: environmental approvals are in place for a marine base and spool base to support offshore oil and gas development and a contract for Front End Engineering Design (FEED) has recently been awarded. FEL has also indicated that the same area could be used as a wind energy/hydrogen site, as a Hydrogen Hub (Fermeuse Energy, 2023).

7.13.1.3.3 Employment, Education and Sources of Income

The tables below provide an overview of:

- full time employment, part time employment and unemployment rate overtime (Tables 7.13.10 and 7.13.11).
- employment distribution across different industries (Tables 7.13.12 and 7.13.13)
- economic indicators and sources of income (Tables 7.13.14 and 7.13.15) and
- highest level of education (Table 7.13.16).

Most information is presented across rural secretariat regions.[75] Data for more (or less) detailed geography (e.g., by regional local areas, local areas, communities, neighborhoods etc.) is publicly available for some topics through the Newfoundland and Labrador Community Accounts Repository.

The Government of Newfoundland and Labrador provided some of this data to the Committee. Their submission is available on the Impact Assessment Registry under document reference number: 271. Notably their submission also includes data on individual tourism operators in the Focus Area.

[75] Tables only include areas adjacent to the Focus Area or with communities in proximity to the Focus Area, and within which there are existing industrial facilities.

Table 7.13.10. Employment in Select Local Areas of Newfoundland and Labrador 1996-2006

Geography	Full Time	Part Time	Unemployment Rate	Full Time	Part Time	Unemployment Rate	Full Time	Part Time	Unemployment Rate
	1996			2001			2006		
Newfoundland and Labrador	198,930	53,620	25.0%	204,696	50,745	21.8%	214,905	52,270	18.6%
Placentia Bay West Centre	680	125	32.0%	740	160	34.8%	635	135	29.1%
Mortier Bay	2,645	735	36.0%	2,485	670	24.3%	2,540	725	24.6%
Burin Area	1,380	395	31.0%	1,355	420	19.9%	1,525	385	19.8%
St. Lawrence Area	500	80	44.0%	590	175	24.3%	535	145	16.5%
Lamaline Area	620	120	50.0%	631	145	35.4%	625	170	36.0%
Fortune-Grand Bank Area	2,000	720	37.0%	2,160	525	18.8%	1,920	675	28.0%
Bay L'Argent Area	520	55	27.0%	460	80	29.9%	435	105	26.8%
Terrenceville Area	305	55	41.0%	380	65	28.9%	335	100	39.5%
Belle Bay	555	150	18.0%	545	160	18.8%	530	130	24.8%
Harbour Breton Area	515	195	45.0%	756	215	51.6%	750	205	28.7%
Hermitage Bay	370	200	44.0%	510	140	51.2%	415	155	45.0%
Bay d'Espoir Area	1,715	220	34.0%	1,541	295	37.1%	1,545	220	32.3%
Burgeo Area	915	420	40.0%	1,010	285	39.8%	1,185	360	34.9%
Port aux Basques Area	2,605	945	36.0%	2,610	660	32.0%	2,470	755	30.7%
Rose Blanche Area	230	105	22.0%	290	40	62.1%	245	30	51.9%
Codroy Valley	670	100	47.0%	565	120	35.8%	740	110	40.8%
Crabbes River	590	110	39.0%	580	85	39.9%	560	110	31.4%
St. George's Area	640	120	43.0%	571	185	43.8%	575	205	32.8%
Stephenville-Port au Port Peninsula	5,500	1,625	30.0%	5,150	1,325	25.3%	5,415	1,505	24.5%
Corner Brook-Pasadena Area	11,490	3,570	18.0%	11,180	3,285	16.8%	12,155	3,235	14.4%
Bay of Islands	1,395	405	40.0%	1,230	440	38.1%	1,285	415	25.5%
Bonne Bay Area	1,280	260	41.0%	1,280	235	35.4%	1,315	230	32.5%

This table shows full time employment, part time employment and unemployment rate overtime for local areas adjacent to the Focus Area.This data was provided to the Committee by the government of Newfoundland and Labrador in August 2024.
* The unemployment rate is the number of unemployed persons expressed as a percentage of the labour force.
Figures may not add to total due to rounding. Also, please note that there may be smaller communities/areas not listed within the local area, therefore communities listed may not add to the total local area.
Symbol legend:
.. data is not available and/or may be suppressed for data quality or confidentiality reasons.
Source: Compiled by the Newfoundland and Labrador Statistics Agency (NLSA) based on information provided from the Census of Population 2001, 2006, 2011, 2016 and 2021 Statistics Canada.

Table 7.13.11. Employment in Select Local Areas of Newfoundland and Labrador 2011-2021

Geography	Full Time	Part Time	Unemployment Rate	Full Time	Part Time	Unemployment Rate	Full Time	Part Time	Unemployment Rate
	2011			2016			2021		
Newfoundland and Labrador	207,080	37,030	14.6%	206,950	39,430	15.6%	186,340	36,960	15.2%
Placentia Bay West Centre	655	65	38.7%	370	75	30.0%	340	85	23.2%
Mortier Bay	2,345	470	18.0%	2,305	425	21.5%	1,930	450	21.0%
Burin Area	1,560	1	13.8%	1,320	255	21.5%	1,265	205	16.4%
St. Lawrence Area	460	65	12.4%	430	85	21.1%	445	80	16.7%
Lamaline Area	595	70	23.5%	515	135	32.1%	440	100	23.7%
Fortune-Grand Bank Area	1,515	295	23.7%	1,520	370	20.3%	1,345	230	17.6%
Bay L'Argent Area	305	75	13.6%	290	50	21.4%	190	50	31.7%
Terrenceville Area	370	30	25.9%	270	50	40.0%	205	50	28.3%
Belle Bay	425	115	23.5%	410	115	20.4%	350	65	14.1%
Harbour Breton Area	720	115	11.4%	635	155	20.2%	525	115	16.7%
Hermitage Bay	340	60	26.2%	270	50	18.8%	285	55	20.0%
Bay d'Espoir Area	1,460	175	26.5%	1,345	215	33.2%	1,040	170	20.2%
Burgeo Area	920	180	43.9%	695	160	35.0%	400	145	25.6%
Port aux Basques Area	2,385	420	25.8%	2,180	465	25.8%	1,785	310	18.2%
Rose Blanche Area	180	35	26.2%	140	55	51.2%	130	35	27.8%
Codroy Valley	550	20	32.0%	475	110	24.6%	410	65	26.4%
Crabbes River	450	35	25.0%	350	70	33.7%	325	70	34.1%
St. George's Area	495	85	29.1%	545	95	26.1%	435	55	25.9%
Stephenville-Port au Port Peninsula	4,750	890	18.8%	4,830	1,070	22.3%	4,175	950	21.1%
Corner Brook-Pasadena Area	11,515	2,025	13.5%	11,780	2,320	13.7%	10,840	2,075	13.6%

Geography	Full Time	Part Time	Unemployment Rate	Full Time	Part Time	Unemployment Rate	Full Time	Part Time	Unemployment Rate
	2011			2016			2021		
Bay of Islands	1,160	215	23.4%	1,260	260	25.5%	1,050	175	19.7%
Bonne Bay Area	1,015	100	34.5%	1,055	135	37.9%	850	120	29.6%

This table shows full time employment, part time employment and unemployment rate overtime for local areas adjacent to the Focus Area. This data was provided to the Committee by the government of Newfoundland and Labrador in August 2024.

* The unemployment rate is the number of unemployed persons expressed as a percentage of the labour force.

Figures may not add to total due to rounding. Also, please note that there may be smaller communities/areas not listed within the local area, therefore communities listed may not add to the total local area.

Symbol legend:

.. data is not available and/or may be suppressed for data quality or confidentiality reasons.

Source: Compiled by the NLSA based on information provided from the Census of Population 2001, 2006, 2011, 2016 and 2021 Statistics Canada.

Table 7.13.12. Selected Industry by Region and Gender Based on 2021 Census Data
Rural Secretariat Regions Adjacent to the Focus Area

North American Industry Classification System (NAICS) 2017	BurinPeninsula			Corner Brook - Rocky Harbour			Grand Falls-Windsor - Baie Verte - Harbour Breton			Stephenville - Port aux Basques			Newfoundland and Labrador		
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T
Total employed population aged 15 years and over	3,225	3,280	6,500	8,115	8,755	16,870	7,325	7,795	15,125	3,870	4,235	8,105	101,470	104,815	206,280
11 Agriculture, forestry, fishing and hunting	530	150	680	480	170	650	920	295	1,215	465	110	580	5,535	1,600	7,130
21 Mining, quarrying, and oil and gas extraction	325	30	355	275	10	285	800	45	845	205	10	215	6,860	1,455	8,310
22 Utilities	55		55	120		120	250	25	275	65	15	80	1,960	670	2,630
23 Construction	395	50	440	1,000	140	1,145	870	65	935	355	35	390	12,240	1,620	13,855
31-33 Manufacturing	415	170	580	640	175	820	405	350	760	195	45	240	6,640	3,130	9,770
41 Wholesale trade	35		40	325	100	425	215	40	255	75	25	100	3,240	1,075	4,315
44-45 Retail trade	295	485	780	1,210	1,465	2,675	845	1,285	2,130	440	660	1,105	11,845	15,090	26,940
48-49 Transportation and warehousing	200	80	280	575	165	740	455	135	595	635	255	895	7,710	2,530	10,245
51 Information and cultural industries	25	10	35	95	80	180	40	35	80	40	35	70	1,340	1,120	2,460
52 Finance and insurance	10	75	80	100	190	290	70	130	200	10	120	130	1,475	2,950	4,430
53 Real estate and rental and leasing	30	20	45	100	50	145	60	30	85	35	..	40	1,130	755	1,890
54 Professional, scientific and technical services	65	40	105	250	235	485	165	155	320	120	85	210	6,035	4,435	10,470
55 Management of companies and enterprises	..	..	..	10	10	20	10	..	20	..	10	15	130	130	255
56 Administrative and support, waste management and remediation services	85	30	115	215	145	360	155	135	285	55	100	155	3,590	2,460	6,055
61 Educational services	110	310	420	515	965	1,480	280	730	1,015	265	515	775	5,200	11,080	16,280
62 Health care and social assistance	225	1,280	1,505	665	3,085	3,750	500	3,000	3,505	300	1,565	1,855	6,440	31,035	37,480
71 Arts, entertainment and recreation	25	20	55	160	150	315	75	60	130	15	40	55	1,330	1,485	2,810

