

Offshore Wind Regional Assessment Requests for Advice: Product Descriptions and Context for Interpretation

Provided by Environment and Climate Change Canada – Canadian Wildlife Service to the
Committees for the Regional Assessment of Offshore Wind Development in Nova Scotia and
Regional Assessment of Offshore Wind Development in Newfoundland and Labrador

November 30, 2023

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Confidentiality Statement

Please note that all information contained in this document is confidential and not meant for publication, until otherwise specified, following a request made to Environment and Climate Change Canada – Canadian Wildlife Service, Atlantic Region (ECCC-CWS-ATL). This document is provided to the Regional Assessment Committees in support of Phase One reporting related to migratory birds and species at risk under ECCC-CWS mandates. Data used to develop various products in this document are currently undergoing publication or are part of ongoing work and have been provided to ECCC-CWS-ATL with the agreement that they are not made publicly available.

1.0 Scope

This document provides information on all products submitted by ECCC-CWS-ATL to the Offshore Wind Regional Assessment (RA) Committees (the Committees) in response to Requests for Advice specific to marine/migratory birds, bats, and species at risk. These contextual pieces are to be used to support interpretation of the submitted products. [Section 2.1](#) includes products provided in the October 31, 2023 submission that did not require further updates. [Section 2.2](#) contains products included in the October 31, 2023 submission that have been updated, based on input from expert reviewers. [Section 3.0](#) includes new products that were under expert review at the time of the October 31, 2023 submission. All sections include information on the data and methods used to develop each product, details on how products should be interpreted, descriptions of assumptions and potential caveats, as well as details related to product updates, where relevant. [Section 4.0](#) includes information on draft products that remain under development at the time of the November 30, 2023 submission. These products will be provided to the Committees as they become available, and no later than March 31, 2024. This includes products that require data that will be obtained through ongoing contracts and external collaborations. Also included is a summary of these products and timelines for when they are anticipated to be provided to the Committees. Any questions regarding completed or upcoming products can be addressed to: scfatlervent-cwsatlrawind@ec.gc.ca.

2.0 Completed Products

2.1 Products Completed for October 31, 2023

This section provides descriptions and context for products that have undergone ECCC-CWS-ATL expert review and were included in the October 31, 2023 submission that did not require further updating. A complete list of metadata used to support development of all products is available here: [RA Phase One Products Metadata](#).

2.1.1 Critical Habitat and Important Areas for Species at Risk

The Committees have requested information on **known areas of higher risk for marine/migratory bird species in relation to offshore wind energy development or marine industrial activity**. Potential impacts of offshore wind energy development or marine industrial activity poses a greater risk to species at risk (SAR), as the loss of a single or few individuals can have significant adverse impacts on populations.

For reference, Table 1 provides the status of species known to occur within the RA Study Areas (study areas) that have been assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and listed, or under consideration for addition, on Schedule 1 of the *Species at Risk Act* (SARA). Critical Habitat (CH) is defined under SARA as the habitat necessary for the survival or recovery of a listed wildlife species, as identified in a recovery document for the species. Critical Habitat for species with final recovery strategies and action plans can be found on the Open Government portal: [Critical Habitat for Species at Risk National Dataset - Canada](#).

Table 1: Species status as per the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and status on Schedule 1 of the *Species at Risk Act* (SARA).

Common Name	Scientific Name	COSEWIC Status	SARA Status
Bank Swallow	<i>Riparia riparia</i>	Threatened	Threatened
Barn Swallow	<i>Hirundo rustica</i>	Special Concern	Threatened
Barrow's Goldeneye	<i>Bucephala islandica</i>	Special Concern	Special Concern
Bicknell's Thrush	<i>Catharus bicknelli</i>	Threatened	Threatened
Bobolink	<i>Dolichonyx oryzivorus</i>	Special Concern	Threatened
Buff-breasted Sandpiper	<i>Calidris subruficollis</i>	Special Concern	Special Concern
Canada Warbler	<i>Cardellina canadensis</i>	Special Concern	Threatened
Chimney Swift	<i>Chaetura pelagica</i>	Threatened	Threatened
Common Nighthawk	<i>Chordeiles minor</i>	Special Concern	Special Concern
Eastern Red Bat	<i>Lasiurus borealis</i>	Endangered	Under consideration for addition
Eastern Whip-poor-will	<i>Antrostomus vociferus</i>	Special Concern	Threatened
Eastern Wood-Pewee	<i>Contopus virens</i>	Special Concern	Special Concern
Eskimo Curlew	<i>Numenius borealis</i>	Endangered	Endangered
Harlequin Duck	<i>Histrionicus histrionicus</i>	Special Concern	Special Concern
Hoary Bat	<i>Lasiurus cinereus</i>	Endangered	Under consideration for addition
Horned Grebe	<i>Podiceps auritus</i>	Endangered	Endangered
Hudsonian Godwit	<i>Limosa haemastica</i>	Threatened	Under consideration for addition
Ivory Gull	<i>Pagophila eburnea</i>	Endangered	Endangered
Leach's Storm-Petrel	<i>Hydrobates leucorhous</i>	Threatened	Under consideration for addition
Least Bittern	<i>Ixobrychus exilis</i>	Threatened	Threatened
Lesser Yellowlegs	<i>Tringa flavipes</i>	Threatened	Under consideration for addition
Little Brown Myotis	<i>Myotis lucifugus</i>	Endangered	Endangered
Monarch	<i>Danaus plexippus</i>	Endangered	Endangered
Northern Myotis	<i>Myotis septentrionalis</i>	Endangered	Endangered
Olive-sided Flycatcher	<i>Contopus cooperi</i>	Special Concern	Special Concern
Piping Plover	<i>Charadrius melodus</i>	Endangered	Endangered
Red Crossbill	<i>Loxia curvirostra</i>	Threatened	Threatened
Red Knot	<i>Calidris canutus</i>	Endangered	Endangered
Red-necked Phalarope	<i>Phalaropus lobatus</i>	Special Concern	Special Concern
Roseate Tern	<i>Sterna dougallii</i>	Endangered	Endangered
Rusty Blackbird	<i>Euphagus carolinus</i>	Special Concern	Special Concern
Savannah Sparrow	<i>Passerculus sandwichensis</i>	Special Concern	Special Concern
Short-eared Owl	<i>Asio flammeus</i>	Threatened	Special Concern
Silver-haired Bat	<i>Lasionycteris noctivagans</i>	Endangered	Under consideration for addition
Tricolored Bat	<i>Perimyotis subflavus</i>	Endangered	Endangered
Wood Thrush	<i>Hylocichla mustelina</i>	Threatened	Threatened

This series of maps show locations of CH, important areas, and/or important movement and migration corridors for SAR in the Atlantic Region.

Maps are provided for the following SARA-listed avian species:

- Bank Swallow (SARA Threatened)
- Horned Grebe (SARA Endangered)

[2.1.1.1 Bank Swallow – Critical Habitat](#)

Product Objective

This map indicates the locations of CH for Bank Swallow (*Riparia riparia*), listed as Threatened under Schedule 1 of SARA. The Bank Swallow is a small insectivorous songbird with brown upperparts, white underparts, and a distinctive dark breast band. This species excavates nest burrows in natural and artificial sites with vertical banks, including riverbanks, lake and ocean bluffs, aggregate pits, road cuts, and stockpiles of soil. Bank Swallows are colonial, often nesting in sandy banks created through coastal erosion; therefore, potentially in close proximity to the marine environment during the breeding season. [Bank Swallow - Critical Habitat](#).

The following data sources were used to produce the map:

- [ECCC. 2022. Recovery Strategy for the Bank Swallow \(*Riparia riparia*\) in Canada.](#)
- [ECCC. 2019. Description of Residence for Bank Swallow \(*Riparia riparia*\) in Canada.](#)

Methodology

This product includes a 10 km buffer around shorelines designated as Bank Swallow CH in the *Recovery Strategy for the Bank Swallow (*Riparia riparia*) in Canada* (ECCC 2022a). The buffer is a conservative estimate of the distance required for swallows to reach flight altitudes higher than anticipated heights of turbine rotor swept zones (25-300 m).

Critical Habitat is identified in the recovery strategy and includes nesting and foraging habitat. To designate CH for the recovery strategy, nesting colonies of Bank Swallow were identified, and a shoreline/coastline buffer was applied around the colony (100 m + the spatial uncertainty of the nesting record). Critical Habitat was then defined as areas meeting biophysical attributes (as listed in the recovery document) within 500 m of those shorelines/coastlines (ECCC 2022a).

Context and Interpretation

Spatial distribution: Includes Bank Swallow CH in Eastern Canada (Nova Scotia, Newfoundland and Labrador, New Brunswick, Prince Edward Island, and Quebec). There is little chance of offshore wind energy developments directly intersecting Bank Swallow CH. However, part of this industrial footprint includes landfall of cables and associated transmission infrastructure, which could impact Bank Swallow CH.

Temporal distribution: The breeding season for Bank Swallow in Canada (or, the possible period occupancy of the burrow) typically ranges from May to late August (ECCC 2019).

Assumptions and Caveats

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

- Unidentified swallows have been observed foraging around offshore wind turbines ~43km offshore. These observations were collected using video systems, and flight heights were estimated to range from 23 m to 127.4 m above sea level (Willmott *et al.* 2023). Therefore, Bank Swallow may forage and interact with wind turbines beyond the 500 m buffer around colonies.
- Additional data has been requested from owners of the Bank Swallow Connectivity Project (Motus) to complement this product. Once provided to ECCC-CWS-ATL an updated product will be provided to the Committees.

2.1.1.2 Horned Grebe – Critical Habitat

Product Objective

This map indicates the locations of CH for Horned Grebe (*Podiceps auritus*), listed as Endangered under Schedule 1 of SARA (ECCC 2013). The Horned Grebe is a small duck-like waterbird with distinctive tufts of showy feathers behind the eye during summer breeding. Winter plumage is black and white, characterized by a black crown and white cheeks. Horned Grebe generally nest in freshwater and occasionally brackish water in areas that contain nest material, concealment, and protection for chicks. [Horned Grebe - Critical Habitat](#).

The following data source was used to produce the map:

- [ECCC. 2013. Recovery Strategy for the Horned Grebe \(*Podiceps auritus*\), Magdalen Islands Population, in Canada.](#)

Methodology

This product includes a 10 km buffer around ponds designated as Horned Grebe CH in the *Recovery Strategy for the Horned Grebe (Podiceps auratus), Magdalen Islands Population, in Canada* (ECCC 2013). The buffer is a conservative estimate of the distance required for birds to reach flight altitudes higher than anticipated heights of turbine rotor swept zones (25-300 m). Critical Habitat is defined in the recovery strategy and includes a total of 52 nesting and foraging ponds (ECCC 2013).

Context and Interpretation

Spatial distribution: Includes Horned Grebe CH in Eastern Canada (Nova Scotia, Newfoundland and Labrador, New Brunswick, Prince Edward Island, and Quebec), which is limited to the Magdalen Islands, Quebec. There is little chance of offshore wind energy developments directly intersecting Horned Grebe CH. However, part of this industrial footprint includes landfall of cables which could impact Horned Grebe CH if sited on the Magdalen Islands.

Temporal distribution: The breeding season for Horned Grebe in Canada (or, the possible period occupancy of nests) typically ranges from May to early August (ECCC 2013).

Assumptions and Caveats

- Critical Habitat for Horned Grebe only includes nesting and foraging habitats in the Magdalen Islands; other important habitats are not identified (e.g., non-breeding sites).
- Horned Grebe are known to overwinter along the coast of Nova Scotia, and the Bay of Fundy (Stedman 2020). However, the exact wintering grounds of the Magdalen Islands Population are unknown but are assumed to be along the Atlantic coast (ECCC 2013).

