

Nova Scotia Bird Colony Buffer Analysis

Product Objective

ECCC recommends applying a buffer around bird colonies to mitigate impacts from Offshore Wind Energy Development (OWED) in Nova Scotia (NS). Siting decisions are the most effective strategy to avoid and minimize impacts of development on breeding birds (Gulka et al., 2024 *preprint*). Buffering colonies can help support avoidance and minimization mitigation strategies through informed siting decisions. Applying a buffer around colonies would reduce the risk of collision and displacement of species during critical life stages. Proponents should contact ECCC during the planning stages of any project for advice on appropriate colony- or species-specific setbacks based on best available data and subject-matter expert information.

Colonial birds show high site fidelity to colonies during breeding, nesting, and chick-rearing, and make repeated foraging and transit movements between nest sites and foraging areas. These repeated movements may cause individuals to be more at risk of displacement or collision as a result of OWED within their natural foraging range around colonies. ECCC provides the following examples of how applying buffers around colonies may reduce the impacts of offshore wind energy developments to foraging birds.

Methods

The results presented here relate to the proposed development areas (PDAs) identified by the NS Regional Assessment Committee in their draft Final Report. The data shown below are taken from the [theoretical foraging range](#) work previously provided by ECCC and [modeled foraging distribution](#) work conducted by Ronconi et al., (2022). Bird abundance values were extracted from the summed, all-species density layer or individual species layers. The same assumptions and limitations associated with previously submitted ECCC products apply to the examples below. It should be noted that the number of birds may not reflect the true abundance of individuals foraging around colonies at a given time. The values below are for illustrative purposes. Also of note, the summed, all-species product does not contain any estimates of Leach's Storm-petrel abundance, as the species' theoretical foraging range overlaps most of the NS study area at high densities. Certain long-range foraging species (e.g., Leach's Storm-petrel, Manx Shearwater) require additional considerations and mitigations. Mitigating the impacts for foraging birds will need to be managed by the regulator and developer, in consultation with ECCC.

ECCC calculated the impact of applying an exclusion buffer around bird colonies in terms of number of birds and the corresponding reduction to proposed development areas. Currently, the NS Regional Assessment Committee has recommended a 25 km coastal buffer with no additional buffer around known breeding bird colonies (Figure 1). While the coastal buffer reduces exposure

to OWED for bird colonies found within this boundary, the benefits of the coastal buffer are not equal across all colonies. Colonies found on islands located farther from the coast will have a reduced effectiveness of the buffer, while colonies found outside the coastal buffer (e.g., St. Paul Island) do not have any buffer from any OWED and associated activities. To demonstrate the importance of colony buffers in addition to the coastal buffer, ECCC applied colony buffers ranging from 5 – 60 km, increased at intervals of 5 km. Any overlapping colony buffer boundaries were merged before extracting bird abundance estimates.