North American Industry Classification System (NAICS) 2017	BurinPeninsula			Corner Brook - Rocky Harbour			Grand Falls-Windsor - Baie Verte - Harbour Breton			Stephenville - Port aux Basques			Newfoundland and Labrador		
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T
72 Accommodation and food services	85	235	320	400	670	1,065	265	495	760	110	240	350	4,915	7,585	12,500
81 Other services (except public administration)	125	130	255	295	415	710	375	315	690	130	160	290	4,035	4,605	8,640
91 Public administration	190	165	360	..	..	..	580	455	1,030	350	205	555	9,815	10,005	19,815

This table shows employed population age 15 and over in different industry sectors for Rural Secretariat Regions adjacent to the Focus Area.
Data disaggregated by gender was available.
M means male, F means female and T means total. Numbers reported are number people.
Sources: Newfoundland & Labrador Statistics Agency, Government of Newfoundland and Labrador, 2023

Table 7.13.13. Selected Industry by Region and Gender Based on 2021 Census Data

Rural Secretariat Regions with communities in proximity to the Focus Area, and within which there are existing industrial facilities.

North American Industry Classification System (NAICS) 2017	Clarenville - Bonavista			Avalon Peninsula			Newfoundland and Labrador		
	M	F	T	M	F	T	M	F	T
Total employed population aged 15 years and over	4,730	4,915	9,650	59,100	60,685	119,785	101,470	104,815	206,280
11 Agriculture, forestry, fishing and hunting	420	130	550	1,645	465	2,110	5,535	1,600	7,130
21 Mining, quarrying, and oil and gas extraction	195	20	220	2,660	700	3,360	6,860	1,455	8,310
22 Utilities	50	15	65	975	505	1,480	1,960	670	2,630
23 Construction	775	85	860	7,130	980	8,110	12,240	1,620	13,855
31-33 Manufacturing	770	385	1,150	3,230	1,335	4,560	6,640	3,130	9,770
41 Wholesale trade	125	25	150	2,105	695	2,800	3,240	1,075	4,315
44-45 Retail trade	490	830	1,320	6,990	8,140	15,130	11,845	15,090	26,940
48-49 Transportation and warehousing	340	115	450	4,155	1,255	5,415	7,710	2,530	10,245
51 Information and cultural industries	20	10	30	1,025	880	1,905	1,340	1,120	2,460
52 Finance and insurance	35	95	130	1,160	2,080	3,240	1,475	2,950	4,430
53 Real estate and rental and leasing	30	30	60	765	535	1,300	1,130	755	1,890
54 Professional, scientific and technical services	185	160	345	4,920	3,420	8,340	6,035	4,435	10,470
55 Management of companies and enterprises	..	..	15	80	90	170	130	130	255
56 Administrative and support, waste management and remediation services	130	110	240	2,475	1,545	4,020	3,590	2,460	6,055
61 Educational services	115	425	540	3,420	6,610	10,035	5,200	11,080	16,280
62 Health care and social assistance	230	1,500	1,730	3,715	16,120	19,840	6,440	31,035	37,480
71 Arts, entertainment and recreation	40	45	80	880	1,020	1,900	1,330	1,485	2,810
72 Accommodation and food services	175	435	615	3,305	4,305	7,610	4,915	7,585	12,500
81 Other services (except public administration)	280	200	480	2,330	2,800	5,130	4,035	4,605	8,640
91 Public administration	330	295	630	6,115	7,205	13,315	9,815	10,005	19,815

This table shows employed population age 15 and over in different industry sectors for Rural Secretariat Regions with communities in proximity to the Focus Area, and within which there are existing industrial facilities. Data disaggregated by gender was available.

M means male, F means female and T means total. Numbers reported are number people.

Sources: Newfoundland & Labrador Statistics Agency, Government of Newfoundland and Labrador, 2023

Table 7.13.14. Economic Indicators and Sources of Income by Region and Gender Based on 2021 Census Data
Rural Secretariat Regions Adjacent to the Focus Area

	Burin Peninsula			Corner Brook - Rocky Harbour			Grand Falls-Windsor - Baie Verte - Harbour Breton			Stephenville - Port aux Basques			Newfoundland and Labrador		
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T
Total Income															
Median ($)	39,300	28,900	33,000	41,900	32,00	36,200	39,700	29,00	33,200	35,600	28,600	31,700	43,200	33,300	37,600
Number Reporting	8,220	8,400	16,620	18,650	20,090	38,740	19020	19,830	38850	12,040	12,430	24,460	208,270	220,330	428,600
Provincial Index			87.8			96.4			88.3			84.3			100
Canadian Index			79.2			86.9			79.6			76			90.2
Market Incomes															
Employment Income															
Contribution of Total (%)	62.3	51.4	57.8	62.5	55.8	59.5	60.3	49.4	55.8	55.4	48.0	52.2	68.0	59.6	64.4
Number Reporting	5,280	4,960	10,240	12,570	12,510	25,070	12,220	11,430	23,650	7,250	6,750	14,000	146,050	140,650	286,700
Investment Income															
Contribution of Total (%)	1.2	0.6	1	2.2	1.6	1.9	1.5	1	1.2	1.1	0.7	0.9	2.2	1.5	1.9
Number Reporting	880	700	1,580	2,250	2,110	4,350	2,030	1,780	3,810	1,020	880	1,900	26,810	24,650	51,460
RRSP Income															
Contribution of Total (%)	0.2	0.6	0.3	0.2	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2
Number Reporting	90	60	150	210	220	430	280	210	490	120	110	230	2,510	2,380	4,890
Private Pension															
Contribution of Total (%)	6.1	6.1	6.1	10	8.5	9.3	8.5	7.6	8.1	9.9	8.6	9.3	8.1	8.2	8.1
Number Reporting	1,380	1,140	2,520	3,970	3,390	7,360	3,830	3,070	6,910	2,500	2,020	4,510	39,020	37,210	76,230
Other Income															

	Burin Peninsula			Corner Brook - Rocky Harbour			Grand Falls-Windsor - Baie Verte - Harbour Breton			Stephenville - Port aux Basques			Newfoundland and Labrador		
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T
Contribution of Total (%)	1.8	2.2	2	2	2.8	2.3	2.5	3.2	2.8	2	2.5	2.2	2.2	2.9	2.5
Number Reporting	1,310	930	2,230	2,740	2,810	5,560	2,960	2,750	5,710	1,580	1,460	3,040	34,100	34,010	68,110
Total Market Incomes															
Contribution of Total (%)	71.6	60.9	67.3	76.8	68.8	73.2	73.1	61.4	68.2	68.6	60.1	64.8	80.7	72.6	77.2
Transfer Payments															
Old Age Security/Net federal supplements															
Contribution of Total (%)	6.3	10.6	8	5.5	8.3	6.7	6.2	10.6	8	7.7	11.5	9.4	4.3	7.1	5.5
Number Reporting	2,700	2,940	5,650	5,690	6,520	12,210	6,160	7,020	13,190	4,130	4,600	8,730	56,280	65,710	121,990
Canada Pension Plan															
Contribution of Total (%)	6.3	6.9	6.6	5.9	6.3	6.1	6.4	6.9	6.6	6.8	6.8	6.8	4.7	5.5	5
Number Reporting	3,580	3,750	7,330	7,490	8,260	15,740	8,300	8,780	17,080	5,480	5,610	11,080	75,470	84,160	159,640
Canada Child Benefit															
Contribution of Total (%)	0.1	3.5	1.5	0.1	3.1	1.5	0.1	3.7	1.6	0.1	3.8	1.8	0.1	2.9	1.3
Number Reporting	90	1,600	1,690	240	4,010	4,250	240	3,730	3,970	140	2,270	2,400	2,640	45,220	47,870
GST Credit															
Contribution of Total (%)	0.3	0.5	0.4	0.3	0.4	0.4	0.4	0.5	0.4	0.4	0.6	0.5	0.3	0.4	0.3
Number Reporting	3,260	3,070	6,330	6,730	7,090	13,820	7,620	7,070	14,690	5,530	5,130	10,660	73,870	75,480	149,350
Employment Insurance															
Contribution of Total (%)	11.5	12.4	11.9	8.4	8.9	8.6	10.2	12.2	11	11.6	11.1	11.4	7.1	7.6	7.3