[2.1.1.3 Roseate Tern – Important Areas](#)

Product Objective

This map indicates important areas for Roseate Tern (*Sterna dougallii*), listed as Endangered under Schedule 1 of SARA. Roseate Terns are a medium-sized, pale coloured seabird with a long, forked white tail. During breeding, adults are almost entirely white, except for a black cap and a black bill that becomes red near the base. In North America, two populations of Roseate Tern breed on the Atlantic coast in distinct locations. The northeastern population extends from the Magdalen Islands, in the Gulf of St. Lawrence, south to New York. The second population breeds from Florida and the Bahamas to the Lesser Antilles. The Canadian population of Roseate Terns breeds almost exclusively on a few islands off the Atlantic coast of Nova Scotia, although small numbers of birds also breed on islands in Quebec and New Brunswick. [Roseate Tern - Important Areas](#).

The US Bureau of Ocean Energy Management (BOEM) conducted a study of Roseate Tern (VHF tracking) in US Atlantic waters (Loring *et al.* 2019). Roseate Terns had peak potential exposure to offshore wind during the post-breeding dispersal period (mid-July through late September). They primarily moved during morning hours and during fair weather conditions (high atmospheric pressure) and flew below 25 m above sea level (Loring *et al.* 2019).

The following data source was used to produce the map:

- [ECCC. 2016. Atlantic Colonial Waterbird Database \(ACWD: ECCC-CWS-ATL\)](#).

Methodology

Roseate Tern colonies that have been active since 2000 (per recommendation from ECCC-CWS-ATL species experts) were identified and plotted. Buffers informed by VHF (Rock *et al.* 2007) and GPS tracking (Pratte *et al.* 2021) were applied to each colony. Additionally, GPS has been deployed on Common Terns (*Sterna hirundo*) on Country Island (n = 26 individuals and 147 tracking days, Nagy-MacArthur, unpublished). The maximum foraging range for Common Terns was 50 km and they did not forage farther than 20 km from land. Considering foraging ranges from the VHF and GPS data, polygons around each Roseate Tern colony were created by extending 50 km on either side of the colony along the coast, and 20 km offshore.

Context and Interpretation

Spatial distribution: Includes important areas for Roseate Tern in Eastern Canada (Nova Scotia, Newfoundland and Labrador, New Brunswick, Prince Edward Island, and Quebec) based on breeding locations.

Temporal distribution: Applies to breeding season while Roseate Terns are present at colonies, and while staging as they prepare to leave the region.

Assumptions and Caveats

- Data were developed using colonies active since 2000. Historical colony information is available, upon request.
- Common Tern was used as surrogate to identify maximum foraging ranges.
- Data does not include movement areas through the offshore environment.

2.1.2 Standardized Colony Setback Parameters

Product Objective

Although not part of the formal Requests for Advice, the Committees requested information on potential parameters that could be used by ECCC-CWS-ATL to determine the appropriate setback distance of offshore wind energy activities from marine bird colonies in Atlantic Canada. This spreadsheet includes details on those parameters: [Standardized Colony Setback Parameters](#).

Context and Interpretation

Marine birds have distinct ecological traits that vary across species and can even vary within a species among breeding colonies and years. For instance, Leach's Storm Petrel (*Hydrobates leucorhous*) forage much farther from their colonies than many other seabird species. This species also has colony-specific variation in foraging distance and spatial extent of foraging areas in Atlantic Canada (see: [Hedd et al. 2018](#)). In this context, the potential impacts of offshore wind activities may be variable from species to species and colony to colony. Other factors could also influence the type and degree of potential impacts of offshore wind energy development on colonial birds, such as turbine size, configuration, and number; timing of activities; proximity to other offshore infrastructure (i.e., oil and gas); and species-specific vulnerability to collision and displacement from activities during all phases of offshore wind energy development. Given the variability of potential impacts, ECCC-CWS-ATL cautions against a "catch all" setback distance of offshore wind energy development activities/infrastructure from marine bird colonies. Rather, a standard set of parameters should be used to evaluate the appropriate setback distance on a project- and colony-specific basis, based on levels of risk.

Proponents would be reasonably expected to provide information on these parameters, and ECCC-CWS-ATL would, in turn, provide project-specific recommendations on setback distances. Most information related to these recommended parameters should be publicly available; however, ECCC-CWS-ATL can supplement information provided by proponents to aid in the setback distance determination. Although not yet publicly available, the parameters in Rows 18-20 (species-specific vulnerability) will be assessed as part of the Regional Assessment and are expected to be available to proponents after the Regional Assessment is completed.

Assumptions and Caveats

- These are **draft parameters** and are considered **CONFIDENTIAL**. The list will be further refined (and likely reduced) using the best available information and in consultation with ECCC-CWS-ATL species experts, environmental assessment coordinators, and external experts.
- Some parameters in the final list may be weighted higher or lower based on expert opinion and supporting evidence.
- Once finalized, the parameters will be used to develop a risk assessment tool to aid in setback distance determination.

2.1.3 Bird Movements

The Committees have requested information on **other known areas of importance for seabirds, including Migratory Bird Sanctuaries, foraging areas, migration corridors, etc.**

Information on Migratory Bird Sanctuaries is presented in [Section 2.2.1.2](#). Information on foraging areas is provided in [Section 3.3](#).

This series of maps indicate movements of various bird species tracked in Eastern Canada. Additional tracking data will be summarized and provided to the Committees in the coming months (see [Section 4.0](#) for more information on products currently under development).

Movement data products are provided for the following species:

- Northern Gannet
- Red-throated Loon
- Surf Scoter
- Great Blue Heron

[2.1.3.1 Marine Birds](#)

[2.1.3.1.1 Northern Gannet Movement Utilization Distribution](#)

Product Objective

This series of maps provide information on fine-scale use and movement patterns of Northern Gannet (*Morus bassanus*) during migration and winter. Adults have white plumage with the exception of narrow grey “spectacles” and black, tapering wingtips. During the breeding season the head and neck have a yellow appearance. Northern Gannets have blue eyes, and the bill is blue to grey blue. Plumage of young gannets in autumn is brown, with many white flecks. With the passing of each season, they become progressively whiter, reaching the complete adult plumage in their fourth or fifth year. The North American population of Northern Gannet is concentrated in six breeding colonies in eastern Canada. The birds' nest on cliffs and atop plateaus, with three colonies along the eastern coast of Newfoundland and three in the Quebec portion of the Gulf of St. Lawrence. Northern Gannet has been identified as a priority for conservation and/or stewardship in one or more Bird Conservation Region Strategies in Canada. [Northern Gannet Movement Utilization Distribution](#).

The following data sources were used to produce the maps:

- [Spiegel et al. 2017. Determining fine-scale use and movement patterns of diving bird species in Federal waters of the Mid-Atlantic United States using satellite telemetry.](#)
- [Stenhouse et al. 2020. Assessing the exposure of three diving bird species to offshore wind areas on the US Atlantic Outer Continental Shelf using satellite telemetry.](#)
- [Northeast Ocean Data. 2023. Data Explorer Tool.](#)

Methodology

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. Utilization distribution (UD) was determined by calculating individual level dynamic Brownian-bridge movement model (dBBMM) surfaces.

Context and Interpretation

Spatial Distribution: This movement model shows a large overlap with the regional assessment study area, with spring and fall movements occurring through the Scotian shelf. The winter movement model showed Northern Gannets mostly moving outside of Atlantic Canada.

Temporal Distribution: Northern Gannet movements were assessed by season: fall, spring, and winter. Only fall and spring seasons overlapped the region or study area.

Assumptions and Caveats

- This product includes non-breeding distributions only.
- ECCC-CWS-ATL will share new/updated data products (e.g., breeding season GPS data) if/when they become available.

2.1.3.1.2 Red-throated Loon Movement Utilization Distribution

Product Objective

This series of maps provide information on fine-scale use and movement patterns of Red-throated Loon (*Gavia stellata*) during migration and winter. This species is a large, ducklike seabird with a long neck, a thin bill, and long, narrow, pointed wings. The legs are set far back on the body and the feet trail behind the tail in flight. Breeding adults are grayish brown above, pale below, with pale gray neck, rusty throat patch, and thin black-and-white stripes on back of neck and sides of breast. Nonbreeding adults are blackish above and white below, with a sharp border along the neck and a mostly white face with a black gab. Immatures are grayish brown above, pale below. The Red-throated Loon has a widespread breeding distribution in northern Canada, and winters in coastal waters. This species has been identified as a priority for conservation and/or stewardship in one or more Bird Conservation Region Strategies in Canada. [Red-throated Loon Movement Utilization Distribution](#).

The following data sources were used to produce the maps:

- [Spiegel et al. 2017. Determining fine-scale use and movement patterns of diving bird species in Federal waters of the Mid-Atlantic United States using satellite telemetry.](#)
- [Stenhouse et al. 2020. Assessing the exposure of three diving bird species to offshore wind areas on the US Atlantic Outer Continental Shelf using satellite telemetry.](#)
- [Northeast Ocean Data. 2023. Data Explorer Tool.](#)

Methodology

A total of 86 Red-throated Loons were released with PTTs during the winters of 2012-2015. Utilization distribution (UD) was determined by calculating individual level dynamic Brownian-bridge movement model (dBBMM) surfaces.

Context and Interpretation

Spatial Distribution: This Red-throated Loon movement model shows minimal overlap with the regional assessment study area, with spring and fall movements occurring through the Bay of Fundy, and into the Gulf of St. Lawrence. The winter movement model showed Red-throated Loons moving outside of Atlantic Canada.

Temporal Distribution: Red-throated Loon movements were assessed by season: fall, spring, and winter. Only fall and spring seasons overlapped the region or study area.

Assumptions and Caveats

- This product does not include breeding season movements.

2.1.3.1.3 Surf Scoter Movement Utilization Distribution

Product Objective

This series of maps provide information on fine-scale use and movement patterns of Surf Scoter (*Melanitta perspicillata*) during migration and winter. The Surf Scoter is a medium-sized sea duck with a thick neck, large hear, and broad bill. Adult males are predominantly black with white patches on the nape, forecrown, and base

of the bill. The bill is orange, with white and black patches near the base. Females are dark brown with dark gray bills and two patches of white on the face. In winter, this species can be found on the Atlantic coast, from Newfoundland south to Florida. Surf Scoter populations are highly sensitive to adult mortality due to its low reproductive rate and success. [Surf Scoter Movement Utilization Distribution](#).

The following data sources were used to produce the maps:

- [Spiegel et al. 2017. Determining fine-scale use and movement patterns of diving bird species in Federal waters of the Mid-Atlantic United States using satellite telemetry.](#)
- [Stenhouse et al. 2020. Assessing the exposure of three diving bird species to offshore wind areas on the US Atlantic Outer Continental Shelf using satellite telemetry.](#)
- [Northeast Ocean Data. 2023. Data Explorer Tool.](#)

Methodology

A total of 187 Surf Scoters (75 males, 112 females) were released with PTTs during 2011-2015, 108 in wintering areas and 79 during fall near Forestville, Québec. Utilization distribution (UD) was determined by calculating individual level dynamic Brownian-bridge movement model (dBBMM) surfaces (Kranstauber *et al.* 2012).

Context and Interpretation

Spatial Distribution: This movement model shows minimal overlap with the regional assessment study area, with spring and fall movements occurring through the Bay of Fundy, and into the Gulf of St. Lawrence. The winter movement model showed Surf Scoters moving outside of Atlantic Canada.

Temporal Distribution: Surf Scoter movements were assessed by season: fall, spring, and winter. Only fall and spring seasons overlapped the region or study area.

Assumptions and Caveats

- Duty cycles of the PTTs were 2-3 h on, 72 h off; many of the migratory movements occurred within the 3 day “off” period.
- These models do not represent the full range of Surf Scoters within the Atlantic Region. This model is useful for identifying staging areas, but less useful for identifying movement corridors.