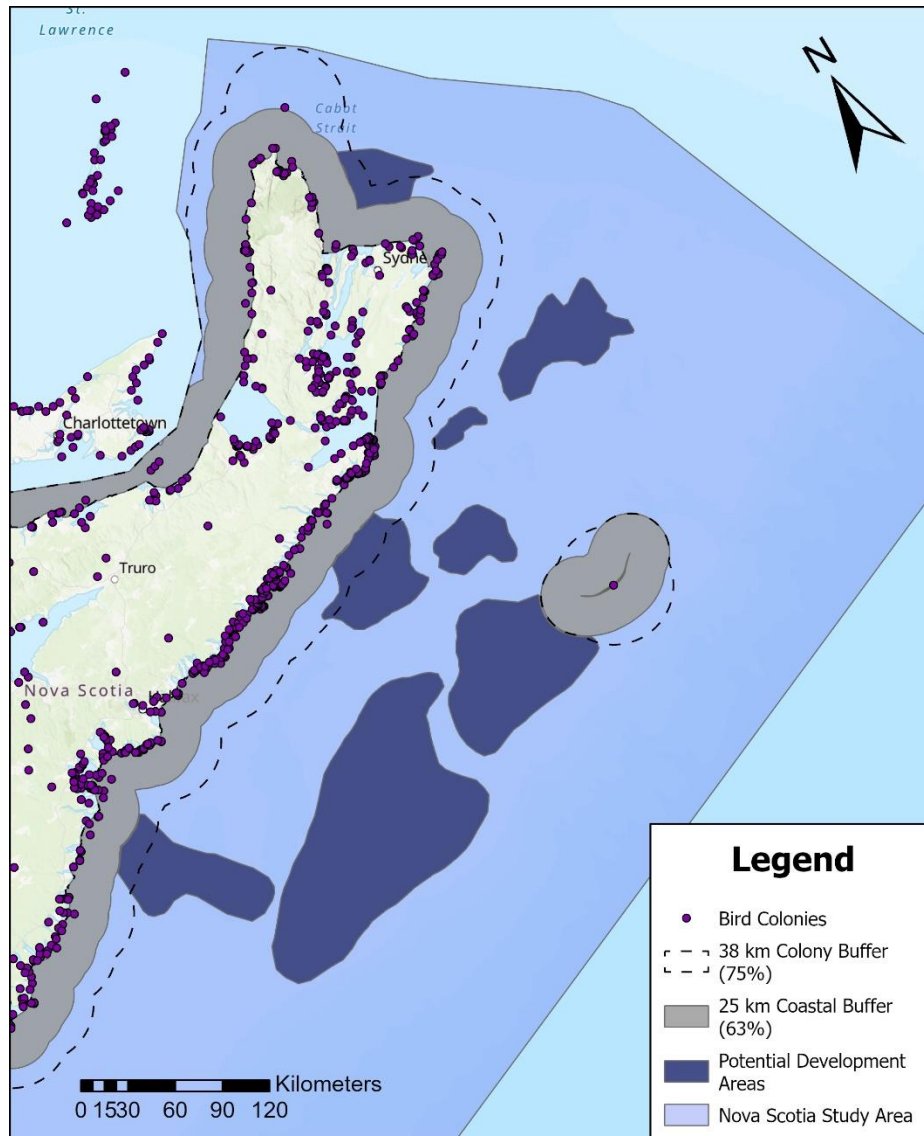


Figure 1. Locations of a subset of known bird colonies in Atlantic Canada, the 25 km coastal buffer (reduced exposure for 63% of foraging birds), and potential offshore wind energy development areas as currently defined within the NS draft Final Report. The dashed black line represents an example of a 38 km buffer around each bird colony that has been merged with the 25 km coastal buffer and would jointly reduce exposure to approximately 75% of foraging birds.

Interpretation

Colonial birds that forage offshore within the NS study area have a collective mean maximum foraging range of 145 km (Figure 2) from the colony (range 2.7 – 1,346 km; [ECCC-CWS 2024](#)). Within the study area, an estimated 155,685 birds may be foraging in offshore waters throughout the breeding season.

ECCC first calculated the number of theoretical foraging birds found at varying distances (0 – 60 km) from colonies (Figure 3). The 25 km coastal buffer alone, with no additional bird colony buffer, avoids potential exposure to OWED for 63.9% (99,526) of breeding colonial birds. ECCC then determined the number of additional foraging birds that would be found within the 25 km coastal buffer plus each of the bird colony buffer sizes beyond the coastal buffer (Table 1; Figure 4). In all scenarios, the 25 km coastal buffer recommended by the NS RA Committee was included and maintained as described in the draft Final Report. Therefore, the scenario with the 0 km bird colony buffer includes only the 25 km coastal buffer and provides the baseline conditions for comparison.

Applying a colony buffer less than or equal to 20 km only limits the potential overlap with OWED for up to an additional 1,400 foraging birds. However, expanding the buffer to 25 km, or beyond, around all colonies begins to reduce exposure to at least 3,100 additional foraging birds (Table 1), while only reducing total PDAs by $\sim 194 \text{ km}^2$ (Appendix 1). Density of foraging birds decreases with distance from a colony and buffers of up to 40 km captures bird densities of greater than 2 birds/ km^2 . To reduce exposure to 75% of birds potentially foraging offshore, a 38 km colony buffer would be required in addition to the coastal buffer. Applying a colony buffer of 145 km (the average maximum foraging range) would be required to avoid exposing 98.5% of breeding colonial birds to OWED. Of note, the combined buffer area does not increase linearly with increasing colony buffer size due to the overlap of many colonies with the coastal buffer, as well as the overlap between individual colonies as the buffer size increases.