	Burin Peninsula			Corner Brook - Rocky Harbour			Grand Falls-Windsor - Baie Verte - Harbour Breton			Stephenville - Port aux Basques			Newfoundland and Labrador		
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T
Number Reporting	3,200	2,480	5,680	5,590	5,220	10,810	6,520	5,750	12,270	4,020	3,250	7,270	59,870	51,960	111,830
Workers Compensation															
Contribution of Total (%)	1.6	1.2	1.4	0.8	0.7	0.8	1	0.7	0.9	1	0.9	0.9	0.8	0.6	0.7
Number Reporting	430	250	680	600	470	1,070	640	410	1,050	390	270	660	6,480	4,960	11,450
Income Support Assistance															
Contribution of Total (%)	0.7	1.4	1	0.7	1.2	0.9	0.9	1.5	1.2	1.5	2.4	1.9	0.7	1.2	0.9
Number Reporting	390	410	800	810	950	1,760	1,050	1,040	2,090	900	990	1890	9,860	10,930	20,790
Provincial tax credits															
Contribution of Total (%)	0.6	1	0.8	0.5	0.8	0.6	0.6	1	0.8	0.8	1.2	0.9	0.4	0.7	0.6
Number Reporting	3,380	3,320	6,700	7,080	8,090	15,170	7,560	7,620	15,180	5,430	5,430	10,850	80,700	89,150	169,850
Other government transfers															
Contribution of Total (%)	1	1.6	1.2	1	1.5	1.2	1	1.7	1.3	1.4	1.8	1.6	1	1.4	1.2
Number Reporting	870	1,210	2,080	2,180	3,060	5,240	2,090	2,810	4,890	1,470	1,880	3,350	25,680	33,240	58,920
Total transfer incomes															
Contribution of Total (%)	28.4	39.1	32.7	23.2	31.2	26.8	26.9	38.6	31.8	31.4	39.9	35.2	19.3	27.4	22.8
Number Reporting	7,140	7,480	14,610	14,900	17,380	32,280	15,940	17,630	33,570	10,430	11,140	21,570	163,080	187,430	350,510
Total transfer incomes per capita															
Amount ($)	12,700	11,700	12,200	10,100	10,400	10,200	11,500	11,300	11,400	12,000	11,700	11,900	9,400	9,700	9,600
Provincial Index	134.4	120.4	127.2	106.9	107.3	107.1	122.1	116.7	119.3	127.6	121.3	124.4	100	100	100

	Burin Peninsula			Corner Brook - Rocky Harbour			Grand Falls-Windsor - Baie Verte - Harbour Breton			Stephenville - Port aux Basques			Newfoundland and Labrador		
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T
Canadian Index	215.2	149.5	177.1	171.1	133.3	149.2	195.5	144.9	166.1	204.3	150.7	173.2	160.1	124.2	139.2

This table shows economic indicators and sources of income for Rural Secretariat Regions adjacent to the Focus Area. Data is disaggregated by gender. M means male, F means female and T means total.
Sources: Newfoundland & Labrador Statistics Agency, Government of Newfoundland and Labrador, 2024a; 2024c.

Table 7.13.15. Economic Indicators and Sources of Income by Region and Gender Based on 2021 Census Data
Rural Secretariat Regions with communities in proximity to the Focus Area, and within which there are existing industrial facilities.

	Clarenville - Bonavista			Avalon Peninsula		
	M	F	T	M	F	T
Total Income						
Median ($)	39,400	29,600	33,800	46,000	37,100	40,900
Number Reporting	11,670	12,070	23,740	104,890	112,750	217,640
Provincial Index						
Canadian Index						
Market Incomes						
Employment Income						
Contribution of Total (%)	61.8	52.8	58.1	71.5	63.7	68.1
Number Reporting	7,680	7,210	14,890	76,770	75,560	152,330
Investment Income						
Contribution of Total (%)	1.1	0.9	1.0	2.8	1.8	2.4
Number Reporting	1,290	1,150	2,430	15,370	14,540	29,910
RRSP Income						
Contribution of Total (%)	0.3	0.4	0.4	0.2	0.3	0.2
Number Reporting	150	120	270	1,320	1,340	2,660
Private Pension						
Contribution of Total (%)	7.8	6.7	7.3	8.1	9.1	8.6
Number Reporting	2,330	1,810	4,140	19,090	20,870	39,960
Other Income						
Contribution of Total (%)	1.9	2.1	2.0	2.3	3.0	2.6
Number Reporting	1,800	1,750	3,540	18,230	19,160	37,380
Total Market Incomes						
Contribution of Total (%)	72.8	63.0	68.8	84.9	77.9	81.9
Transfer Payments						
Old Age Security/Net federal supplements						
Contribution of Total (%)	6.1	10.6	8.0	3.3	5.4	4.2
Number Reporting	3,880	4,310	8,190	24,370	29,630	54,000
Canada Pension Plan						
Contribution of Total (%)	6.1	6.7	6.3	3.9	5.1	4.4
Number Reporting	5,100	5,370	10,470	32,900	38,780	71,680

	Clarenville - Bonavista			Avalon Peninsula		
	M	F	T	M	F	T
Canada Child Benefit						
Contribution of Total (%)	0.1	3.2	1.4	0.1	2.6	1.2
Number Reporting	100	2,190	2,290	1,450	23,960	25,410
GST Credit						
Contribution of Total (%)	0.3	0.5	0.4	0.2	0.3	0.3
Number Reporting	4,740	4,280	9,020	34,380	37,860	72,240
Employment Insurance						
Contribution of Total (%)	11.4	11.4	11.4	4.9	5.2	5.0
Number Reporting	4,540	3,490	8,040	24,330	21,760	46,090
Workers Compensation						
Contribution of Total (%)	0.8	0.8	0.8	0.7	0.6	0.6
Number Reporting	390	290	680	3,170	2,630	5,800
Income Support Assistance						
Contribution of Total (%)	0.6	1.1	0.9	0.7	1.1	0.9
Number Reporting	480	500	980	4,900	5,730	10,630
Provincial tax credits						
Contribution of Total (%)	0.6	1.0	0.7	0.3	0.6	0.5
Number Reporting	4,760	4,620	9,380	40,460	47,700	88,160
Other government transfers						
Contribution of Total (%)	1.0	1.8	1.4	1.0	1.3	1.1
Number Reporting	1,310	1,860	3,160	14,240	17,520	31,760
Total transfer incomes						
Contribution of Total (%)	27.2	37.0	31.2	15.1	22.1	18.1
Number Reporting	9,990	10,620	20,600	78,520	93,470	171,990
Total transfer incomes per capita						
Amount ($)	12,200	11,300	11,800	7,900	8,600	8,200
Provincial Index	129.7	116.7	123.0	83.6	88.4	86.1
Canadian Index	207.6	145.0	171.2	133.8	109.8	119.9

This table shows economic indicators and sources of income for Rural Secretariat Regions with communities in proximity to the Focus Area, and within which there are existing industrial facilities. Data is disaggregated by gender. M means male, F means female and T means total.

Sources: Newfoundland & Labrador Statistics Agency, Government of Newfoundland and Labrador, 2024a; 2024c.

Table 7.13.16. Highest Level of Education Across Newfoundland and Labrador Local Areas

Geography	Less than High School Certificate	High School Certificate Only	Post Secondary certificate, diploma or degree	Trades Certificate or Diploma	University Certificate, Diploma or Degree at Bachelor Level or Above	Total Population Aged 15+
Newfoundland and Labrador	**20.4%**	**27.6%**	**51.9%**	**9.8%**	**16.6%**	**433,955**
Cow Head	20.3%	36.2%	43.5%	7.2%	7.2%	345
St. Paul's	54.8%	29.0%	16.1%	6.5%	..	155
Placentia Bay West Centre	**39.0%**	**23.0%**	**38.5%**	**8.5%**	**6.5%**	**1,000**
Baine Harbour (Municipality)	28.6%	25.0%	46.4%	21.4%	10.7%	140
Boat Harbour-Brookside	..	..	..	..	..	..
Parkers Cove (Municipality)	..	..	..	..	..	..
Red Harbour (Municipality)	19.4%	19.4%	61.3%	9.7%	6.5%	155
Rushoon (Municipality)	35.3%	21.6%	41.2%	7.8%	3.9%	255
Mortier Bay	**20.8%**	**24.0%**	**55.1%**	**14.4%**	**9.9%**	**5,080**
Marystown (Municipality)	22.1%	23.4%	54.3%	12.9%	9.6%	4,380
Winterland (Approx. Municipality)	5.9%	31.4%	62.7%	17.6%	17.6%	255
Burin Area	**25.6%**	**21.7%**	**52.9%**	**13.3%**	**8.3%**	**2,885**
Burin (Municipality)	26.8%	22.2%	51.0%	11.7%	8.2%	1,960
Epworth-Great Salmonier (Approx. Local Service District)	..	..	..	..	..	0
Fox Cove - Mortier (Municipality)	31.9%	25.5%	44.7%	12.8%	4.3%	235
Lewin's Cove	16.7%	25.8%	57.6%	16.7%	13.6%	330
St. Lawrence Area	**19.4%**	**35.9%**	**45.1%**	**15.0%**	**6.3%**	**1,030**
Little St. Lawrence	16.7%	36.7%	43.3%	23.3%	6.7%	150
St. Lawrence (Municipality)	19.8%	35.6%	45.2%	13.6%	7.3%	885
Lamaline Area	**38.6%**	**22.3%**	**39.1%**	**9.9%**	**4.3%**	**1,165**
Lamaline (Municipality)	37.2%	27.9%	34.9%	4.7%	4.7%	215
Lawn (Municipality)	29.9%	25.8%	44.3%	16.5%	7.2%	485
Lord's Cove (Municipality)	40.0%	12.5%	45.0%	10.0%	5.0%	200
Point May (Municipality)	42.1%	23.7%	34.2%	..	..	190
Fortune-Grand Bank Area	**31.7%**	**26.8%**	**41.4%**	**12.0%**	**5.5%**	**3,790**
Fortune (Municipality)	36.7%	28.3%	34.5%	9.7%	5.8%	1,130
Frenchman's Cove, Fortune Bay	21.4%	21.4%	57.1%	14.3%	10.7%	140
Garnish (Municipality)	23.0%	31.0%	45.0%	15.0%	6.0%	500
Grand Bank (Approx. Municipality)	31.1%	25.8%	43.1%	11.2%	4.8%	1,960
Bay L'Argent Area	**38.6%**	**29.4%**	**32.0%**	**10.5%**	**2.6%**	**765**
Bay L'Argent (Municipality)	37.5%	35.0%	27.5%	7.5%	..	200
Harbour Mille-Little Harbour East (Local Service District)	42.1%	36.8%	26.3%	..	..	95