[2.1.3.2 Coastal Waterbirds](#)

[2.1.3.2.1 Great Blue Heron GPS Locations and Tracks](#)

Product Objective

This map provides information on GPS locations and tracks of Great Blue Heron (*Ardea herodias*) during migration. This species is a large wading bird, common near the shores of open water and in wetlands throughout most of North America. Flight feathers are gray, and thighs are red-brown with a paired red-brown and black stripe along the flanks. Great Blue Herons have a mostly white face with a pair of dark plumes that extend from just above the eyes to the back of the head. The bill is yellowish, becoming orange briefly at the start of the breeding season. Great Blue Heron are vulnerable to wetland destruction and disturbances to nesting sites and breeding colonies. [Great Blue Heron GPS Locations and Tracks](#).

The following data source was used to produce the map:

- [Brzorad. 2014. Egrets and Herson. Obtained on MoveBank \(Project 17469219\).](#)

Methodology

GPS fixes (points) and estimated fall movement tracks (Euclidean distance between points) were mapped over the study area. This project GPS tagged 20 individual herons over 5 different states. Three of these tagged birds were observed in the RA Study Areas.

Context and Interpretation

Spatial Distribution: Great Blue Heron display transoceanic migratory flights through the RA Study Areas, travelling in a southern direction. One of the tagged birds in this study flew 38 hours to overwinter in Cuba. The average flight altitude during oceanic migration in this study was 185 m above sea level.

Temporal Distribution: This product includes tracks during fall migration.

Assumptions and Caveats

- This map displays fall migration routes only; ECCC-CWS-ATL has not acquired data on spring migration routes in the study area.

2.1.4 Extralimital Marine Birds

The Newfoundland and Labrador RA Committee requested information on marine and migratory birds that are generally known to occur in the study area, including **species considered extralimital (e.g., White-tailed Tropicbird)**. Extralimital species are those that are not considered common within the RA Study Areas, however, are known to occasionally occur in the Atlantic Region. Examples of such species include White-tailed Tropicbird, as well as Bermuda, Zioni's, Desertas, and Black-capped Petrels. Note that ECCC-CWS-ATL are working with external partners to access and present additional products on extralimital Petrel species.

2.1.4.1 *White-tailed Tropicbird Density*

Product Objective

These maps show densities of White-tailed Tropicbird (*Phaethon lepturus*) within the study area. This species is a medium-sized seabird that is white with black marks on the wings, and a yellow beak. Long, white tail streamers are clearly visible during flight. This species often nests on cliffs of rocky islands, remaining close to shore during nesting periods and otherwise spending significant time at sea. Timing of occurrence in the Atlantic Region is spring and summer and individuals can be forced inland during inclement weather and hurricanes. [White-tailed Tropicbird Density](#).

The following data source was used to produce the map:

- [Mejías et al. 2017. Distribution and at-sea behavior of Bermudan White-tailed Tropicbirds \(*Phaethon lepturus catesbyi*\) during the non-breeding season.](#)

Methodology

The maps display seasonal densities of White-tailed Tropicbird tagged using GLS. These products include point kernel density estimates for late summer and fall/winter. A total of 60 birds were tagged in breeding sites in Bermuda in 2014 and 2015. Of these, 39 entered the study area. Kernel density estimates were produced using a cell size of 5,000 m and a search radius of 40,000 m.

Context and Interpretation

Spatial Distribution: This White-tailed Tropicbird movement model shows an overlap with the eastern/southeastern limit of the RA Study Area.

Temporal Distribution: White-tailed Tropicbird movements were assessed by season: spring, late summer and fall and winter. Only late summer, fall, and winter seasons overlapped the RA Study Areas. Densities are lower during late summer.

Assumptions and Caveats

- Densities were based on data from a single tracking study.
- The accuracy of GLS tags is ± 150 km.

2.1.5 Monarch

Product Objective

This map indicates locations of Monarch (*Danaus plexippus*) observations in Atlantic Canada. Monarch is currently listed as Special Concern under Schedule 1 of SARA and is under consideration for a status change to Endangered. Monarch adults are large with predominantly orange wings outlined by a broad black border and two rows of circular white spots. The caterpillar is distinctively white, yellow, and black-banded with a pair of black filaments at the head and tail. The chrysalis is green and gold. The Monarch is a migratory butterfly, with a Canadian range including portions of all ten provinces and the Northwest Territories. Eastern Monarchs breed from Alberta east to Nova Scotia and migrate south to overwinter in the mountains of Central Mexico. Milkweed species are the sole food plant for Monarch caterpillars. These plants grow predominantly in open and periodically disturbed habitats such as roadsides, fields, wetlands, prairies, and open forests. Monarchs require staging areas which are used to rest, feed, and avoid inclement weather during migration. [Monarch](#).

The following data source was used to make the map:

- [ACCDC. 2023. Atlantic Canada Conservation Data Centre database.](#)

Methodology

Locations of Monarch observations were obtained from ACCDC and mapped.

Context and Interpretation

Spatial Distribution: There are few Monarch observations in the marine environment. It is difficult to show key areas or spatial distribution of potential Monarch movements/habitats, as it relates to offshore wind energy. Additional follow-up studies to fill this knowledge gap will be identified through future work planning sessions and included during Phase 2 of the RA, which relates to mitigations, monitoring, and follow-up recommendations.

Temporal Distribution: Peak over-water flights are related to Monarch northward (spring; May to early June) and southward (fall; early August to early November) migration.

Assumptions and Caveats

- Little research has been done to understand the effects of offshore wind energy development on Monarchs.

Additional Information

Collisions with wind turbines have been identified as a potential threat for migrating Monarchs but have not been documented in Canada and the magnitude of this threat is unknown (COSEWIC 2016). However, migrating Monarchs have been recorded at altitudes between 2 – 3,350 m depending on the wind patterns (Grealey and Stephenson 2007). Monarch sightings in the Gulf of Mexico have been recorded as far as ~185 km offshore. Additionally, Monarch observations on Sable Island are included in ACCDC data sets, located a minimum distance of ~150 km from mainland Nova Scotia.

Per Grealey and Stephenson (2007), data suggest that the wind speeds and patterns associated with operating wind turbines likely will not create a collision issue with butterflies. However, further studies are needed to assess Monarch migration in the offshore environment and potential impacts from wind energy development.

- [Grealey and Stephenson. 2007. Effects Of Wind Turbine Operation on Butterflies.](#)
- [COSEWIC. 2016. COSEWIC assessment and status report on the Monarch *Danaus plexippus* in Canada.](#)

2.2 Products Updated for November 30, 2023

This section provides product descriptions, context, and update details for products that have undergone ECCC-CWS-ATL expert review and have been updated since the October 31, 2023 submission.

2.2.1 Significant Areas for Birds

The Committees have requested information on **locations of coastal seabird colonies and identified important bird areas**, as well as **other known areas of importance for seabirds, including Migratory Bird Sanctuaries, foraging areas, migration corridors, etc.**

This series of maps indicate locations of significant areas for birds in Atlantic Canada. Significant areas presented in this section include marine bird colonies, migratory bird sanctuaries, national wildlife areas, important bird areas, important shorebird sites, and sea duck key habitat sites.

Maps are provided as follows:

- Marine Bird Breeding Colony Locations. These maps have been updated with recent records from the Atlantic and Quebec Regions, as well as Maine. Colony maps have a standard symbology for size that is replicated in species-specific colony maps. There is an additional mapping product that displays the number of species recorded at a colony.
- Migratory Bird Sanctuaries and National Wildlife Areas. Note that there are also locations not included on this map that are not publicly designated but are in the process of becoming official.
- Important Bird Areas. This product has been updated to include inland locations.
- Important Shorebird Sites. This map has been updated to include regionally significant shorebird sites, based on records from Atlantic Canada Shorebird Surveys.
- Sea Duck Key Habitats. This product has been updated to include inland locations.

Data related to Marine Important Bird Areas has been requested and will be provided once available.

Significant areas for species at risk are discussed in Sections [2.1.1](#) and [2.2.2](#). Information on foraging areas is presented in [Section 3.3](#). Some information on movement and migration is provided in Sections [2.1.3](#), [2.2.3](#), and [3.2](#); however, additional information will be provided once data are received.

2.2.1.1 Marine Bird Colonies

Product Objective

These maps demonstrate the locations of marine bird colonies in Atlantic Canada, Quebec, and the State of Maine, and show the maximum total bird count at each colony ([Marine Bird Colonies - Max Count](#)) as well as the number of species found at each colony ([Marine Bird Colonies - Species Richness](#)). Many colonial nesting species are particularly vulnerable to effects of human disturbance. Colonies are used by species to court, mate, lay and incubate eggs, and raise and feed chicks. Marine bird colonies within the Regional Assessment (RA) Study Area and Focus Area (Study Areas) provide important habitat for a large number of seabirds, shorebirds, and waterfowl. These colonies support significant numbers of birds on both a regional and national scale, with some colonies being the largest in the world (e.g., Leach's Storm-petrel; Wilhelm *et al.* 2019).

The following data sources were used to produce the map:

- [ECCC. 2016. Atlantic Colonial Waterbird Database \(ACWD: ECCC-CWS-ATL\)](#).
- ECCC. 2023a. Banque informatisée des oiseaux de mer au Québec (BIOMQ: ECCC-CWS-Quebec Region). Internal unpublished data. **[CONFIDENTIAL]**.
- USFWS. 2023. Unpublished Data. Maine Seabird Database.

Methodology

Marine bird colony locations in Eastern Canada were plotted and symbolized using the maximum count field (the maximum total count of any species observed at the colony since 1960). Colonies with fewer individuals are denoted by a smaller circle, whereas those with more individuals are indicated by a larger circle.

Context and Interpretation

Spatial Distribution: The colony data includes colony counts, by species, for known colonies located in Eastern Canada (Quebec, Nova Scotia, New Brunswick, Prince Edward Island, and Newfoundland and Labrador). As indicated on the map, marine bird colonies are distributed along most of the coastline adjacent to the Study Areas.

Temporal Distribution: Colonies will be active during the breeding season which is species-specific.

Assumptions, Caveats, and Product Updates

- While colonies are unlikely to be directly adjacent to offshore wind energy development, they are crucial for evaluating risks to birds transiting between nesting and offshore foraging areas. Colonies will also need to be considered for land-based components of offshore wind energy development, such as landfall cables and port infrastructure.
- Species colony counts are rarely conducted annually, and some species require different census techniques (e.g., Gulls with conspicuous nests versus Alcids that use burrows).
- The maximum count field may underestimate the actual maximum count of individuals at a colony (e.g., non-breeding individuals).
- All colonies with count data were included, even if colonies are not currently suitable for breeding, as it is assumed that colonies may reactivate after years of non-use.
- Impacts of sea level rise and climate change on colonial nesting habitats remains a data/knowledge gap. This information will be required to assess long-term impacts on populations of colonial nesting birds.
- Update: Colony maps have been updated to include standardized colony size symbology that is consistent with species-specific colony maps in [Section 3.3](#).

- **Update:** Colony locations have been updated to include more recent colony records from CWS-ATL, CWS-Quebec Region, and the state of Maine.
- An additional mapping product has been developed to demonstrate the number of species recorded at a colony.

2.2.1.2 Migratory Bird Sanctuaries and National Wildlife Areas

Product Objective

This map presents the locations of Migratory Bird Sanctuaries (MBS) and National Wildlife Areas (NWA) relative to the RA Study Areas. MBS are designated areas that hold significant importance for migratory birds throughout their annual cycle. These sanctuaries are recognized at various levels, ranging from regional and international designations to the hemispheric scale, depending on factors including peak species counts and the percentage of the biogeographic population that relies on the site annually. MBS provide safe refuge for migratory birds in both the terrestrial and marine environment and comprise nearly 11.5 million hectares of habitat in 92 locations across Canada. The Migratory Bird Sanctuary Schedule describes rules and prohibitions regarding these locations. NWA are created and managed for the purposes of wildlife conservation, research, and interpretation. These are selected based on specific criteria and occur only on federal lands. Currently, NWA protect over 3.5 million hectares of habitat. [Migratory Bird Sanctuaries and National Wildlife Areas](#).