For individual species, the results from both ECCC-CWS (2024) and Ronconi et al., (2022) indicate that the current 25 km coastal buffer greatly reduces exposure for species with short foraging ranges (Figure 5; Figure 6). A buffer of this size may be particularly important for reducing exposure for terns, herons, Black Guillemots, Common Eiders, and cormorants. Applying an additional colony buffer will further reduce exposure for colonies found at the edge or outside of the coastal buffer, and for species with intermediate to long-distance foraging ranges including gulls, Black-legged Kittiwakes, Atlantic Puffins, and Northern Gannets. While large proportions of long-distance foraging birds may not be captured by a buffer less than 145 km, any applied colony buffer will reduce exposure for birds foraging or using offshore waters within that area.

Larger minimum buffers around bird colonies will help avoid and minimize impacts from future offshore wind energy development in Nova Scotia. ECCC recommends applying a colony buffer to better mitigate impacts to foraging colonial birds during their breeding seasons. For project-level environmental assessments, proponents should consult with ECCC for additional guidance. For Leach's storm-petrel, and other long-range foraging species including Manx Shearwater, proponents should consult with ECCC for additional guidance.

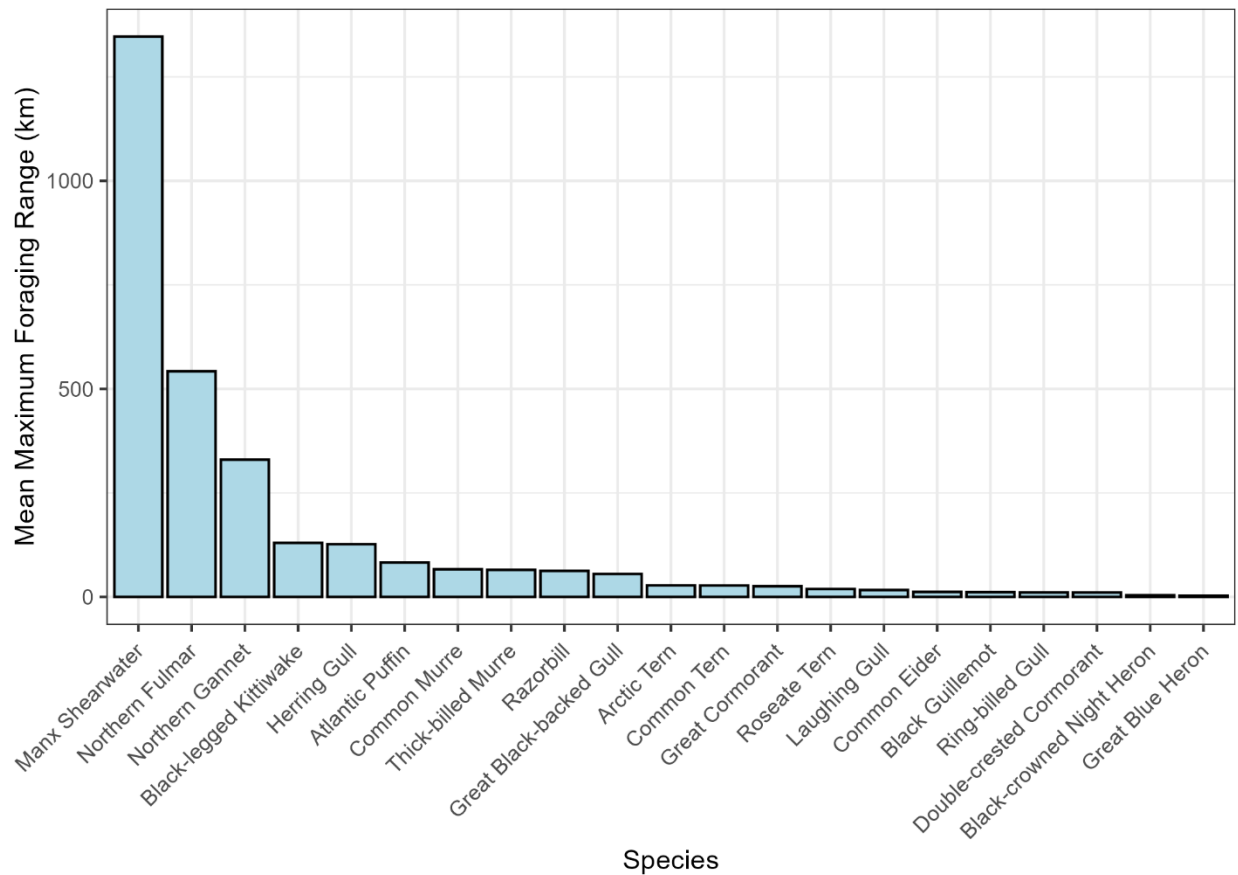


Figure 2. Mean maximum foraging ranges collected through a literature survey (ECCC-CWS, 2024) for species found to either nest in colonies or with foraging ranges that overlap the Nova Scotia Study Area.

Table 1. Total birds found within the 25 km coastal buffer plus the additional colony buffer sizes. Combined buffer area is the summed area of both the 25 km coastal buffer and a given colony buffer. Density is calculated by dividing the total birds by the combined buffer area.

Coastal Buffer (km)	Additional Colony Buffer (km)	Birds with Reduced Exposure	Combined Buffer Area (km ²)	Density (birds/km ²)
25	0	99,527	36,437	2.73
25	5	99,624	36,509	2.73
25	10	99,942	36,752	2.72
25	15	100,347	37,152	2.70
25	20	100,979	37,812	2.67
25	25	102,664	39,619	2.59
25	30	108,288	45,461	2.38
25	35	113,950	51,926	2.19
25	40	119,226	58,562	2.04
25	45	124,272	65,306	1.90
25	50	128,118	72,112	1.78
25	55	132,320	80,705	1.64
25	60	135,124	87,959	1.54