Geography	Less than High School Certificate	High School Certificate Only	Post Secondary certificate, diploma or degree	Trades Certificate or Diploma	University Certificate, Diploma or Degree at Bachelor Level or Above	Total Population Aged 15+
Little Bay East (Municipality)	..	..	..	..	..	0
St. Bernard's-Jacques Fontaine (Municipality)	36.6%	24.4%	39.0%	15.9%	2.4%	410
Terrenceville Area	**45.4%**	**30.5%**	**23.4%**	**9.9%**	**..**	**705**
English Harbour East (Municipality)	44.4%	22.2%	29.6%	..	..	135
Grand Le Pierre (Municipality)	51.6%	29.0%	19.4%	..	..	155
Terrenceville (Municipality)	43.9%	32.9%	23.2%	14.6%	..	410
Belle Bay	**43.2%**	**31.5%**	**25.4%**	**8.5%**	**4.7%**	**1,065**
Belleoram (Municipality)	57.6%	28.8%	15.3%	6.8%	..	295
Pool's Cove (Municipality)	38.7%	19.4%	38.7%	9.7%	6.5%	155
Rencontre East (Municipality)	23.8%	42.9%	38.1%	9.5%	..	105
St. Jacques-Coomb's Cove (Municipality)	40.8%	33.0%	24.3%	8.7%	7.8%	515
Harbour Breton Area	**36.7%**	**29.7%**	**33.2%**	**8.2%**	**7.0%**	**1,280**
Harbour Breton (Municipality)	36.7%	29.7%	33.2%	8.2%	7.0%	1,280
Hermitage Bay	**48.6%**	**32.6%**	**19.6%**	**6.5%**	**3.6%**	**690**
Gaultois (Municipality)	..	..	..	..	..	0
Hermitage-Sandyville	46.3%	37.8%	14.6%	3.7%	4.9%	410
Seal Cove, Fortune Bay (Municipality)	45.7%	28.3%	26.1%	10.9%	4.3%	230
Bay d'Espoir Area	**32.9%**	**26.6%**	**40.3%**	**11.6%**	**6.7%**	**2,705**
Milltown-Head of Bay D'Espoir (Municipality)	33.8%	30.0%	36.9%	8.5%	6.9%	650
Samiajij Miawpukek	27.6%	23.7%	48.7%	15.4%	7.1%	780
St. Alban's (Approx. Municipality)	38.1%	26.7%	35.2%	10.2%	5.9%	1,180
Burgeo Area	**38.5%**	**30.8%**	**30.5%**	**7.1%**	**4.9%**	**1,625**
Burgeo	..	..	..	..	..	..
Francois (Local Service District)	..	..	..	..	..	0
Grey River (Local Service District)	57.9%	26.3%	21.1%	..	..	95
La Poile (Local Service District)	..	..	..	..	..	0
Ramea (Municipality)	49.3%	27.5%	23.2%	5.8%	4.3%	345
Port aux Basques Area	**32.0%**	**30.2%**	**37.9%**	**7.9%**	**7.7%**	**4,800**
Burnt Islands	..	..	..	..	..	..
Cape Ray (Local Service District)	..	..	..	..	..	..
Channel-Port aux Basques (Approx. Municipality)	29.1%	31.0%	39.9%	8.2%	8.9%	3,595
Isle aux Morts (Municipality)	36.9%	23.3%	38.8%	5.8%	8.7%	515
Rose Blanche Area	**37.7%**	**24.7%**	**36.4%**	**7.8%**	**3.9%**	**385**
Rose Blanche-Harbour le Cou (Approx. Municipality)	37.7%	24.7%	36.4%	7.8%	3.9%	385
Codroy Valley	**24.3%**	**33.3%**	**42.3%**	**8.6%**	**9.5%**	**1,110**

Geography	Less than High School Certificate	High School Certificate Only	Post Secondary certificate, diploma or degree	Trades Certificate or Diploma	University Certificate, Diploma or Degree at Bachelor Level or Above	Total Population Aged 15+
Codroy-Cape Anguille	44.1%	35.3%	20.6%	5.9%	..	170
South Branch-Coal Brook	26.9%	42.3%	30.8%	11.5%	..	130
St. Andrew's (Local Service District)	17.2%	20.7%	65.5%	..	20.7%	145
Crabbes River	**35.6%**	**27.5%**	**37.4%**	**10.4%**	**2.7%**	**1,110**
Bay St. George South (Local Service District)	35.6%	27.5%	37.4%	10.4%	2.7%	1,110
St. George's Area	**27.1%**	**27.8%**	**45.1%**	**10.9%**	**12.3%**	**1,420**
Barachois Brook (Local Service District)	..	..	..	..	..	..
St. George's (Municipality)	22.0%	25.4%	52.6%	12.9%	15.3%	1,045
Stephenville-Port au Port Peninsula	**27.0%**	**25.8%**	**47.2%**	**10.3%**	**10.3%**	**12,905**
Cape St. George	47.3%	27.4%	24.7%	8.9%	2.7%	730
Kippens (Municipality)	15.6%	24.2%	60.4%	11.0%	17.5%	1,630
Lourdes (Municipality)	33.7%	23.6%	42.7%	14.6%	6.7%	445
Noels Pond	14.3%	19.0%	61.9%	9.5%	14.3%	105
Port au Port East (Municipality)	19.7%	28.9%	50.0%	10.5%	7.9%	380
Port au Port West-Aguathuna-Felix Cove (Municipality)	30.9%	17.6%	52.9%	8.8%	14.7%	340
Stephenville (Approx. Municipality)	21.8%	26.3%	51.8%	9.8%	12.4%	5,730
Stephenville Crossing (Approx. Municipality)	32.4%	26.6%	41.0%	7.8%	8.5%	1,465
West Bay (Local Service District)	33.3%	30.8%	35.9%	7.7%	7.7%	195
Corner Brook-Pasadena Area	**16.4%**	**28.0%**	**55.6%**	**11.0%**	**17.5%**	**24,875**
Corner Brook (Municipality)	16.5%	28.5%	55.1%	10.5%	17.1%	16,290
Gillams (Municipality)	23.3%	25.6%	51.2%	12.8%	5.8%	430
Hughes Brook (Municipality)	19.5%	24.4%	53.7%	17.1%	7.3%	205
Irishtown-Summerside (Municipality)	18.1%	26.6%	55.3%	16.1%	6.5%	995
Massey Drive (Municipality)	11.7%	21.2%	66.3%	14.0%	29.2%	1,320
McIver's (Municipality)	33.0%	29.8%	38.3%	7.4%	10.6%	470
Meadows (Municipality)	20.7%	36.8%	41.4%	10.3%	6.9%	435
Mount Moriah	21.5%	36.4%	43.0%	13.1%	9.3%	535
Pasadena (Municipality)	15.3%	26.5%	58.4%	11.1%	20.0%	2,980
Steady Brook (Municipality)	5.6%	29.6%	66.2%	9.9%	28.2%	355
Bay of Islands	**34.3%**	**25.9%**	**39.6%**	**11.4%**	**7.6%**	**2,640**
Cox's Cove (Municipality)	49.1%	23.1%	25.9%	5.6%	3.7%	540
Humber Arm South (Municipality)	29.1%	27.2%	43.7%	13.1%	9.7%	1,340
Lark Harbour (Municipality)	35.0%	25.0%	37.5%	11.3%	6.3%	400
York Harbour (Municipality)	30.1%	23.3%	46.6%	15.1%	8.2%	365
Bonne Bay Area	**33.3%**	**26.1%**	**40.6%**	**9.6%**	**14.5%**	**2,450**

Geography	Less than High School Certificate	High School Certificate Only	Post Secondary certificate, diploma or degree	Trades Certificate or Diploma	University Certificate, Diploma or Degree at Bachelor Level or Above	Total Population Aged 15+
Glenburnie-Birchy Head-Shoal Brook (Municipality)	32.5%	37.5%	30.0%	12.5%	7.5%	200
Norris Point (Municipality)	34.7%	28.1%	37.2%	6.6%	14.0%	605
Rocky Harbour (Municipality)	26.9%	21.0%	52.1%	10.8%	20.4%	835
Trout River (Municipality)	44.0%	31.0%	23.8%	8.3%	2.4%	420
Woody Point (Municipality)	35.1%	24.6%	40.4%	10.5%	17.5%	285

This table shows the highest level of education by percent of total population aged 15+ for local areas and municipalities adjacent to the Focus Area. Data was provided to the Committee by the Government of Newfoundland and Labrador August 2024.
Figures may not add to total due to rounding. Also, please note that there may be smaller communities/areas not listed within the local area, therefore communities listed may not add to the total local area.
Symbol legend:.. data is not available and/or may be suppressed for data quality or confidentiality reasons.
Source: Compiled by the NLSA based on information provided from the Census of Population 2006, 2011, 2016 and 2021 Statistics Canada.

7.13.2 Potential Effects

Offshore wind development in other jurisdictions has shown both positive and adverse impacts on communities and economies. 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.[76]

The sections below provide an overview of offshore wind development impacts to communities and economies reported in other jurisdictions, and approaches for mitigating or enhancing effects. 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 offshore wind farms 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.

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.

[76] 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

7.13.2.1.1 Economic Impacts, Local Jobs and Supply Chains

Offshore wind development creates jobs to support manufacturing, construction, operation and decommissioning of projects. Over its lifetime, a 500 MW project is estimated to create 2.1 million days of work (OREAC, 2020). In their 2015 report on offshore wind development impacts to well-being, the Crown Estate reports 3,151 direct jobs created and 7,000 indirect jobs created along the supply chain by 2015. They also report 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).