The following data source was used to produce the map:

- [ECCC. 2023b. Canadian Protected and Conserved Areas Database \(CPCAD\)](#).

Methodology

The locations of MBS and NWA (polygons) were retrieved from the Canadian Protected and Conserved Areas Database (CPCAD) and plotted to include a 10 km buffer, based on recommendations from species experts.

Context and Interpretation

Spatial Distribution: The map includes federally protected MBS (blue) and NWA (green) located in Eastern Canada (Quebec, Nova Scotia, New Brunswick, Prince Edward Island, and Newfoundland and Labrador). As indicated on the map, there are some MBS and NWA within or adjacent to the RA study areas. Of note is Sable Island MBS off the coast of Nova Scotia.

Temporal Distribution: MBS and NWA are protected year-round.

Assumptions, Caveats, and Product Updates

- The list of Canada's NWA and MBS are continuously updated as new locations are identified and designated.
- **Update:** This map has been updated to include Big Glace Bay, which was designated as an NWA (2022) in addition to its status as an MBS.
- Additional NWAs will be undergoing public consultation in the coming months and provided to the RA Committees once available.
- While not under federal protection or ownership, species experts recommend considering the following locations as important bird areas:
 - Little Fogo Islands, NL
 - Bird Islands, Elliston, NL
 - Lawn Islands Archipelago, NL (provincial ecological reserve)
 - Ragged Beach, Witless Bay, NL (provincial ecological reserve)

2.2.1.3 Important Bird Areas

Product Objective

This map indicates Important Bird Area (IBA) locations, relative to the RA Study Areas. IBAs are specific geographic regions recognized for their significance in supporting avian populations. These areas are categorized based on the importance they hold for various bird species, ranging from regional and international levels to the hemispheric scale. The designation depends on factors including peak species counts and the percentage of the biogeographic population relying on the site annually. The Study Areas are known to include highly productive waters and important habitats, including foraging habitats, for several species (MacFarlane Tranquilla *et al.* 2013; Fredericksen *et al.* 2016; Wong *et al.* 2018; van Bemmelen *et al.* 2019). [Important Bird Areas](#).

The following data source was used to produce the map:

- [Birds Canada. 2015. Important Bird Areas of Canada Database.](#)

Methodology

IBA locations (shapefiles) were acquired from BirdLife International and plotted.

Context and Interpretation

Spatial Distribution: The map includes IBA locations in Eastern Canada (Quebec, Nova Scotia, New Brunswick, Prince Edward Island, and Newfoundland and Labrador).

Temporal Distribution: IBA locations will have species-specific considerations; many sites are important year-round.

Assumptions, Caveats, and Product Updates

- The map does not display marine Important Bird Areas. ECCC-CWS-ATL has requested the marine IBA layer from BirdLife International and will provide an updated map to the Committees if received (see [Section 4.0](#)). A map of marine IBAs can be found here: [BirdLife Marine IBA Inventory](#).
- This map does not include the *draft* [Key Biodiversity Areas](#). ECCC-CWS-ATL has requested this layer from BirdLife International and will provide an updated map to the Committees if received (see [Section 4.0](#)).
- Update: This map has been updated to include inland areas.

2.2.1.4 Important Shorebird Sites

Product Objective

This map indicates the locations of important shorebird sites in Eastern Canada. Western Hemisphere Shorebird Reserve Network sites are areas that have been nominated and proved as important for shorebirds in the Western Hemisphere, on a regional, international, or hemispheric scale, depending on the peak species counts and/or percentage of biogeographic population using the site annually. Important Shorebird Sites are areas identified as important for shorebirds but not yet nominated for WHSRN status or may not qualify for nomination. Note that sites that do not qualify for nomination under WHSRN could be significant areas for shorebirds on a regional or local scale. As such, regionally significant sites have also been included to demonstrate the importance of areas for consideration in offshore wind energy development that do not currently qualify for nomination under WHSRN. The network of important shorebird sites, combined with the other shorebird data, indicate potential nodes of movement for shorebirds as they move through the region. It is assumed that shorebird sites are connected and could imply movements (and exposure to offshore wind) in the regional assessment study areas, such as between Cape Breton and the island of Newfoundland, the Gulf of

Maine, within the Gulf of St. Lawrence, and along the south coast of Nova Scotia into the offshore environment for transoceanic migratory flights. [Important Shorebird Sites](#).

The following data sources were used to produce the map:

- [WHSRN. 2023a. Designated WHSRN site boundaries](#).
- [WHSRN. 2023b. Important Shorebird Sites \(Potential WHSRN sites\)](#).
- [McKellar et al. 2020. Potential Western Hemisphere Shorebird Reserve Network sites in Canada: 2020 update](#).
- CWS. 2023a. Regionally Important Shorebird Sites (derived from ACSS data). Internal unpublished data.

Methodology

Shapefiles of Important Shorebird Sites (points) and Western Hemisphere Shorebird Reserve Network (WHSRN) sites (polygons) were obtained from WHSRN and plotted with ECCC Regionally Important Shorebird Sites (points) overlaid.

Context and Interpretation

Spatial Distribution: The map includes important areas for shorebirds in Eastern Canada (Quebec, Nova Scotia, New Brunswick, Prince Edward Island, Newfoundland, and Labrador). 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.

Temporal Distribution: The period of highest risk for shorebirds is during migration; however, some shorebirds breed or overwinter in the region and therefore these areas could be used year-round.

Assumptions, Caveats, and Product Updates

- It is possible for additional sites to be added under WHSRN criteria, as well as additional regionally significant sites to be identified through ongoing work.
- Update: This product has been updated to include regionally significant shorebird sites, based on results of the Atlantic Canada Shorebird Survey.
- New England represents the convergence of multiple shorebird flyways, which may skew importance.

2.2.1.5 Sea Duck Key Habitat Sites

Product Objective

This map indicates the locations of sea duck key habitats in Eastern Canada: [Sea Duck Key Habitat Sites](#). Sea duck key habitat sites are designated areas known for their crucial importance to sea ducks, particularly during their migration and breeding seasons. These sites are recognized and classified based on their significance to sea duck populations, with designations ranging from regional and international levels to the hemispheric scale. The specific designation depends on factors such as the number of sea ducks frequenting the area and the percentage of the biogeographic population that relies on these sites each year.

The Sea Duck Key Habitats Atlas describes 85 important sites for Sea Ducks in North America. It describes habitats critical to sea ducks during at least one season of their annual cycle.

The following data source was used to produce the map:

- [Bowman et al. 2022. Atlas of sea duck key habitat sites in North America](#).

Methodology

Sea Duck Key Habitat Site locations (polygons) were retrieved from the North American Atlas and plotted. To produce the Sea Duck Key Habitat Site Atlas, key sites in Eastern Canada were identified using available survey data and expert knowledge:

- Wintering Common Eider (*Somateria mollissima*): georeferenced winter survey data, included the largest area where eiders were counted while meeting minimum criteria for inclusion in the atlas.
- Eastern Harlequin Duck (*Histrionicus histrionicus*): Coastal block, sites were defined by buffering polygons 500 m from all coastlines and coastal islands based on expert knowledge of habitat use.
- Expert knowledge on scoter and eider molting areas.

Refer to the [Sea Duck Key Habitat Sites Atlas](#) for additional information on site selection methodology.

Context and Interpretation

Spatial Distribution: The map includes sea duck key habitats in Eastern Canada (Quebec, Nova Scotia, New Brunswick, Prince Edward Island, and Newfoundland and Labrador).

Temporal Distribution: Timing considerations have been included in the key habitat site descriptions in the sea duck atlas.

Assumptions, Caveats, and Product Updates

- Information on sea duck use of these sites is based on expert opinion and single or infrequent surveys. Therefore, this should not be considered a comprehensive assessment of important areas for sea ducks.
- Additional important areas for sea ducks will be shared with the Committee when/if they are identified by species experts or subsequent data analyses.
- Update: This product has been updated to include inland areas.

2.2.2 Critical Habitat and Important Areas for Species at Risk

The Committees have requested information on **known areas of higher risk for marine/migratory bird species in relation to offshore wind energy development or marine industrial activity**. Potential impacts of offshore wind energy development or marine industrial activity poses a greater risk to species at risk (SAR), as the loss of a single or few individuals can have significant adverse impacts on populations.

For reference, Table 1 provides the status of species known to occur within the RA study areas that have been assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and are listed on Schedule 1 of the *Species at Risk Act* (SARA). Critical Habitat (CH) is defined under SARA as the habitat necessary for the survival or recovery of a listed wildlife species, as identified in a recovery document for the species. Critical Habitat for species with final recovery strategies and action plans can be found on the Open Government portal: [Critical Habitat for Species at Risk National Dataset - Canada](#).

Table 1: Species status as per the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and status on Schedule 1 of the *Species at Risk Act* (SARA).

Common Name	Scientific Name	COSEWIC Status	SARA Status
Bank Swallow	<i>Riparia riparia</i>	Threatened	Threatened
Barn Swallow	<i>Hirundo rustica</i>	Special Concern	Threatened
Barrow's Goldeneye	<i>Bucephala islandica</i>	Special Concern	Special Concern
Bicknell's Thrush	<i>Catharus bicknelli</i>	Threatened	Threatened
Bobolink	<i>Dolichonyx oryzivorus</i>	Special Concern	Threatened
Buff-breasted Sandpiper	<i>Calidris subruficollis</i>	Special Concern	Special Concern
Canada Warbler	<i>Cardellina canadensis</i>	Special Concern	Threatened
Chimney Swift	<i>Chaetura pelagica</i>	Threatened	Threatened
Common Nighthawk	<i>Chordeiles minor</i>	Special Concern	Special Concern
Eastern Red Bat	<i>Lasiurus borealis</i>	Endangered	Under consideration for addition
Eastern Whip-poor-will	<i>Antrostomus vociferus</i>	Special Concern	Threatened
Eastern Wood-Pewee	<i>Contopus virens</i>	Special Concern	Special Concern
Eskimo Curlew	<i>Numenius borealis</i>	Endangered	Endangered
Harlequin Duck	<i>Histrionicus histrionicus</i>	Special Concern	Special Concern
Hoary Bat	<i>Lasiurus cinereus</i>	Endangered	Under consideration for addition
Horned Grebe	<i>Podiceps auritus</i>	Endangered	Endangered
Hudsonian Godwit	<i>Limosa haemastica</i>	Threatened	Under consideration for addition
Ivory Gull	<i>Pagophila eburnea</i>	Endangered	Endangered
Leach's Storm-Petrel	<i>Hydrobates leucorhous</i>	Threatened	Under consideration for addition
Least Bittern	<i>Ixobrychus exilis</i>	Threatened	Threatened
Lesser Yellowlegs	<i>Tringa flavipes</i>	Threatened	Under consideration for addition
Little Brown Myotis	<i>Myotis lucifugus</i>	Endangered	Endangered
Monarch	<i>Danaus plexippus</i>	Endangered	Endangered
Northern Myotis	<i>Myotis septentrionalis</i>	Endangered	Endangered
Olive-sided Flycatcher	<i>Contopus cooperi</i>	Special Concern	Special Concern
Piping Plover	<i>Charadrius melodus</i>	Endangered	Endangered
Red Crossbill	<i>Loxia curvirostra</i>	Threatened	Threatened
Red Knot	<i>Calidris canutus</i>	Endangered	Endangered
Red-necked Phalarope	<i>Phalaropus lobatus</i>	Special Concern	Special Concern
Roseate Tern	<i>Sterna dougallii</i>	Endangered	Endangered
Rusty Blackbird	<i>Euphagus carolinus</i>	Special Concern	Special Concern
Savannah Sparrow	<i>Passerculus sandwichensis</i>	Special Concern	Special Concern
Short-eared Owl	<i>Asio flammeus</i>	Threatened	Special Concern
Silver-haired Bat	<i>Lasionycteris noctivagans</i>	Endangered	Under consideration for addition
Tricolored Bat	<i>Perimyotis subflavus</i>	Endangered	Endangered
Wood Thrush	<i>Hylocichla mustelina</i>	Threatened	Threatened

This series of updated maps show locations of CH, important areas, and/or important movement and migration corridors for SAR in the Atlantic Region.