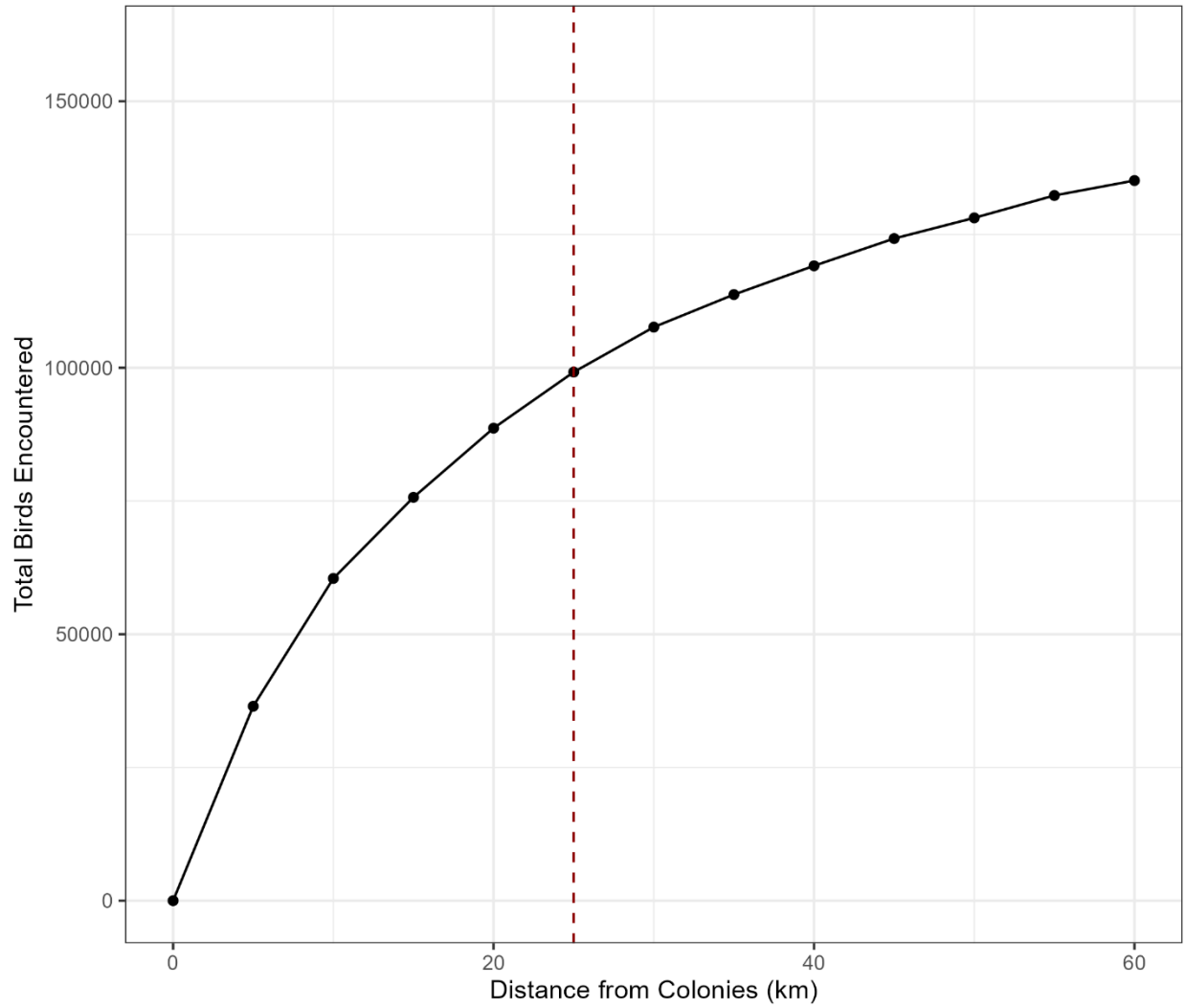


Figure 3. Total foraging birds that would be theoretically encountered in offshore waters with increasing distance from colonies. The red dashed line represents the number of birds found within the baseline 25 km coastal buffer.