The number of jobs varies according to project, and most employment occurs during manufacturing and project construction. An installation rate of 1 GW of offshore wind per year typically uses about 25,000 full time equivalents (FTEs) during the capital phase. During operation, each 1 GW of operating plant uses about 600 FTEs each year (BVG Associates,2019). Table 7.13.17 below lists examples of projects and estimated jobs.

Table 7.13.17. 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 • Up to 90 people (majority from local area) based in the Wick O&M building. Jobs range from office administrators to offshore technicians.

Project	Scale/Description	Estimated Jobs
Able Marine Energy Park	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 • 4,100 direct FTE jobs on site (manufacturing of marine energy components) once AMEP completed • 5,000 direct FTE jobs in the Yorkshire and Humber region and elsewhere in the UK • 3,200 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 • 1,020 -1,230 during operation

This table shows estimated number of jobs for offshore wind development projects of various scale in other jurisdictions. The table was adapted from Gould and Cresswell (2017). Additional examples from other sources were added.
Additional Sources: MMO, 2014; SSE Renewable, 2019.

Types of jobs by project phase include (Gould and Cresswell, 2017):

- Planning and Development: Identifying potential sites; conducting surveys, data collection, and environmental reviews; obtaining permits, leases, and project financing; designing the wind power plant; producing components.
- Manufacturing: 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 administration professionals, assemblers, public relations and marketing professionals, logisticians, and site/plant managers.
- Construction, Installation and Decommissioning: electricians, painters, pile drivers, laborers, stevedores, millwrights, ironworkers, carpenters, welders, plumbers
- Operations and Maintenance (regular inspection and repair of turbines, foundations, and cables and any necessary remedial work): vessel crews, site or plant managers, executives, engineers, back office and administrative professionals, logisticians, public engagement or marketing specialists.
- Training Consulting and Research: 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.

Planning and development require at least 2 years on average but is typically longer depending on the project and can last more than 10 years. Manufacturing includes designing, producing, testing and selling components. This phase is ongoing and Original Equipment Manufacturers can be involved in multiple projects or orders at the same time. Construction and installation typically last 3-5 years, and technological advancements aim to shorten this period. Operations and maintenance time or dependent on leas and energy agreements but typically last about 20 years. Training, consulting and research is ongoing throughout all phases. Individual involvement can be months or years depending on factors like project specifics and funding. (Gould and Cresswell, 2017).

7.13.2.1.2 Local Opportunity

Like the number of types of jobs, the distribution of local and foreign employment varies with project phase and over time. For a new market, 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 7.13.18).

Table 7.13.18 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 •

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.
Source: World Bank Group, 2021.

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 and 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.

Glasson et al., (2022) also notes that reports tend not to differentiate between local, regional and national scales when reporting local benefits.

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 to 2023. Full time employment has increased from 271 in 2021 to 1346 in 2023 (Port of Argentia, 2024a).

7.13.2.1.3 Barriers to Women's Employment in Wind Development[77]

In 2019, the International Renewable Energy Agency administered a survey across the wind sector (onshore and offshore wind) to understand women's representation and barriers in the wind industry.[78] 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 (Mishl, 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 and to 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,

[77] See Section 11 of this Report for more discussion on intersectionality and GBA Plus.
[78] 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.

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. For entry, perceptions of gender role, cultural and social norms were ranked highest. Other barriers were considered less relevant, with lack of educational background considered least limiting (i.e., women reported being 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%), seminars (41%).

7.13.2.1.4 Broader Economic Impacts

Broader economic impacts of offshore wind development include increased financial and manufactured 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 manufactured 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).

7.13.2.1.5 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 and Angell, 2011; Sutherland and Flin, 1989).
- A U.S, study in the early 90'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 order and drunkenness involving in-migrant workers were reported. The numbers were reduced to 5 arrests each in 1993. Between 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 and 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 7.13.19 and 7.13.20 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 7.13.19. 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

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.
Source: Jones (1998) from Storey and Jone (2003).

Table 7.13.20. 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

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).
Source: Jones (1998) from Storey and Jone (2003).

In addition to these survey findings, Storey and 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 and Jones, 2023).

Overall, researchers concluded that economic benefits were 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 consultation to identify concerns of residents in the area and to develop realistic solutions.

7.13.2.1.6 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 US, 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).

7.13.2.1.7 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. and Australia (Aitchison, 2004; British Wind Energy Association, 2006; Frantál and 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 and Lutzeyer, 2012; Ladenburg and Möller, 2011; Westerberg et al., 2013).

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.

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 such as the Offshore Development Fund, hard work by local companies and industry associations, and individuals. And they have proved to be sustainable (Community Resources Services, 2003; Stantec, 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.

The table below summarizes some mitigation and enhancement measures used in other jurisdictions to promote positive effects and avoid or reduce adverse effects.

Table 7.13.21. Measures to Mitigate and/or Enhance Impacts of Offshore Wind Development on Communities and Economies

Desired Effect	Mitigation and Enhancement Measures
Increase Local Jobs and Supply Chain Capabilities	• Engage with industry early and throughout development to understand requirements and maximize local supply benefits. • 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 (IPGS) econext project “Clean Energy Initiative: Workforce Development and Innovation”. • Commission supply chain gap analysis to identify gaps in global supply chain that could be viably filled in country of supply
Address Gender Gaps	• In a 2019 survey completed by the International Renewable Energy Agency, the following measures were rated most helpful for reducing barriers for women in offshore wind: networking opportunities (73%), mentoring opportunities (65%), training (60%), sharing experiences (58%), gender policies (44%), internships (42%), seminars (41%). •

Desired Effect	Mitigation and Enhancement Measures
Avoid, mitigate or offset adverse impacts to local communities	• 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 depicting mitigation and enhancement measures for potential impacts of offshore wind development on Communities and Economy.
Sources: IRENA,202; Storey and Jones, 2003; World Bank Group, 2021;

7.13.3.1.1 Key Considerations for Enhancing Local Supply Chains

Table 7.13.22, contrasts different approaches used in other jurisdictions to enhance local economic benefits of offshore wind development. Related to these, the World Bank offers several recommendations (see below), and overall, emphasizes the need to balance localized cost of energy and local economic benefits. Examples where local content requirements were mandated early on showed negative outcomes like reduced market competition, increased cost and risk, and slow market development. Countries should focus on tools to promote long-term, and broader use of local supply.

Table 7.13.22. 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

Jurisdiction	Approach	Outcomes
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 (41)
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* [41] •

This table compares approaches used by various jurisdictions to enhance local economic benefits of offshore wind development projects.
Source: World Bank Group, 2021.

Recommendations from the World Bank

- 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.
- 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; 2017b; 2018; Maryland Energy Administration, 2020; NYSERDA, 2017).

- 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 (U.K.) clusters provide examples where investing in port development attracted international company support to develop the offshore wind supply chain (World Energy Cities Partnership, ND; Port Esbjerg, ND; BEIS, 2021).
- 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.

7.13.4 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 area, in Stephenville.
- 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 is 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 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,[79] MFN recommended:
- "That in the spirit of the Truth and Reconciliation Committee (TCR) recommendations, Calls to Action, Section 92 – Business and Reconciliation, proponents of [offshore wind development] should engage adjacent First Nations as per the following:
- 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.

[79] A link to the Registry post was not available in time for inclusion in this Report, but it should be uploaded to the Registry in the near future.

  - 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 their 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 their ability to sustain their 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 their traditional territories and disruption of their 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 Offshore wind turbine developments.
- 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 consultation 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.

7.13.5Data 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 (reference) but is fairly dated and has limited consideration of how diverse populations experience impacts.

7.13.6 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 Tech Fund and continue to support active industry associations (e.g., MRC, EnergyNL, econext, Oceans Advance, NetZero Atlantic etc.,)
- The Committee recommends that developers work with government agencies to support and collaborate with local communities, once an areas is identified as a potential location for offshore wind development. Developers and government agencies should be transparent and provide available information as soon as possible, so that towns can plan effectively.

7.13.7References

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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 has multiple references to the identification, consideration, and analysis of cumulative effects within this Regional Assessment. It does not request the completion of a cumulative effects assessment (CEA) and gives the Committee flexibility in determining how to address cumulative effects.

This section summarizes available guidance on consideration of cumulative effects regional assessments under the IAA, acknowledges the challenges of CEA, and presents federal authority input and Indigenous and public engagement outcomes relevant to cumulative effects. This section also describes how the Committee's constraints analysis approach and resulting licencing areas is 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, 2023). The Committee requested the IAAC provide advice on how to assess cumulative effects in a manner that fulfills the Agreement. [80] 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). The interim message 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

[80] Request for Advice (Cumulative Effects) - Impact Assessment Agency of Canada

contributors to that plan. 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

CEA already presents a practical and theoretical challenge (e.g., Blakley and Franks, 2021). The spatial, temporal, natural, and anthropogenic dynamics of the marine environment creates further complexity for CEA. 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). The Regional Assessment for Offshore Oil and Gas Exploratory Drilling East of Newfoundland and Labrador, the first and only regional assessment completed to date, offers a particularly relevant example. Assessment of cumulative effects understandably proved challenging, even with a specific development goal and timeline and decades of data available (Bangay et al. 2020).[81]

In addition to these challenges, jurisdictions with offshore wind industries contend with knowledge and data gaps. In areas where offshore wind is new, there is limited knowledge about the localized environmental impacts when the first projects are developed. Where offshore wind 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 may remain untested in the offshore wind context. Given the comparatively harsh and inaccessible nature of the offshore environment, it can be both challenging and expensive to collect data and test mitigation strategies. Consequently, mitigation measures implemented in earlier projects might not be as effective as initially anticipated. A related concern amongst stakeholders in the EU is the inadequate sharing of data, which hinders learning from the earlier projects. Without comprehensive data on the impacts and mitigation measures, it becomes more challenging to assess cumulative impacts (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).