Updated maps are provided for the following SARA-listed avian species:

- Ipswich Sparrow (SARA Special Concern)
- Piping Plover (SARA Endangered)
- Roseate Tern (SARA Endangered)

Maps of important habitat for Leach's Storm Petrel (*Hydrobates leucorhous*), along with movement data will be provided in the coming months.

Information related to Monarch (*Danaus plexippus*) and bat SAR are provided in Sections [2.1.5](#) and [2.2.7](#), respectively.

[2.2.2.1 Ipswich Sparrow – Important Fall Migration](#)

Product Objective

These maps indicate potentially important areas for adult and juvenile Ipswich Sparrow (*Passerculus sandwichensis princeps*), listed at Special Concern under Schedule 1 of SARA, during fall migration. This species has greyish-brown upper parts streaked with white, black and buff; a distinctive yellow stripe over and in front of the eye (which is very faint in the autumn and winter); whitish under parts streaked with greyish-brown; and a dusky, slightly forked tail. The *princeps* subspecies nests almost exclusively on Sable Island and winters in the mid-Atlantic States between Nova Scotia and northern Florida. Ipswich Sparrow nests in heath-dominated terrain and in dense marram grass on coastal dunes and upper beaches. [Ipswich Sparrow - Important Fall Migration](#).

The following data source was used to produce the map:

- [Crysler et al., 2016. Differential fall migratory routes of adult and juvenile Ipswich Sparrows \(*Passerculus sandwichensis princeps*\)](#).

Methodology

The above publication analyzed fall migration routes (using the Motus Wildlife Tracking System) for adult and juvenile Ipswich Sparrows tagged on Sable Island, Nova Scotia (NS). The study radio tagged 64 Ipswich Sparrows (16 adult males, 15 adult females, 33 fledglings) in August 2013. To represent the potential risk of offshore wind energy development on migrating Ipswich Sparrow, ECCC-CWS-ATL used spatial data from this publication to create and map polygons of general Ipswich Sparrow migration areas in the marine environment. The polygons encompass all straight-line routes between Motus station detections for all individuals tracked in the study. The areas highlighted in blue show the spatial extent of the estimated fall migratory routes for adults, whereas the areas in yellow show estimated routes for juveniles. This approach was used because the ECCC-CWS-ATL did not have access to raw movement trajectories.

Context and Interpretation

Spatial Distribution: The orientation of over-water flights was slightly different between adults and juveniles (288° vs. 299°; Crysler et al. 2016). Individuals then travelled southwest along the coastline. Adults seemed to move from Southwest NS over the Gulf of Maine. Juveniles either flew over the Gulf of Maine or north over the Bay of Fundy before moving down the coastline.

Temporal Distribution: In the study, juveniles were detected on mainland NS from September 17 until October 23. Adults were detected on mainland NS from October 18 until November 11. Adults and juveniles were temporally separate during migration through NS. Spring migration movement data for Ipswich Sparrow has been requested and will be provided to the committees if/when received and analyzed.

Assumptions, Caveats, and Product Updates

- These layers provide a general spatial representation of important areas for Ipswich Sparrow in fall; migration of Ipswich Sparrow is not confined to the polygons provided. Therefore, much caution must be used in interpreting these data layers.
- Update: A separate map for adults and juveniles is now presented. Movement lines have been added between Motus Tower detections to show potential routes, noting that the lines do not represent actual movement paths.

2.2.2.2 Piping Plover – Critical Habitat and Important Areas

Product Objective

This map indicates the locations of Critical Habitat and potentially important areas for Piping Plover (*Charadrius melodus melodus*), listed as Endangered under Schedule 1 of SARA. Piping Plover is a small shorebird that is found only in North America. It has a pale, sand-coloured back, short stout bill and orange legs. During the breeding season, it also has a single black band across the breast, another black band across the forehead between the eyes, and a distinctive black tip on the orange bill. Individuals of the eastern subspecies breed in the Gulf of St. Lawrence: 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 US. Piping Plovers winter along the Gulf coast of the US and Mexico, southern Atlantic US coast, and the Caribbean, including the Bahamas and Cuba. [Piping Plover - Critical Habitat and Important Areas](#).

The following data sources were used to produce the map:

- [ECCC. 2021. Recovery Strategy \(Amended\) and Action Plan for the Piping Plover melodus subspecies \(Charadrius melodus melodus\) in Canada.](#)
- [ACCDC. 2023. Atlantic Canada Conservation Data Centre database.](#)
- CWS. 2022. Piping Plover nesting record database, 2017-2022. Unpublished internal data. **[CONFIDENTIAL]**.

Methodology

This product includes a 10 km buffer around shorelines that are identified as Piping Plover critical habitat, as identified in the Amended Recovery Strategy and Action Plan for Piping Plover *melodus* subspecies. Observations of Piping Plover outside the breeding season (stopover and/or pre- or post-breeding areas) and breeding locations recorded between 2017 and 2022 were also mapped with a 10 km buffer. The buffer is a conservative estimate of the distance required for plovers to reach flight altitudes higher than anticipated heights of turbine rotor swept zones (20-300 m).

Context and Interpretation

Spatial distribution: Includes Piping Plover Critical Habitat and observations in Nova Scotia, Newfoundland and Labrador, New Brunswick, and Prince Edward Island. Another spatial product available for Piping Plover is the coastal density map, to be provided to the Committees by November 30, 2023.

Temporal distribution: Includes Critical Habitat (identified up to 2016) during the breeding season (May to August) and observations of Piping Plover outside the breeding season (stopover areas post/pre-breeding or during migration). Another temporal product available for Piping Plover is the temporal trend map of Piping Plover coastal density, to be provided to the Committees by November 30, 2023.

Assumptions, Caveats, and Product Updates

- Critical Habitat for Piping Plover only includes breeding sites and foraging areas close to nesting sites. Other important habitats may not be included (e.g., stopover sites).
- Update: This map has been updated to include breeding locations between 2017 and 2022 and observations from outside the breeding season.

2.2.3 Bird Movements

The Committees have requested information on **other known areas of importance for seabirds, including Migratory Bird Sanctuaries, foraging areas, migration corridors, etc.**

Information on Migratory Bird Sanctuaries is presented in [Section 2.2.1.2](#). Information on foraging areas is provided in [Section 3.3](#).

This series of maps indicate movements of various bird species tracked in Eastern Canada. Additional tracking data will be summarized and provided to the Committees in the coming months (see [Section 4.0](#) for more information on products currently under development).

Movement data products have been updated for the following species:

- Whimbrel

2.2.3.1 Shorebirds

2.2.3.1.1 Whimbrel Locations and Tracks

Product Objective

This map provides information on Argos PTT locations and tracks of Whimbrel (*Numenius phaeopus*) during migration. This is a large shorebird species with a long, curved bill and relatively long neck and legs. Wings are long and point, and the tail is short. Whimbrel are predominantly brownish above, tan below, with neat dark stippling. The crown is dark brown with a pale central stripe, and most show a narrow dark eyeline. Whimbrel migrates in long bouts from its arctic breeding grounds to wintering grounds in South America. Saltmarshes, mudflats, beaches, and small islands are also important during migration. Whimbrel are sometimes found inland after being grounded by storms, taking refuge in farm fields, airports, lakeshores, or other open environments. [Whimbrel Locations and Tracks](#).

The following data sources were used to produce the map:

- Shorebird Science and Conservation Collective. 2023a. Whimbrel tracking dataset.
- CWS. 2016. Whimbrel Argos PTT tracking dataset. Unpublished Data. **[CONFIDENTIAL]**.

Methodology

Argos PTT fixes (points) and estimated fall movement tracks (Euclidean distance between points) were mapped over the study area. Data included 9 individuals tagged at their breeding sites near the Mackenzie River Delta,

Northwest Territories (NWT), and 8 individuals tagged at stopover sites on Miscou Island, NB (n = 5), Virginia, USA (n = 2) and Massachusetts, USA (n = 1).

Context and Interpretation

Spatial Distribution: Whimbrel display transoceanic migratory flights through the regional assessment study areas, travelling in a southeast direction toward South America. Though the sample size is limited, these data show spatial overlap of Whimbrel migratory routes with potential offshore wind energy development areas.

Temporal Distribution: Includes tracks during fall migration.

Assumptions, Caveats, and Product Updates

- This product is considered **CONFIDENTIAL** because it contains unpublished data. It cannot be made publicly available unless otherwise specified by ECCC-CWS-ATL.
- This map displays fall migration routes only; ECCC-CWS-ATL has not acquired data on spring migration routes in the study area.
- Update: locations have been added based on data compiled by the Shorebird Collective and from internal ECCC-CWS-ATL data.

2.2.4 Seabird Densities and Distribution

The Committees have requested information on **general densities of seabirds within the study area, and trends on where and when increased densities may occur.**

This section describes the densities and distributions of seabirds in the RA Study Areas.

2.2.4.1 Marine Birds

2.2.4.1.1 Pelagic Bird Survey Effort

Product Objective

This series of maps show survey effort for boat-based Eastern Canada Seabird at Sea (ECSAS) surveys. These maps are provided to give context on densities described in [Section 2.2.4.1.2](#). The Newfoundland and Labrador Committee requested information on ECSAS survey effort to help inform their review of the proposed Newfoundland focus area for the RA (outlined in red on the maps). [Pelagic Bird Survey Effort](#).

The following data source was used to produce the map:

- ECCC. 2023c. Atlas of Seabirds at Sea in Eastern Canada 2006 - 2020 (unpublished 50 km hex update). **[CONFIDENTIAL]**.

Methodology

ECSAS survey tracks were plotted and overlaid with hex grids to indicate survey effort within each grid. See [Eastern Canada Seabirds at Sea \(ECSAS\) standardized protocol for pelagic seabird surveys from moving and stationary platforms](#) for more details.

Context and Interpretation

These maps demonstrate that there are temporal and spatial information gaps in ECSAS survey effort.

Spatial Distribution: Hexes are 50 km in width and shaded to reflect the number of kilometers surveyed with yellow indicating the most heavily surveyed areas (i.e., the number of km surveyed in each hex). The raw survey tracks are overlaid on the map as grey points.

Temporal Distribution: Maps are presented in three seasons: April to July; August to November; and December to March.

Assumptions, Caveats, and Product Updates

- This product is considered **CONFIDENTIAL** because it contains unpublished data. It cannot be made publicly available unless otherwise specified by ECCC-CWS-ATL.
- Survey effort gaps should be filled to improve the state of knowledge related to species using the offshore, especially during winter months (December to March).
- Update: Data and analyses were confirmed and reviewed internally to match the current version and Atlas update.

2.2.4.1.2 Pelagic Bird Seasonal and Annual Density and Distribution

Product Objective

This series of map will demonstrate the seasonal and year-round distributions and densities of species observed through boat-based Eastern Canada Seabirds at Sea (ECSAS) surveys. At-sea seabird densities indicate areas with more potential for exposure to potential offshore wind areas. Movements from mainland to these areas also increase exposure risk to offshore wind, as well as movement between high use areas. [Pelagic Bird Seasonal and Annual Density and Distribution](#).

The following data source was used to produce the maps:

- ECCC. 2023c. Atlas of Seabirds at Sea in Eastern Canada 2006 - 2020 (50 km hex update, unpublished). **[CONFIDENTIAL]**.