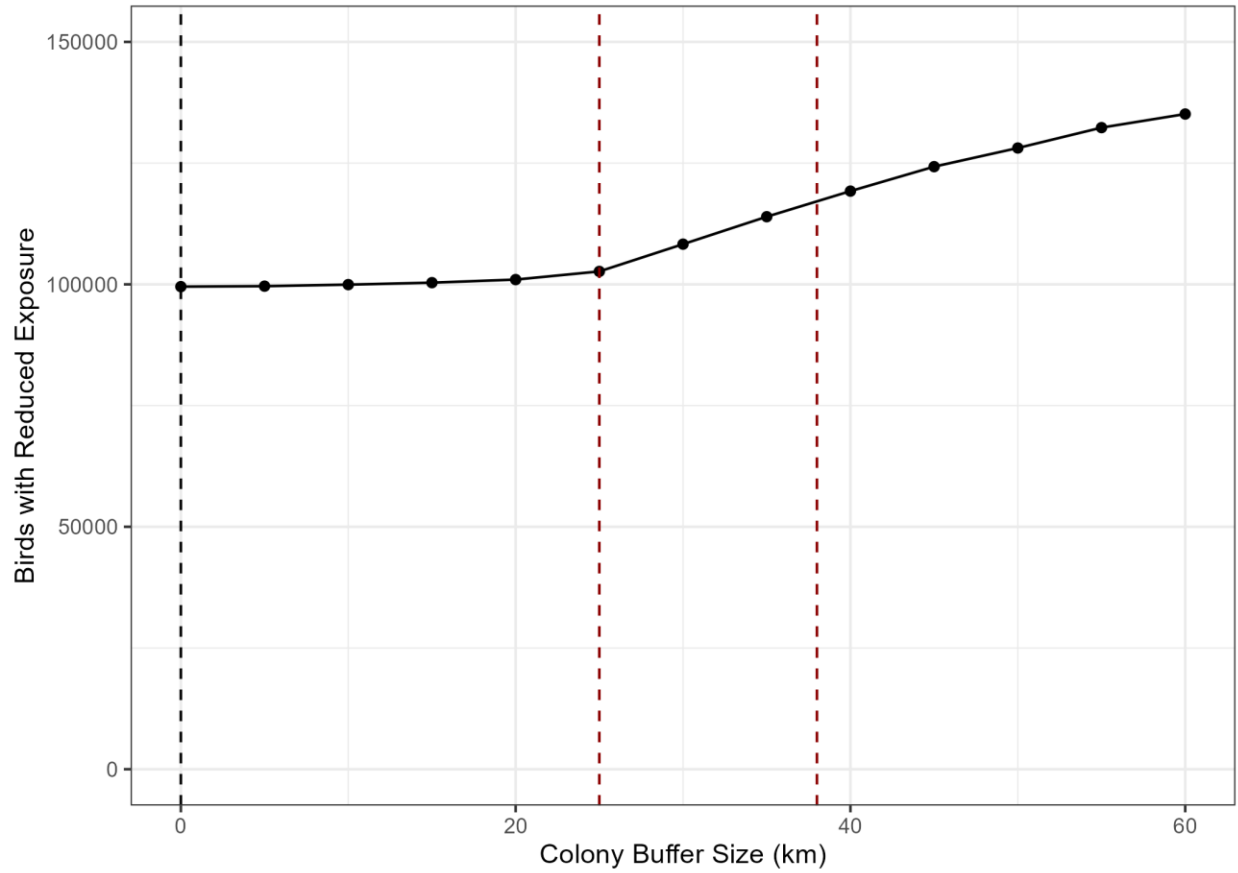


Figure 4. Total foraging birds that would experience reduced exposure to offshore wind energy development within a baseline 25 km coastal buffer (at x-axis = 0, black dashed line), with additional colony buffers at 5 km increments. The red dashed lines represent the additional 25 km and 38 km colony buffers.