[81] 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.

Finally, the Project Envelope Approach poses a unique challenge for CEA.[82] The Project Envelope Approach is necessary to accommodate the rapid evolution of offshore wind technology. It enables developers to describe their projects using broad parameters, including technology options (e.g., more than one proposed foundation type). While this flexibility is required from a project design and engineering standpoint, it poses a challenge for CEA. As described in Section 4 of this Report, there are multiple technology options for offshore wind, 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 CEA, 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 (Caine, 2022).

8.3 Federal Authority Input and Initiatives

Federal authorities provided input on cumulative effects primarily through written responses to Committee requests.[83] 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.[84] Staff from numerous federal and provincial departments attended,[85] and DFO, ECCC, NRCan, and TC gave presentations. 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.

[82] The proposed ORER 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, should design or technologies change during the approval process.
[83] The Committee's Public, Fisheries, and Stakeholder Engagement – What We Heard Report contains a list of requests and responses.
[84] Letter to Impact Assessment Agency of Canada RE: Consulting Expert Authorities on Cumulative Effects
[85] The Committee's Public, Fisheries, and Stakeholder Engagement – What We Heard Report contains a list of all meetings and meeting participants.

Table 8.3.1: Cumulative effects of offshore wind – Federal authority input

Air Quality and GHGs (ECCC, 2024a)
Overall, the carbon footprint of wind power is significantly lower than that of fossil-based power.
Marine Fish and Fish Habitat (DFO, 2023a)

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, 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 and Hasager, 2005; Schulze 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 and Bartlett, 2021). Studies, however, have not attempted to ascertain the exact relationship between electric or magnetic fields and observed behavioural modifications (DFO, 2023a).
- 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 and Bartlett, 2021; DFO, 2014).
- 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

- Cumulative effects research and approach development underway (see Table 8.3.2)

Marine Mammals, Sea Turtles, and Sharks (DFO, 2023a)

- Cumulative impacts associated with at-risk marine species, 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.
- 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 have been far more problematic than models using single stressors. This is mainly due to our 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, vessels 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, 2023a)

- There have not been any studies or reviews conducted regarding cumulative impacts on EBSAs, SiBAs, or other important areas in the Newfoundland region.

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).
Fisheries and Other Ocean Uses (DFO, 2023a)
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, 2023)
• 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, 2023)

• 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 utilise the range of information from an ensemble of climate models for a range of future emission scenarios.

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 5 MSP areas across Canada: Southern British Columbia, Pacific North Coast, NLS, Estuary and GSL, Scotian Shelf and Bay of Fundy (DFO, 2024a).	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

Federal authority - Initiative	Description	Status
		focused to help advance economic opportunities (DFO, 2023b).
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. 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, 2023c)	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 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, 2023c).
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.* 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, 2024b).	DFO is finalizing the Position Statement to be published in the coming year (DFO, 2024b).

Federal authority - Initiative	Description	Status
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, 2024b).	Does not include impacts from offshore wind development. Completion date of Fall 2025 (DFO, 2024b).
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, 2024b).	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, 2024b).
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, 2024b).	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.

Federal authority - Initiative	Description	Status
		• Look at impacts across different time periods versus aggregating data over multiple decades. • Incorporate climate change into analyses to inform proactive planning (DFO, 2024b).
ECCC-STB and ECCC-CWS-ATL (with BRI) - Conceptual Framework	ECCC and BRI are developing a *Conceptual Framework for Assessing the Cumulative Effects of Offshore Wind Energy and Other Pressures on Aerofauna* (Ferguson et al. 2024). This framework adopts a population- or species-centric approach, is adaptable to various ecological information levels, and is designed for regional application, particularly in Atlantic Canada. The intention of this framework is to allow for standardization of metrics and criteria across cumulative effects processes. This framework is a synthesis of best practices that has been informed by a comprehensive review of CEA approaches in regions with advanced offshore wind industries (ECCC, 2024b).	ECCC plans to issue the Conceptual Framework, as well as submit a manuscript for a peer-reviewed publication, prior to the publication of the Committee's Final Report (January 2025). Work funded until March 31, 2028 (ECCC, 2024b).
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). Results indicate a lack of field-testing mitigation for effectiveness, and a lack of effectiveness where tested (Gulka et al. 2024).	ECCC plans to submit a manuscript for a peer-reviewed publication, prior to the publication of the Committee's Final Report (January 2025). Work funded until March 31, 2028 (ECCC, 2024b).
NRCan-Office of the Chief Scientist – Open Science and	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 sources from all levels of government	NRCan is continually updating the OSDP with information.

Federal authority - Initiative	Description	Status
Data Platform (OSDP)	sources. It includes datasets and scientific publications relevant to cumulative effects and to the Regional Assessment, and can be enhanced over time (NRCan, 2024).	The Regional Assessment Study Area, Focus Area, and Preliminary Offshore Wind Licencing Areas (from Interim Report, March 2024) are available on the OSDP. The Proposed Offshore Wind Licensing Areas 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 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 production for the production of hydrogen in Atlantic Canada (NRCan, 2024).	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. 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.

This table describes initiatives by the federal government that exist to are planned to occur as well as their respective status.

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 the 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 they should recommend another mechanism through which a CEA 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 recommended offshore wind 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 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 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 must include Project Nujio'qonik.
- The cumulative effect of onshore and offshore wind 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 need to apply a gender and diversity lens to this aspect in particular 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 Port of Stephenville (see Section 7.13).

8.4.4 Cumulative 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 8.4.4: Participant comments on cumulative effects of offshore wind 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).
Fisheries and Other Ocean Uses	• Some Indigenous and non-Indigenous fish harvesters have been clear throughout this process that offshore wind 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, 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 not only on the community as a whole, but also on the individuals who will be working in the industry.

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 CEAs at the project level. The Committee also appreciates that because of this, participants had high expectations for CEA 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 them to be able to undertake a CEA in this Regional Assessment. No projects or development goals have been announced on which to base realistic scenarios. As already identified throughout this Report, there are numerous information and data gaps that must be addressed to better understand the effects of offshore wind 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, some use differing methods to account for data deficiencies, and those most relevant to offshore wind 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 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 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 Offshore Wind Licencing Areas. 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 licencing areas avoid marine critical habitat, MPAs, marine traffic routes, a proposed NMCA, significant viewscapes from a National Park and WHS, and high-density fishing areas. 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. In identifying the recommended licencing areas based on avoidance and minimization, the Committee has demonstrated mitigation of cumulative effects on a proactive, regional level.

8.5.2 Approaches for addressing cumulative effects at a regional scale

The Committee acknowledges that CEA 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 CEA will also be critical in helping to address the various knowledge and data gaps identified throughout this Report. However, relying on only project level CEA 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 recommended 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.

8.6 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.

- The Government of Canada continue to support ECCC in their offshore wind CEA 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 licencing areas (once the determined) with the key objective of supporting a more thorough assessment of cumulative effects.
    - The strategic assessment should be designed by federal authorities who hold expertise in CEA, and in the specific valued components (e.g., ECCC for aerofauna, DFO for marine fish and fish habitat, commercial fisheries) 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 should include engagement with Indigenous peoples, fish harvesters, residents of coastal communities with port infrastructure suitable for offshore wind, and other segments of the population that are most likely to be adversely affected by offshore wind.
    - The strategic assessment 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 recommended offshore wind 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 CLNOER develop specific guidelines that define parameters for Project Design Envelopes, that consider the implications of a "worst case scenario" when it comes to CEA.

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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 and 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.

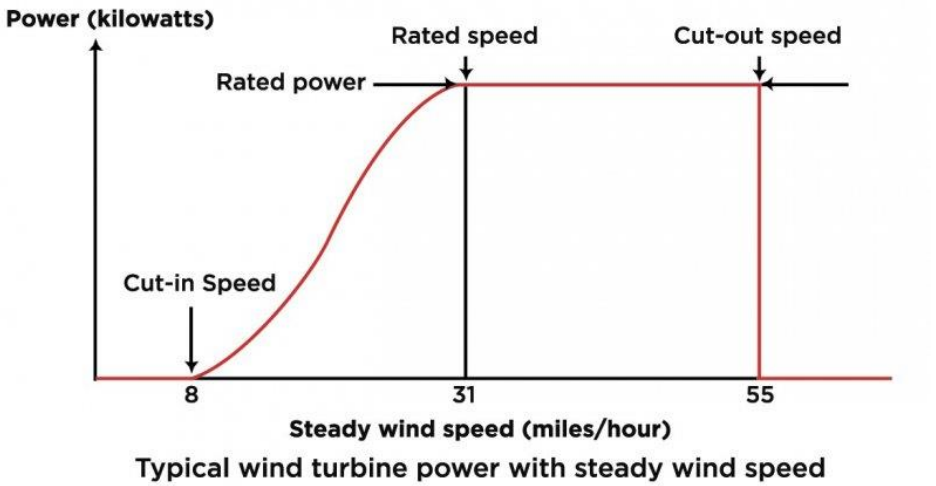
9.1.1 Wind

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. The MSC Wave Atlas map also shows the average wind speed being greater than 8 m/s on the south coast and greater than 7 m/s on the west coast of Newfoundland, meeting the typical requirement for wind speeds before the 100 m height adjustment. The wind speeds should be significantly more than recorded after the 100 m adjustment (ECCC, 2023a).

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).