Seasonal and year-round density and distribution maps are provided for the following species/species groups:

- Atlantic Puffin
- Black Guillemot
- Black-legged Kittiwake
- Bonaparte's Gull
- Common Murre
- Dovekie
- Great Black-backed Gull
- Glaucous Gull
- Herring Gull
- Iceland Gull
- Jaegers
- Loons
- Murres
- Northern Fulmar
- Northern Gannet
- Phalaropes

- Razorbill
- Ring-billed Gull
- Shearwaters
- Skuas
- Storm-petrels
- Thick-billed Murre

Methodology

The seasonal density estimates for each species (mean number of birds/km² within each 50 km hex grid) and the coefficient of variation (%) of the mean were mapped. The density estimates are displayed between blue (low) to yellow (high) per species, per season. An additional all-season map was included to highlight areas of high density from each season in one map. The hex grid line widths represent the variation; hex grids with thick lines represent densities with more variation, while hex grids with thin lines have less variation.

To calculate year-round densities, ArcMap was used to break the density values down into Quantile ranges for each of the seasons with available data. When all seasons were categorized, an average of the values was taken to find a scale range that would best represent all seasons with a consistent display of ranges across panels within each species' map. The lowest range was always set to 0, to represent where no birds were sighted, and the next 3 ranges of the quantiles were taken as the average of each of the seasons with the upper range set to the highest density value across all seasons. This upper range not being the average was to ensure that no upper and outlier values were missed across any of the seasons.

Context and Interpretation

Spatial Distribution: Hexes are 50 km in width and shaded to reflect species density with darker blue areas indicating lower density and yellow areas indicating higher density.

Temporal Distribution: Each map consists of four panels: April to July; August to November; December to March; and all seasons. Note that not all species are observed across seasons, and panels without observations include "No Data".

Assumptions, Caveats, and Product Updates

- This product is considered **CONFIDENTIAL** because it contains unpublished data. It cannot be made publicly available unless otherwise specified by ECCC-CWS-ATL.
- Update: Data and analyses for each species were confirmed and reviewed internally by species experts to match the current version and Atlas update.

2.2.5 Shorebird Coastal Density and Temporal Trends

Product Objective

Although not explicitly requested by the Committee, this series of maps will show species-specific relative densities and temporal trends of shorebirds in Atlantic Canada during all seasons. [Shorebird Coastal Density and Temporal Trends](#).

The following data sources were used to produce the maps:

- CWS. 2012. Atlantic Canada Shorebird Surveys (ACSS) data, 1971-present. Internal database.
- CWS. 2023b. Purple Sandpiper Surveys. 1971-2023. Internal database.

- CWS. 2014. Semipalmated Sandpiper aerial survey data from Bay of Fundy 1976 – 2014. Internal database.
- CWS. 2015. Phalarope Aerial Surveys in the Bay of Fundy 2009, 2010 and 2015. Internal database.
- [eBird. 2023. Status and Trends Data - Observations for timing of occurrence.](#)

Migratory shorebirds could interact with offshore wind energy developments during migratory flights or when transiting between habitats used for foraging, resting, and breeding. Therefore, these species should be considered for the RA.

Methodology

Distribution and density mapping are based on data obtained from the Atlantic Canada Shorebird Surveys (ACSS) data and eBird for 28 species. Additional records were obtained for the Purple Sandpiper (PUSA) from the ECCC-CWS-ATL dataset, for the Semipalmated Sandpiper (SESA) from SESA aerial surveys (1976 – 2014), and for Phalaropes from aerial surveys done in 2009, 2010, and 2015. ACSS data contains records from 1971-2023, while the ECCC-CWS-ATL PUSA data contains records from 1971-2023. Site maxima records (i.e., the record with the highest count for each area, using the standardized area name column) were calculated for each season of interest. Seasons include fall (July 1 to December 31), winter (January 1 to March 14), spring (March 15 to May 31), and all seasons combined (January 1 to December 31).

Point data layers using the complete datasets were created for each species and site maxima point data layers were also created for each season/species. A density analysis was conducted for each species and season of interest to map their density/distribution in Atlantic Canada. Point data density rasters were then created for each species. Analysis was done using the density function of the spatstat package of the R programming language. Density estimates were calculated using a cell size of 500 m and a sigma of 5,000 m. Density values were rescaled between 0 and 1 and very low values ($< 10e-4$) set to 0 to remove modelling artifacts. Data values of “0” were excluded from the classification and a colour ramp of blue to yellow was used.

Seasonal occurrence of shorebirds in the study area was compiled using the “ebirdst” R package (<https://ebird.github.io/ebirdst/>). This package retrieves Status and Trends Data Products compiled by Cornell University based on the eBird dataset. Weekly median abundance rasters were downloaded for each species, cropped to the study area, and normalized across the year. Timing data presented represent values for the year 2022.

Shorebird coastal density and temporal trend maps are be provided for the following species:

- American Golden Plover
- American Oystercatcher
- Black-bellied Plover
- Buff-breasted Sandpiper
- Dunlin
- Greater Yellowlegs
- Hudsonian Godwit
- Killdeer
- Least Sandpiper

- Lesser Yellowlegs
- Pectoral Sandpiper
- Piping Plover
- Purple Sandpiper
- Red Knot
- Red Phalarope
- Red-necked Phalarope
- Ruddy Turnstone
- Sanderling
- Semipalmated Plover
- Semipalmated Sandpiper
- Solitary Sandpiper
- Spotted Sandpiper
- Whimbrel
- Willet
- Wilson's Phalarope
- Wilson's Snipe
- White-rumped Sandpiper

Context and Interpretation

Spatial Distribution: Includes shorebird densities and temporal trends in Atlantic Canada (Nova Scotia, Newfoundland and Labrador, New Brunswick, and Prince Edward Island). The spatial distribution of shorebirds within the study area is unknown, as these datasets are terrestrial. However, these maps indicate coastal hotspots (e.g., southeastern Nova Scotia, Bay of Fundy) that could be areas of higher risk for offshore wind energy development, as birds may interact with nearshore turbines while travelling between roosting locations during stopover or while initiating migratory transoceanic flights.

Temporal Distribution: Most species showed one or more pronounced peaks in abundance and most peaks occurred somewhere between summer and early fall (July-October), indicating these periods would be the riskiest for migrating shorebirds with respect to offshore wind energy development. Most species have low abundance or are absent in the winter months, except Purple Sandpiper which shows moderate relative abundance over winter with peak abundance in April.

Assumptions, Caveats, and Product Updates

- Update: Data was updated with most current records and additional data.

2.2.6 Waterfowl and Game Birds

Although not part of the formal Request for Advice, the Newfoundland RA Committee requested information on known harvest areas for migratory birds. ECCC-CWS-ATL will also provide information on waterfowl and game bird relative abundance and distribution, as many species use the study area for foraging, migrating, or staging and should therefore be considered in the RA.

2.2.6.1 Waterfowl Relative Abundance

Product Objective

This series of maps show species-specific relative densities of waterfowl along coastal blocks in Atlantic Canada. [Waterfowl Relative Abundance](#).

The following data source was used to produce the maps:

- CWS. 2023c. Coastal Waterfowl Block Observations. Internal database.

Methodology

Coastlines along Eastern Canada in the Atlantic Ocean and the Saint Lawrence River have been surveyed by the Canadian Wildlife Service which includes recorded observations of coastal waterfowl dating back to the 1960s. That data has been summarized into coastal blocks, following this historical survey method. To produce the map, the maximum number of individuals observed over all years was extracted for each species and each coastal block. From these values, the relative importance of blocks was calculated, between 0 and 1, for each species.

Context and Interpretation

Spatial Distribution: At-sea distributions are limited for many species. Coastal waterfowl block surveys were used to assess which areas could have more individuals of a waterfowl species.

Temporal Distribution: For waterfowl species nesting in the Atlantic Region, nesting calendars are for some species (Birds Canada 2023) were used to inform potential periods of higher risk for waterfowl. Movement related metrics for migrating waterfowl (e.g., snow geese) remain to be developed.

- [Birds Canada. 2023. Nesting Calendar Query Tool](#).

Assumptions, Caveats, and Product Updates

- 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/migrate within the rotor swept zone of offshore wind turbines.
- Data are historical and updated triennial surveys have taken place that do not use the coastal block system. This approach has thus been supplemented with more recent data from the triennial surveys and can be found in [Section 3.5](#).
- The coastal blocks surveys focus on the non-breeding season only.
- **Update:** Relative abundance was updated to display a constant scale between all species (i.e., equal interval bins). The constant scale between species allows the relative patterns of abundance to be interpreted correctly.

2.2.6.2 Waterfowl Band Encounters

Product Objective

This series of maps show relative densities of regulated gamebird harvest around coastal areas of Atlantic Canada: [Waterfowl Band Encounters](#).

The following data source was used to produce the maps:

- [USGS. 2023. Game bird banding and encounter data release July 2023](#).

Game bird harvest density maps are provided for the following species:

- American Black Duck
- American Wigeon
- American Woodcock
- Bufflehead
- Blue-winged Teal
- Canada Goose
- Common Eider
- Common Goldeneye
- Common Merganser
- Common Murre
- Gadwall
- Greater Scaup
- Green-winged Teal
- Hooded Merganser
- Lesser Scaup
- Mallard
- Northern Pintail
- Northern Shoveler
- Red-breasted Merganser
- Ring-necked Duck
- Surf Scoter
- Thick-billed Murre
- Wilson's Snipe
- Wood Duck
- White-winged Scoter

Methodology

The maps were created using band recovery data from hunted birds in the study area using the United States Geological Survey (USGS) Game Bird dataset. The USGS game bird banding database was queried for all band recoveries that resulted from 'shooting' that were not recovered the same year they were banded to reduce the importance of banding sites in density estimations. Regional relative densities were produced, but only displayed within coastal block areas. Point density kernel estimates were calculated using the "spstats" package (v 3.0-6) of the R programming language (v4.2.2). A cell size of 1,000 m and a search radius of 10 km were used in each analysis. Estimates were rescaled between 0 and 1 and values lower than $10e-4$ were set to 0.

Context and Interpretation

Spatial Distribution: Includes harvest densities in Atlantic Canada (Nova Scotia, Newfoundland and Labrador, New Brunswick, and Prince Edward Island).

Temporal Distribution: Current harvest density maps reflect band recovery, so some timing information is available. However, harvest season timelines are set and therefore can represent when regulated harvest is happening within the region.

Assumptions, Caveats, and Product Updates

- The current assessment is incomplete, as it only includes datasets that were available to ECCC-CWS-ATL at the time of submission. Therefore, these densities do not reflect the true pattern of regulated hunting of game birds in Atlantic Canada.
- This dataset does not include any assessment of harvest by Indigenous Nations.
- Band recovery distributions are affected by the location and timing of banding, the distributions of hunters and hunter effort, reporting rates, and distributions of birds.
- National harvest survey results from ECCC-CWS-National Capital Region would help better represent gamebird harvest and could supplement data from band recoveries. ECCC-CWS-ATL has requested these data and will provide an updated product to the Committees if/when received and analyzed.
- Update: Using banding recoveries as indications of gamebird harvest densities is heavily biased by banding effort. Banding stations can appear as "hotspots" for all species in the vicinity of band recoveries. This would potentially mute other areas with high harvest because band recoveries would be lower despite harvest pressure likely being just as high in some cases. The recovery distributions are affected by the location and timing of banding, the distributions of hunters and hunter effort, reporting rates (which are known to be low in NL), and distributions of birds. To reduce these effects, only birds that were reported in a different year they were banded were used for the analysis.

2.2.7 Bat Species at Risk

The Committees have requested information relating to **bat species and their movements within the study area, and any identified areas or times of year where presence is higher.**

2.2.7.1 *Locations of Bat Observations*

Product Objective

This map indicates locations of bat observations in the Maritimes (Nova Scotia, New Brunswick, and Prince Edward Island) and in the northeastern Atlantic offshore: [Location of Bat Observations](#).