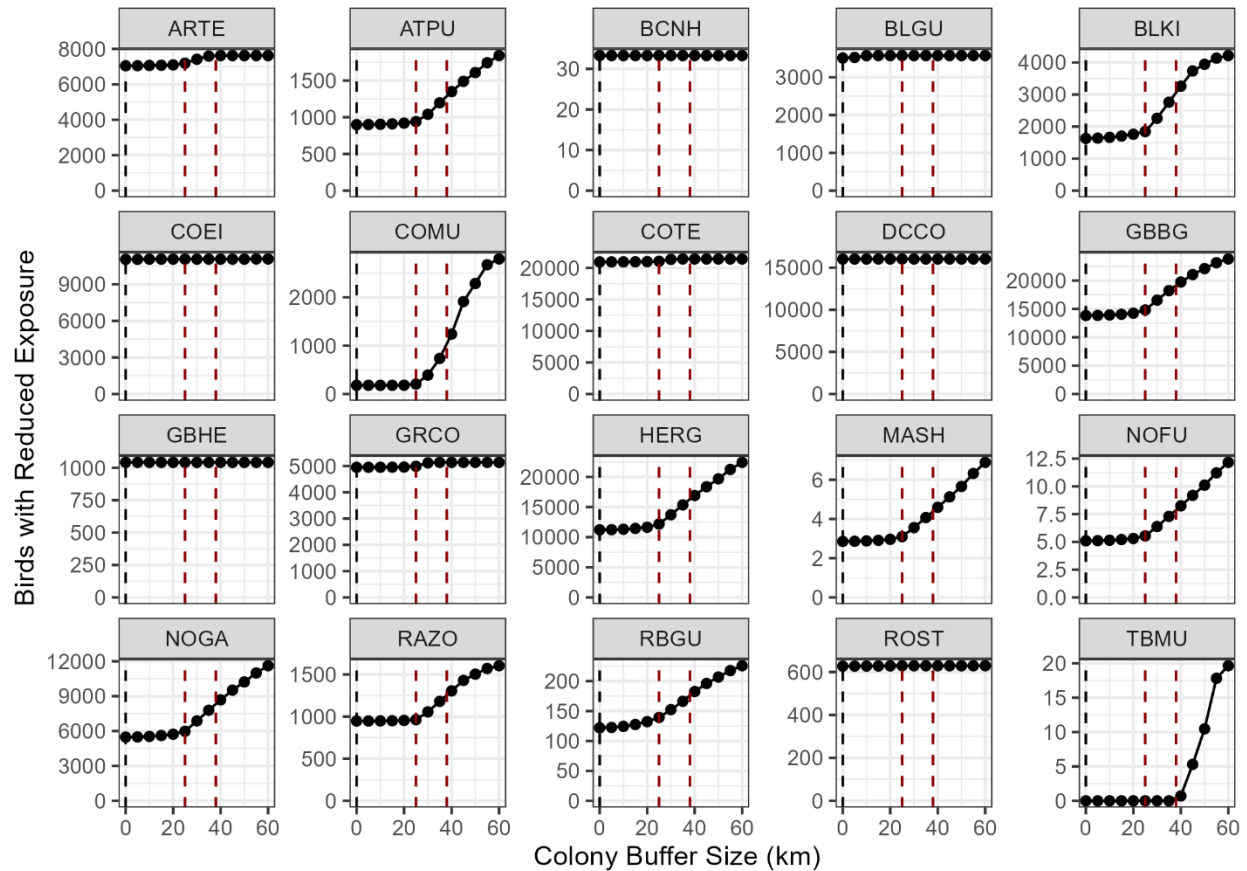


Figure 5. Total foraging birds that would experience reduced exposure to offshore wind energy development within a baseline 25 km coastal buffer (at x-axis = 0; black dashed line), with additional colony buffers at 5 km increments. Species data were extracted from theoretical foraging distribution work conducted by ECCC-CWS. The red dashed lines represent the additional 25 km and 38 km colony buffers.

Species codes: ARTE = Arctic Tern; ATPU = Atlantic Puffin; BCNH = Black-crowned Night Heron; BLGU = Black Guillemot; BLKI = Black-legged Kittiwake; COEI = Common Eider; COMU = Common Murre; COTE = Common Tern; DCCO = Double-crested Cormorant; GBBG = Great Black-backed Gull; GBHE = Great Blue Heron; GRCO = Great Cormorant; HERG = Herring Gull; MASH = Manx Shearwater; NOFU = Northern Fulmar; NOGA = Northern Gannett; RAZO = Razorbill; RBGU = Ring-billed Gull; ROST = Roseate Tern; TBMU = Thick-billed Murre