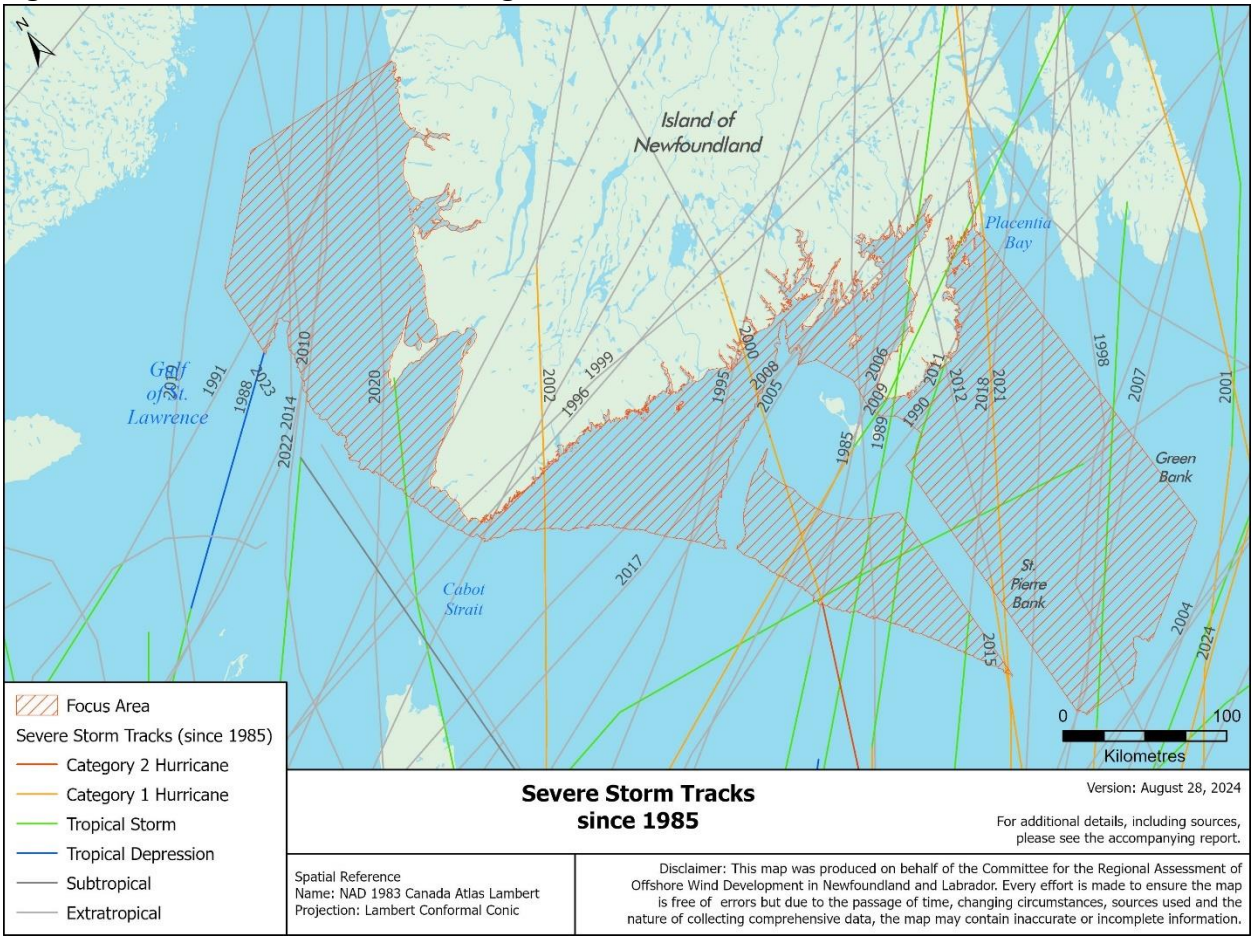
Figure 9.1. Power Output of Turbines against Steady Wind Speeds



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).

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 1973-2022, the Focus Area experienced 44 severe storms (ranging from less than hurricane force to Category 2 hurricanes), some caused severe damage to 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



Map depicting severe storm tracks since 1985 that have passed through the Focus Area.
Source: (National Centers for Environmental Information, n.d.)

9.1.2 Waves

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 100km/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 30m in offshore waters, and once they reach the coastline, they can be very destructive to infrastructure (ECCC, 2023b). 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 2m can become difficult depending on the type of vessel used.

9.1.3 Icebergs, 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 farms. 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 and also impact the cost-effectiveness of the system. Overall, different variations of ice can cause a variety of issues to turbines, including:

- 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 (Battisti et al., 2006).

9.1.4 Visibility

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.

9.1.5 Tidal 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

Port	Tidal Range (m)	
	Mean Tide	Large Tide
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 depicting 2024 predicted tidal ranges for listed secondary ports that are within the Focus Area (Fisheries and Oceans 2024a;2024b)

9.1.6 Seismic 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

Turbine Type	Seismic Effects
	• 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 describing potential effects on turbine types caused by seismic activity (Bhattacharya et al., 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, creating 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 outlining different types of scour that could occur with various fixed turbine structures (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).

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., 2017b).

9.2 Accidental Effects

The available information on accidental events associated with offshore wind 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 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, Jr., 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, Jr., 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; Vize et al., 2008). When combined with the wear in power cables caused by biofouling and/or hydrodynamic forces in the water column, floating offshore wind 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).
- 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 (Uadiale et al., 2014; Mou et al., 2021). 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, 2024), 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 the service vessel is at sea (Taylor & Jeon, 2018). This mobilization window may differ

Effect	Mitigation/Enhancement Measure	Mitigation Description & Examples in Other Jurisdictions
		depending on the service vessel used, so wave heights should be monitored accordingly to ensure the safety of the workers. • 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 3m 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, 2024).
	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*.

Effect	Mitigation/Enhancement Measure	Mitigation Description & Examples in Other Jurisdictions
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).
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 won't 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., 2017b).
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 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.
- Developers should consider hurricane force winds, and associated winds and atmospheric icing, in project design given the potential for these forces throughout the Focus Area.
- Developers should utilize the precautionary approach when siting a project, especially when considering areas prone to sea ice or icebergs.
- Developers 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.
- 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.

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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*, 2019).

Sustainability is contextual and may be defined in different ways by communities or groups within communities. The IAAC's 2022 to 2026 Federal Sustainable Development Strategy (FSDS) collates sustainable development goals, targets, short-term milestones, and implementation strategies from across the Government of Canada (ECCC, 2024). 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 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 10.6 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 of 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 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 (2019) review 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, 2019). A brief description of some of the direct and indirect socioeconomic benefits follows as 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, 2019). Many of these services would be needed by offshore wind companies. The offshore oil and gas industry has made a substantial contribution to infrastructure development in Newfoundland and Labrador. Some of this infrastructure has contributed to the diversification of Newfoundland and Labrador's 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 other countries (Stantec, 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, 2019). The industry has also funded a number of new research chairs at Memorial University and new equipment and curricula at 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, 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 is to

improve on the development and use of a circular economy for the wind 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. Dept 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. Dept 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, 2023, 2024). 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 materials with about 85 - 90% of the components used to construct wind turbines and associated infrastructure being recyclable materials (U.S. Dept of Energy, 2023; n.d.). Recycling or reusing turbine blades and hub and nacelle covers poses a considerable challenge due to the strength of some materials for 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. Dept of Energy, 2023; n.d.). R&D and activities to meet this sustainability challenge and these circular economy goals are being funded and conducted by industry, governments, and academic institutions throughout the world (Jacoby, 2022; Marsh, 2017; U.S. Dept of Energy, n.d.). Three areas in which R&D is being focused and examples of R&D activities include:

- 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 (U.S. Dept of Energy, n.d.)).
- 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 (Siemens Gamesea Press Release (2021)).
- 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 (Calma (2023)).

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, 2020). 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 licensing 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 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 (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* (2019), 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 United States and Canada (1916)	All offshore wind 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 (Fish and Fish Habitat, Marine Mammals and Sea Turtles, Aerofauna). 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);	*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 (Fish and Fish Habitat, Marine Mammals and Sea Turtles, Aerofauna). 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).

Obligation	Federal and International Control Mechanisms	Provincial Control Mechanisms	Relevant Potential Effect	Implications for Meeting Obligation
	• *Fisheries Act* (1985) and associated Marine Mammals Regulations (1993).			
Montreal Protocol (Ozone) (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 (Government of Canada, 2016b).
International Union for Conservation of Nature (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 whales, North Atlantic Right whales, 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 7.4.2 and 7.3.3). There are no known specific, adverse effects

Obligation	Federal and International Control Mechanisms	Provincial Control Mechanisms	Relevant Potential Effect	Implications for Meeting Obligation
				of pile driving from offshore wind construction on tuna.
London Protocol (1996 and 2006 amendments)	*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 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
Northwest Atlantic Fisheries Organization Convention (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). *Wildlife Act* (1992); *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.

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 United States and Canada, 1916; Disposal at Sea Regulations, 2001; ECCC, 2020a, b; *Endangered Species Act, 2001*; *Environmental Protection Act, 2002*; *Environmental Protection Act, 2019*; Environmental Response Regulations, 2019; Fayram & de Risi, 2007; Federal Halocarbon Regulations, 2022; *Fisheries Act, 1985*; Government of Canada, 2016b; Government of NL, 2019a, b; *IAA, 2019*; IAAC, 2020; ICCAT, 2022; International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2017; IUCN, 1948; London Protocol, 2006; Marine Mammals Regulations, 1993; MARPOL, 1973; *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; *Wildlife Act, 1992*).

10.2.2Climate Change Commitments

Canada has numerous commitments related to mitigating the effects on climate change which stem from a variety of agreements and protocols (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 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 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 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 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 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.