The following data sources were used to make the map:

- [Solick and Newman. 2021. Oceanic records of North American bats and implications for offshore wind energy development in the United States. Ecology and Evolution.](#)
- [Hatchet al. 2013. Offshore observations of eastern red bats \(*Lasiurus borealis*\) in the mid-Atlantic United States using multiple survey methods.](#)
- [Pelletier, S.K., K. Omland, K.S. Watrous, T.S. Peterson. 2013. Information Synthesis on the Potential for Bat Interactions with Offshore Wind Facilities – Final Report. U.S. Dept of the Interior, Bureau of Ocean Energy Management, Headquarters, Herndon, VA. OCS Study BOEM 2013-01163. 119 pp.](#)
- [True et al. 2021. Monitoring and modeling tree bat \(*Genera: Lasiurus, Lasionycteris*\) occurrence using acoustics on structures off the mid-Atlantic coast—Implications for offshore wind development.](#)
- [True et al. 2023. Fall migration, oceanic movement, and site residency patterns of eastern red bats \(*Lasiurus borealis*\) on the mid-Atlantic Coast.](#)
- [ACCDC. 2023. Atlantic Canada Conservation Data Centre database.](#)
- Humber, J. 2023. Unpublished Bat Observations. Obtained November 3, 2023.

The map includes locations for the following species:

- Myotis (due to difficulties in species identification, locations are unspecified between Little Brown [*Myotis lucifugus*] and Northern [*Myotis septentrionalis*]; both SARA-listed Endangered)
- Eastern Red Bat (COSEWIC assessed Endangered)
- Hoary Bat (COSEWIC assessed Endangered)
- Silver-haired Bat (COSEWIC assessed Endangered)

Methodology

Locations of bat observations in Atlantic Canada were obtained from the above sources and mapped.

Context and Interpretation

Spatial Distribution: Includes observations in Atlantic Canada (Nova Scotia, Newfoundland and Labrador, New Brunswick, and Prince Edward Island).

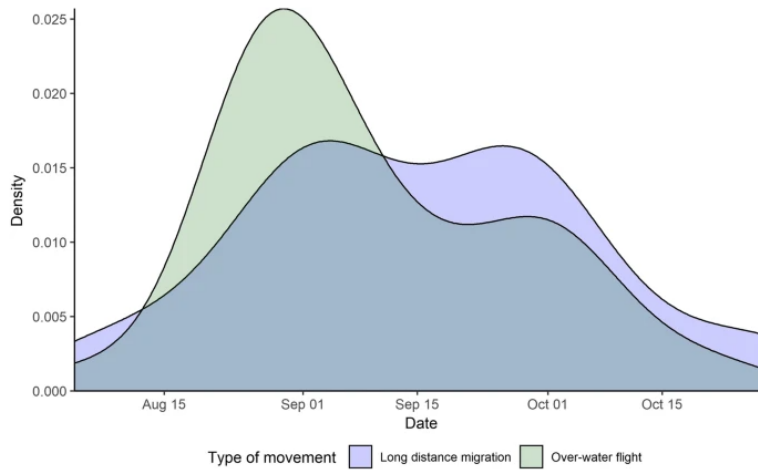
Temporal Distribution: Risks to bat species from offshore wind energy development are likely highest during migration periods.

Assumptions, Caveats, and Product Updates

- Note that species sensitivities exist related to bat locations. Therefore, this product is considered **CONFIDENTIAL** and cannot be made publicly available unless otherwise specified by ECCC-CWS-ATL.
- Update: Additional data will be incorporated following input from Bat Conservation International, who are under contract with ECCC-CWS-ATL.
- There are few bat observations in the marine environment. It is difficult to show key areas or spatial distribution of potential bat movements/habitats, as it relates to offshore wind energy.
- Additional follow-up studies to fill this knowledge gap will be identified through future work planning sessions and included during Phase 2 of the RA, which relates to mitigations, monitoring, and follow-up recommendations.

Additional Information

A United States Geological Survey (USGS) study with Eastern Red Bats (using the Motus Wildlife Tracking System) along the United States (US) coast shows that migration along the Atlantic Coastal Plains occurred between August and October, with peak over-water flights occurring late-August to early-September (True et al. 2023):



The density of long-distance migration events (blue curve) and over-water flights (green curve) and as they relate to time of the year from Motus telemetry data on eastern red bats (*Lasiurus borealis*) in the mid-Atlantic Coastal Plain in falls of 2019 and 2021. Over-water forays distinctly peaked in late August to early September while long distance migration events were sustained from late August to early October. Note that tagging events were not evenly distributed throughout this period

3.0 New Products

This section provides descriptions and context for products that were under ECCC-CWS-ATL expert review at the time of the October 31, 2023 submission. These products have been prepared based on input from experts.

3.1 Critical Habitat and Important Areas for Species at Risk

The Committees have requested information on **known areas of higher risk for marine/migratory bird species in relation to offshore wind energy development or marine industrial activity**. Potential impacts of offshore wind energy development or marine industrial activity poses a greater risk to species at risk (SAR), as the loss of a single or few individuals can have significant adverse impacts on populations.

For reference, Table 1 provides the status of species known to occur within the RA study areas that have been assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and are listed on Schedule 1 of the *Species at Risk Act* (SARA). Critical Habitat (CH) is defined under SARA as the habitat necessary for the survival or recovery of a listed wildlife species, as identified in a recovery document for the species. Critical Habitat for species with final recovery strategies and action plans can be found on the Open Government portal: [Critical Habitat for Species at Risk National Dataset - Canada](#).

Table 1: Species status as per the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and status on Schedule 1 of the *Species at Risk Act* (SARA).

Common Name	Scientific Name	COSEWIC Status	SARA Status
Bank Swallow	<i>Riparia riparia</i>	Threatened	Threatened
Barn Swallow	<i>Hirundo rustica</i>	Special Concern	Threatened
Barrow's Goldeneye	<i>Bucephala islandica</i>	Special Concern	Special Concern
Bicknell's Thrush	<i>Catharus bicknelli</i>	Threatened	Threatened

Bobolink	<i>Dolichonyx oryzivorus</i>	Special Concern	Threatened
Buff-breasted Sandpiper	<i>Calidris subruficollis</i>	Special Concern	Special Concern
Canada Warbler	<i>Cardellina canadensis</i>	Special Concern	Threatened
Chimney Swift	<i>Chaetura pelagica</i>	Threatened	Threatened
Common Nighthawk	<i>Chordeiles minor</i>	Special Concern	Special Concern
Eastern Red Bat	<i>Lasiurus borealis</i>	Endangered	Under consideration for addition
Eastern Whip-poor-will	<i>Antrostomus vociferus</i>	Special Concern	Threatened
Eastern Wood-Pewee	<i>Contopus virens</i>	Special Concern	Special Concern
Eskimo Curlew	<i>Numenius borealis</i>	Endangered	Endangered
Harlequin Duck	<i>Histrionicus histrionicus</i>	Special Concern	Special Concern
Hoary Bat	<i>Lasiurus cinereus</i>	Endangered	Under consideration for addition
Horned Grebe	<i>Podiceps auritus</i>	Endangered	Endangered
Hudsonian Godwit	<i>Limosa haemastica</i>	Threatened	Under consideration for addition
Ivory Gull	<i>Pagophila eburnea</i>	Endangered	Endangered
Leach's Storm-Petrel	<i>Hydrobates leucorhous</i>	Threatened	Under consideration for addition
Least Bittern	<i>Ixobrychus exilis</i>	Threatened	Threatened
Lesser Yellowlegs	<i>Tringa flavipes</i>	Threatened	Under consideration for addition
Little Brown Myotis	<i>Myotis lucifugus</i>	Endangered	Endangered
Monarch	<i>Danaus plexippus</i>	Endangered	Endangered
Northern Myotis	<i>Myotis septentrionalis</i>	Endangered	Endangered
Olive-sided Flycatcher	<i>Contopus cooperi</i>	Special Concern	Special Concern
Piping Plover	<i>Charadrius melodus</i>	Endangered	Endangered
Red Crossbill	<i>Loxia curvirostra</i>	Threatened	Threatened
Red Knot	<i>Calidris canutus</i>	Endangered	Endangered
Red-necked Phalarope	<i>Phalaropus lobatus</i>	Special Concern	Special Concern
Roseate Tern	<i>Sterna dougallii</i>	Endangered	Endangered
Rusty Blackbird	<i>Euphagus carolinus</i>	Special Concern	Special Concern
Savannah Sparrow	<i>Passerculus sandwichensis</i>	Special Concern	Special Concern
Short-eared Owl	<i>Asio flammeus</i>	Threatened	Special Concern
Silver-haired Bat	<i>Lasionycteris noctivagans</i>	Endangered	Under consideration for addition
Tricolored Bat	<i>Perimyotis subflavus</i>	Endangered	Endangered
Wood Thrush	<i>Hylocichla mustelina</i>	Threatened	Threatened

This series of updated maps show locations of CH, important areas, and/or important movement and migration corridors for SAR in the Atlantic Region.

Maps are provided for the following SARA-listed avian species:

- Lesser Yellowlegs (under consideration for addition to Schedule 1 as Threatened)
- Red Knot (SARA Endangered)

3.1.1 Red Knot – Important Stopover Areas

Product Objective

This map indicates important stopover sites for Red Knot (*Calidris canutus*), a species listed as Endangered under Schedule 1 of SARA. The Red Knot is a medium-sized shorebird with rusty-red plumage during the breeding season and dull grey and white plumage during the non-breeding season (Baker et al. 2020). This species undertakes extraordinarily long migrations, breeding in the high arctic and wintering as far south as Tierra Del Fuego in South America. Red Knot occur in Atlantic Canada exclusively during spring and fall migration, with the highest concentrations occurring in late summer and early fall. [Red Knot - Important Stopover Areas](#).

The following data source was used to produce the map:

- ECCC. 2023d. Red Knot Priority Sites in Atlantic Canada. Internal unpublished data. **[CONFIDENTIAL]**.

Methodology

Locations of shorelines identified as Red Knot priority stopover sites were mapped with a 10 km buffer. The 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). The list of priority sites was developed by ECCC-CWS-ATL and is based on Atlantic Canada Shorebird Survey (ACSS) data (maximum counts) collected since 1974.

Context and Interpretation

Spatial distribution: Important stopover locations in Atlantic Canada are depicted (Newfoundland and Labrador, Nova Scotia, New Brunswick, and Prince Edward Island).

Temporal distribution: Data include stopover sites used during spring and migration periods. Breeding and non-breeding habitat is not shown on the map because Red Knot are only present in the region during migration.

Assumptions and Caveats

- This product is considered **CONFIDENTIAL** because data are unpublished and associated with a species at risk. Therefore, it cannot be made publicly available unless otherwise specified by ECCC-CWS-ATL.
- There may be other important stopover sites not depicted on this map that will be identified through ongoing research.
- Only marine-facing sites are included (terrestrial sites were removed).

3.1.2 Lesser Yellowlegs – Migration Areas

Product Objective

This map indicates migration tracks for Lesser Yellowlegs (*Tringa flavipes*) travelling through Atlantic Canada during fall migration. The Lesser Yellowlegs is a medium-sized shorebird with long yellow legs, a long neck, buffy brown upperparts and white underparts (Tibbitts and Moskoff 2020). This species breeds in the subarctic and arctic and its non-breeding range extends from the southern United States to southern South America. They occur in Atlantic Canada primarily during fall migration, with higher concentrations in August. Some individuals also use the region during spring migration. COSEWIC assessed Lesser Yellowlegs as Threatened in 2020 and consequently, this species is currently under consideration for addition to SARA. [Lesser Yellowlegs - Migration Areas](#).

The following data sources were used to produce the map:

- CWS. 2023d. Lesser Yellowlegs GPS tracking dataset. Internal unpublished data. **[CONFIDENTIAL]**.
- Shorebird Science and Conservation Collective. 2023b. Lesser Yellowlegs tracking dataset.