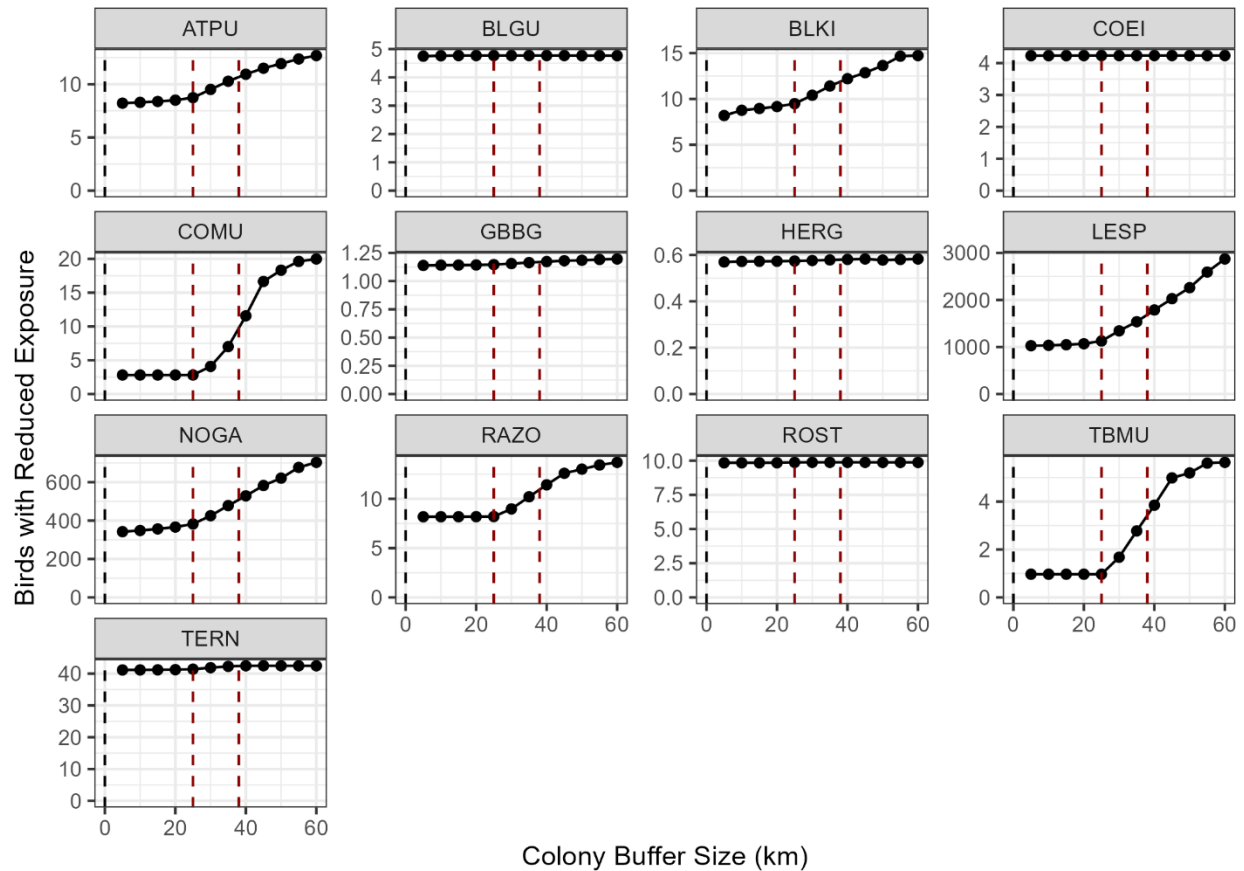


Figure 6. Total foraging birds that would experience reduced exposure to offshore wind energy development within a baseline 25 km coastal buffer (at x-axis = 0, black dashed line), with additional colony buffers at 5 km increments. Species data were extracted from modeled foraging distribution work conducted by Ronconi et al., 2022. The red dashed lines represent additional 25 km and 38 km colony buffers.

Species codes: ATPU = Atlantic Puffin; BLGU = Black Guillemot; BLKI = Black-legged Kittiwake; COEI = Common Eider; COMU = Common Murre; GBBG = Great Black-backed Gull; HERG = Herring Gull; LESP = Leach's Storm-Petrel; NOGA = Northern Gannett; RAZO = Razorbill; ROST = Roseate Tern; TBMU = Thick-billed Murre, TERN = Terns (Arctic tern and Common tern).

References

Gulka, J., Knapp, S., Soccorsi, A., Avery-Gomm, S., Knaga, P., Williams, K. A. (2024). Strategies for Mitigating Impacts to Aeroфаuna from Offshore Wind Energy Development: Available Evidence and Data Gaps. <https://doi.org/10.1101/2024.08.20.608845>

Environment and Climate Change Canada, Canadian Wildlife Service (ECCC-CWS). 2024. Colonial Bird Theoretical Foraging Radii. Submitted to the Nova Scotia Committee for Offshore Wind Energy Development in Atlantic Canada.