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, Grosso, & Rigamonti, 2023; *Canadian Energy Regulator Act*, 2019; *Canadian Net-Zero Emissions Accountability Act*, 2021; Canadian Intergovernmental Conference Secretariat, 2015, 2016; *Canada Shipping Act*, 2001; ECCC, 2016, 2019a, 2020b, 2022; *Environmental Protection Act*, 2002; Government of Canada, 2016a; Government of Canada, 2016a; *IAA*, 2019; IAAC, 2020; International Energy Agency, 2020; MEPC 80, 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 insignificant in comparison to GHG emissions from alternative non-renewable energy sources and GHG targets (West Michigan Wind Assessment, 2014). Offshore wind is expected to offset 3.5Mt CO_2/GW of unabated coal energy and 1.6Mt 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 1.24kton/MW of installed wind power capacity per year (Delarue, Luickx & D'haeseleer, 2009). Another article estimated that even accounting for the pollution emitted during construction, operation and decommissioning, one 3.0MW 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 to 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 to 45 kg CO_2-eq/MWh and a median of 11 kg CO_2-eq/MWh (Bonou, Laurent & Olsen, 2016; Dolan & Gavin, 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 4MW and 6MW 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 in the coming period.

Table 10.3. Potential GHG Emissions for Single Turbines and 10 Turbine Farms (4MW and 6MW Capacities).[1]

Turbine (MW)	4	6
Energy to grid/turbine/year (MWh)	20528	31045
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)	410560	776125
Lifetime tCO2-eq/turbine	4475.104	6053.775
Lifetime tCO2-eq for ten turbines	44751.04	60537.75

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.

[1]Values derived from article by Bonou, Laurent & Olsen (2016). Calculations completed by RA Committee and Secretariat.

The cumulative annual GHG emissions for one 6MW turbine were then converted to annual cumulative emissions for 10 6MW 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 6MW turbines are predicted to contribute <0.05 percent of the federal 2020 and 2030 GHG targets.

Table 10.4. Estimated Annual GHG Emissions from 10 6MW Offshore Wind Turbines in Comparison to Federal Targets.

	Calculate Annual GHG Emissions for 10 6MW Turbine Farm ($MtCO_2$-eq/year)[1]	**Federal GHG Emissions Targets ($MtCO_2$-eq/year)**	
		2020	**2030**
	0.002237552	607	513
Contribution to GHG targets	-	<0.05%	<0.05%

[1]This table shows the total annual GHG emissions for 10 6MW turbines based on calculations from Table 10.3 and the relative contribution to federal GHG emissions targets for 2020 and 2030.

Sources: (ECCC, 2019).

10.2.3Engagement 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 on these components are addressed in their respective sections (see Sections 7.2-7.6, and 7.9 of this Report). Table 10.2 and 10.2 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 in Newfoundland and Labrador. Some participants noted Newfoundland and Labrador has sufficient renewable energy from hydro-electric projects to meet its domestic needs and 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 proponents, may make use of federal and provincial subsidies and incentives to fund project start up, which means ultimately tax-payers will be paying, for offshore wind projects at least in part.

In a letter to the Committee on April 10th, 2024 ECE Law suggested that marine spatial plans be developed for the region in future to support sustainable development of offshore wind 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, the MFN called on proponents of offshore wind developers 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,

- 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.

10.2.4Committee Conclusions and Recommendations

Offshore wind development can pose risks to the environment, but experience elsewhere indicates that those adverse effects can be avoided or be mitigated. Offshore wind would be expected to contribute to Canada and Newfoundland and Labrador's environmental obligations and commitments in respect of 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 for remaining within its emissions targets and meeting its climate change commitments. While offshore wind 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. Instead, any offshore wind farm project would likely contribute to Canada's ability to meet its emission targets and help mitigate future global climate change

The Committee recommends that:

- Offshore wind projects in the waters off Newfoundland and Labrador should be expected by the Licensing Authority to utilize state of the art technologies for the sustainable management of waste, both during operations and maintenance and decommissioning stages of the projects.

10.2.5 References

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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.

The Committee strives to raise the bar for GBA Plus in future impact assessments of offshore wind projects. The Committee's work on intersectionality continues and the Final Report will provide further information, analyses, and recommendations beyond what is presented here.

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, 2021), and a tool for assessing the quality of GBA Plus in a proponent's Impact Statement (IAAC, n.d.a). 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, 2023), 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
- Identify 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, 2023). 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, 2021).

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.[86] At the time of this Report, CRIAW has produced a draft report, Publicly Available Data to Support Gender-Based Analysis Plus in Newfoundland and Labrador (CRIAW, 2024).[87] CRIAW continues to progress its scope of work and will be preparing a more comprehensive report for the Committee's consideration in its Final Report. The Committee will update and refine the information and analyses presented here for the Final Report based on CRIAW's findings and recommendations.

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; Steinstra, 2020; Oxfam, 2023). For example,

[86] 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.
[87] CRIAW's draft report is available on the Registry under document reference number 277.

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",[88] including displacement of other ocean users, undermining the livelihoods of fishers, and inequitable distribution of economic benefits (e.g., Bennett et al. 2020).

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 Ltd., 2023). Research pertaining to GBA Plus in the European offshore wind industry tends to focus on employment of diverse populations, particularly women (e.g., IRENA, 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 and Snell, 2023).

The Committee continues to work with CRIAW to identify the impacted communities. Based on research and participant engagement to date, the Committee anticipates the communities that will be most impacted by offshore wind development, relative to the Recommended Offshore Wind 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.

[88] 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."

- Potentially positive impacts on populations living on the west and south coast of the island of Newfoundland.
- Potentially positive impacts specific segments of the population in the context of health/climate change.

11.2.3 Engage with diverse groups and individuals

The Committee has engaged with diverse groups and individuals throughout the Regional Assessment process (see Section 3 of this Report, and Appendices A and B). Participants in the Indigenous and public, fisheries, and stakeholder engagement programs and the advisory groups represent diverse viewpoints and have provided outcomes relevant to GBA Plus. These outcomes are mentioned throughout this Report in the various sections relevant to GBA Plus.

Recognizing the importance of GBA Plus, the Committee established a GBA Plus Advisory Group. The Committee continues to work with CRIAW to leverage this advisory group to inform this aspect of the Regional Assessment. Additionally, CRIAW is conducting key informant interviews with an extensive cross-section of organizations in Newfoundland and Labrador that represent 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. This will primarily be staff of community organizations and may also include provincial organizations for certain populations, as well as members or leaders of organizations or communities.

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, 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, 2021).

CRIAW completed a review of publicly available data to support GBA Plus/intersectional analysis for this Regional Assessment (CRIAW, 2024). CRIAW found that disaggregated data is not available for many identity and social factors. For example:

- In the NLSA dataset under “trade and business, employment insurance and environment,” no disaggregated data is available.
- In the Newfoundland and Labrador Community Accounts dataset, no disaggregated data is available on income, production, or infrastructure.
- Neither dataset provides disaggregation for violent crimes.

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 some promising developments (CRIAW, 2024).

CRIAW concluded that there are major gaps in the publicly available data. Throughout this Report, the Committee has incorporated the disaggregated data that is available in describing existing conditions for the relevant components. CRIAW continues to establish a better understanding of the baseline, including identifying additional sources of disaggregated data, and evaluating the best available data from these sources for key indicators and measures. In doing so, CRIAW will be identifying remaining data gaps and recommending ways to address those gaps.

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.

Currently, the available disaggregated data is mainly based on gender and/or age. Throughout this Report, the Committee has considered this data, engagement outcomes, and findings from the literature in identifying potential effects of offshore wind on the relevant components, and potential mitigation and enhancement measures to address those effects. Since the data is mostly gender (and the binary for that matter) and age-based, the effects and measures identified to date are limited to women's employment in an industry that employs more men. While this is an important consideration, it is not the sole consideration when applying GBA Plus. The Committee continues to work with CRIAW to apply a more intersectional lens to this Regional Assessment.

11.3 Committee Conclusions and Next Steps

The Committee's work on intersectionality continues, including engagement and data collection and evaluation. In the Final Report, the Committee will provide further information and analyses beyond what is presented here. It will also provide recommendations for how future impact assessments should consider and address the intersection of sex and gender with other identity factors.

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12. Conclusion

The Committee was appointed in March 2023. Early in the process, the Committee was briefed by several federal agencies, particularly NRCan, who had been investigating the potential of offshore wind 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 in many jurisdictions 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 commercial fishers and other ocean users, and to potential impacts on environmental, health, economic, and social conditions, the Regional Assessment becomes 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 the precautionary principle. The Committee considered existing technical requirements for offshore wind farms such as depth, seafloor conditions, and factors unique to this offshore and not faced or addressed elsewhere 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 was to be based on existing, available public information. The Committee has benefited greatly from the input from various federal departments (particularly the support provided by IAAC staff on loan to the Committee to serve on its Secretariat), Indigenous communities, advisory group members, commercial fishers, 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 effort would be 'the low hanging fruit'. This may mean (or meant) monopile foundations in water depths of 60 m or less, where the monopiles can be embedded in the seafloor, close to a deep-water port where the offshore wind facility could be supported, and the electricity could be delivered and/or used.

Perhaps the most notable feature over the past year 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 and 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 even deeper areas 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 is a beginning and provides a starting point for consideration of specific offshore wind energy project development.

This Report is a draft. Where the Committee is aware that additional data or information is forthcoming to be included in the Final Report, this is indicated in the text. The Committee is pleased to provide the Draft Report for review by the Indigenous groups, industry, federal and provincial government agencies, and the public. The Committee will carefully consider your input on the Draft Report, in preparing the Final Report. The Final Report will be submitted to the Ministers no later than January 23, 2025.

Finally, 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.