Ronconi, R.A., Lieske, D.J., McFarlane Tranquilla, L.A., Abbott, S., Allard, K.A., Allen, B., Black, A.L., Bolduc, F., Davoren, G.K., Diamond, A.W. and Fifield, D.A. (2022). Predicting seabird foraging habitat for conservation planning in Atlantic Canada: Integrating telemetry and survey data across thousands of colonies. *Frontiers in Marine Science*, 9, p.816794.

Appendix 1

The extended colony buffer sizes were also overlaid with the potential development areas identified in the NS Committee's draft Final Report. This exercise calculates the proposed development areas that would be removed if a given colony buffer size were implemented. There are no potential development areas found within either the coastal buffer or colony buffers below 20 km (Table A1).

Table A1. Total area of overlap between proposed offshore wind energy development areas and extended colony buffers.

Coastal Buffer (km)	Colony Buffer (km)	Overlap with Potential Development Areas (km ²)						Total
		Canso Bank	French Bank	LaHave Basin	Misaine Bank	Sable Island Bank	Sydney Bight	
25	5	-	-	-	-	-	-	0
25	10	-	-	-	-	-	-	0
25	15	-	-	-	-	-	-	0
25	20	-	6.69	-	-	-	-	6.69
25	25	-	155.37	38.06	-	-	-	193.43
25	30	-	385.69	243.78	-	-	263.5	892.96
25	35	-	730.73	464.67	-	-	598.1	1793.49
25	40	22.49	1129.47	690.44	-	34.45	898.32	2775.19
25	45	81.44	1512.57	942.1	-	140.22	1186.34	3862.67
25	50	162.85	1875.16	1199.29	-	350.95	1381.71	4969.96
25	55	302.5	2276.42	1501.84	-	720.92	1462.88	6264.56
25	60	388.26	2543.03	1722.99	38.13	1038.7	1463.54	7194.64