Methodology

GPS fixes (points) and interpolated track lines were mapped over the study area. Data were collected between 2019 and 2023 and include one individual tagged in Manitoba and six birds tagged along coastal sites in southeast New Brunswick. The GPS tags collected one to two locations every two days.

Context and Interpretation

Spatial Distribution: Locations and tracks in the Atlantic Region are shown (Nova Scotia, Newfoundland and Labrador, New Brunswick, and Prince Edward Island); locations and tracks outside the region were removed. Lesser Yellowlegs undertook transoceanic migratory flights through the regional assessment study areas, travelling in a southerly direction toward New England, USA or Central/South America. Though the sample size is limited, these data show spatial overlap of Lesser Yellowlegs migratory routes with potential offshore wind energy development areas.

Temporal distribution: This product includes southbound tracks during post-breeding (fall) migration.

Assumptions and Caveats

- This product is considered **CONFIDENTIAL** because it contains unpublished data. It cannot be made publicly available unless otherwise specified by ECCC-CWS-ATL.
- This map shows migration tracks for a small number of individuals (n <10) and may not be representative of the entire population.
- The map does not provide information on key stopover locations for this species. Stopover sites are used for refuelling and resting during migration and high-quality stopover sites are critical for migratory shorebirds.
- All lines are interpolated migration tracks (straight lines between GPS fixes) and therefore should not be considered 'true' migration tracks.
- ECCC-CWS-ATL did not obtain any migration tracks of individuals travelling northbound during spring migration.

3.2 Bird Movements

The Committees have requested information on **other known areas of importance for seabirds, including Migratory Bird Sanctuaries, foraging areas, migration corridors, etc.**

Information on Migratory Bird Sanctuaries is presented in [Section 2.2.1.2](#). Information on foraging areas is provided in [Section 3.3](#).

This series of maps indicate movements of various bird species tracked in Eastern Canada. Additional bird movement data products are provided in Sections [2.1.3](#) and [2.2.3](#).

New movement data products are provided for the following species:

- American Golden-plover

- American Woodcock
- Black-bellied Plover
- Hudsonian Godwit
- Pectoral Sandpiper
- Red Phalarope

Additionally, a new movement data product for Lesser Yellowlegs is provided in [Section 3.1.2](#).

3.2.1 American Golden-plover

Product Objective

This map provides information on GPS locations and interpolated tracks of American Golden-plover (*Pluvialis dominica*, n=6) during migration. This species is a medium-sized shorebird with a large head, slim neck, long, pointed wings, and relatively long legs. The bill is short, slender, and straight. Breeding birds are gold-spangled above, blackish below, with a white “scarf” extending from brow to breast sides. Juveniles and nonbreeding birds show some gold tones above but are predominantly gray below. In Canada, the American Golden-plover breeds widely across the low to mid Arctic and winters in grasslands and wetlands of South America. Habitat loss and disturbance are among main threats to the species. American Golden-plover has been identified as a priority for conservation and/or stewardship in one or more Bird Conservation Region Strategies in Canada. [American Golden-plover](#).

The following data source was used to produce the map:

- Shorebird Science and Conservation Collective. 2023c. American Golden-plover tracking dataset.

Methodology

GPS fixes (points) and interpolated track lines were mapped over the study area. Data were collected between 2018 and 2022 and included 3 individuals tagged in Alaska, USA, and 3 individuals tagged in Nunavut, Canada. The GPS tags collected a location once every two days.

Context and Interpretation

Spatial Distribution: Locations and tracks in the Atlantic Region are shown (Nova Scotia, Newfoundland and Labrador, New Brunswick, and Prince Edward Island); locations and tracks outside the region were removed. American Golden-plover undertook transoceanic migratory flights through the regional assessment study areas, travelling in a southerly direction toward Central/South America. Though the sample size is limited, these data show spatial overlap of American Golden-Plover migratory routes with potential offshore wind energy development areas.

Temporal Distribution: Includes southbound tracks during post-breeding (fall) migration.

Assumptions and Caveats

- This map displays southbound fall migration routes only; ECCC-CWS-ATL has not acquired data on northbound spring migration routes in the study area.
- This map shows migration tracks for a small number of individuals and is not representative of the entire population.
- The map does not provide information on key stopover locations for this species. Stopover sites are used for refuelling and resting during migration and high-quality stopover sites are critical for migratory shorebirds.

- All lines are interpolated migration tracks (straight lines between GPS fixes) and therefore should not be considered 'true' migration tracks.

3.2.2 American Woodcock

Product Objective

This map provides information on GPS locations and interpolated tracks of American Woodcock (*Scolopax minor*, n=3) during migration. This species is a plump, short-legged shorebird with a long, straight bill. American Woodcock has a large head and short neck. Wings are broad and rounded compared to most shorebirds. American Woodcock have light brown, black, buff, and gray-brown tones, which are ideal for camouflage in their preferred habitats of fields and forest floors. The American Woodcock breeds in forested habitats across eastern North America and is most abundant between 40 and 50 degrees North. Birds breeding in Canada migrate as far south as the Texas Gulf Coast in winter. This species is harvested and has been identified as a priority for conservation and/or stewardship in one or more Bird Conservation Region Strategies in Canada. [American Woodcock](#).

The following data source was used to produce the map:

- Shorebird Science and Conservation Collective. 2023d. American Woodcock tracking dataset.

Methodology

GPS fixes (points) and interpolated track lines were mapped over the study area. Data were collected between 2020 and 2022 and included one individual tagged in Nova Scotia, one individual tagged in North Carolina, USA, and one individual tagged Maryland, USA. The GPS tags collected a location once every four days.

Context and Interpretation

Spatial Distribution: Locations and tracks in the Atlantic Region are shown (Nova Scotia, Newfoundland and Labrador, New Brunswick, and Prince Edward Island); locations and tracks outside the region were removed. American Woodcock appear to have taken transoceanic migratory flights through the regional assessment study areas, travelling over the outer Bay of Fundy and Gulf of Maine in a southerly direction toward New England, USA. Though the sample size is limited, these data show spatial overlap of American Woodcock migratory routes with potential offshore wind energy development areas.

Temporal Distribution: Includes southbound tracks during post-breeding (fall) migration and northbound tracks during pre-breeding (spring) migration.

Assumptions and Caveats

- This map shows migration tracks for a small number of individuals (n=6) and is not representative of the entire population.
- The map does not provide information on key stopover locations for this species. Stopover sites are used for refuelling and resting during migration and high-quality stopover sites are critical for migratory shorebirds.
- All lines are interpolated migration tracks (straight lines between GPS fixes) and therefore should not be considered 'true' migration tracks.

3.2.3 Black-bellied Plover

Product Objective

This map provides information on Argos PTT locations and interpolated tracks of Black-bellied Plover (*Pluvialis squatarola*, n = 9) during migration. This species is a large-headed shorebird with a short, thick bill. It has long, pointed wings and moderately long legs. Breeding males are a mix of black and white with checkered upperwings, a black face and belly, a white crown, nape, and undertail, and dark legs and bill. Adult females in breeding plumage are similar but with less contrast. Nonbreeding adults are pale gray above and gray-white below. Juveniles have a scalier appearance on the back. All plumages show black “armpits” in flight. Black-bellied Plover nests in the Arctic in both wet and dry tundra and winters in coastal lagoons and estuaries. Migrants stop along coastlines and in harvested agricultural areas including sod farms, and muddy edges of lakes and rivers. Black-bellied Plovers are sensitive to habitat degradation, particularly at migratory stopover locations. This species has been identified as a priority for conservation and/or stewardship in one or more Bird Conservation Region Strategies in Canada. [Black-bellied Plover](#).

The following data source was used to produce the map:

- Shorebird Science and Conservation Collective. 2023e. Black-bellied Plover tracking dataset.

Methodology

Argos PTT fixes (points) and interpolated track lines were mapped over the study area. Data were collected between 2015 and 2018 and included eight individuals tagged in Nunavut, Canada and one individual tagged in Quebec, Canada. The tags collected multiple detections every two days.

Context and Interpretation

Spatial Distribution: Locations and tracks in the Atlantic Region are shown (Nova Scotia, Newfoundland and Labrador, New Brunswick, and Prince Edward Island); locations and tracks outside the region were removed. Black-bellied Plover took transoceanic migratory flights through the regional assessment study areas, travelling in a southerly direction toward New England, USA or Central/South America. Some individuals were detected in the northern portion of the study area (e.g., Great Northern Peninsula) whereas others were detected further south (e.g., Gulf of Maine). Though the sample size is limited, these data show spatial overlap of Black-bellied Plover migratory routes with potential offshore wind energy development areas.

Temporal Distribution: Includes southbound tracks during post-breeding (fall) migration and northbound tracks during pre-breeding (spring) migration.

Assumptions and Caveats

- This map shows migration tracks for a small number of individuals (n=9) and is not representative of the entire population.
- The map only includes a single track during spring migration. Therefore, data are biased toward fall migration.
- The map does not provide information on key stopover locations for this species. Stopover sites are used for refuelling and resting during migration and high-quality stopover sites are critical for migratory shorebirds.
- All lines are interpolated migration tracks (straight lines between GPS fixes) and therefore should not be considered ‘true’ migration tracks.

3.2.4 Hudsonian Godwit

Product Objective

This map provides information on Argos PTT locations and interpolated tracks of Hudsonian Godwit (*Limosa haemastica*, n=2) during migration. Hudsonian Godwit is currently under consideration for addition to Schedule 1 of SARA as Threatened. This species is a large shorebird with long legs, a long neck, and a long, slightly upturned bill. Breeding adults are spangled in black, brown, and gold above, with rich chestnut and dark barring below. Females are less vibrant than males. Nonbreeding adults are gray-brown above and paler brown below. Juveniles are similar to nonbreeding adults, with a scalier appearance above. In all plumages, the bill has a pale pink or orange base with a dark tip. The tail is white with a broad black band at the tip. The “armpit” is blackish; the upperwing shows a narrow white wing stripe. Hudsonian Godwit nests in freshwater tundra marshes and bogs; winters in coastal lagoons, marshes and ocean coasts in South America. Migrants appear in many types of wetlands, including coastal and inland locations. Primary threats include reduced suitability of nesting habitat and changes in prey availability arising from climate change, as well as loss of habitat and disturbance on the wintering grounds [Hudsonian Godwit](#).

The following data source was used to produce the map:

- Shorebird Science and Conservation Collective. 2023f. Hudsonian Godwit tracking dataset.

Methodology

Argos PTT fixes (points) and interpolated track lines were mapped over the study area. Data were collected between 2013 and 2019 and included one individual tagged in Lagos, Chile and one individual tagged in Magallanes, Chile. The tags collected multiple daily detections.

Context and Interpretation

Spatial Distribution: Locations and tracks in the Atlantic Region are shown (Nova Scotia, Newfoundland and Labrador, New Brunswick, and Prince Edward Island); locations and tracks outside the region were removed. Hudsonian Godwit undertook transoceanic migratory flights through the regional assessment study areas, travelling through the Gulf of Maine and between Browns Bank and Sable Island Bank in a southerly direction toward Central/South America. Though the sample size is limited, these data show spatial overlap of Hudsonian Godwit migratory routes with potential offshore wind energy development areas.

Temporal Distribution: Includes southbound tracks during post-breeding (fall) migration.

Assumptions and Caveats

- This map displays southbound fall migration routes only; ECCC-CWS-ATL has not acquired data on northbound spring migration routes in the study area.
- This map shows migration tracks for a small number of individuals and is not representative of the entire population.
- The map does not provide information on key stopover locations for this species. Stopover sites are used for refuelling and resting during migration and high-quality stopover sites are critical for migratory shorebirds.
- All lines are interpolated migration tracks (straight lines between PTT fixes) and therefore should not be considered ‘true’ migration tracks.

3.2.5 Pectoral Sandpiper

Product Objective

This map provides information on Argos PTT locations and interpolated tracks of Pectoral Sandpiper (*Calidris melanotos*, n=7) during migration. This species is a stout, medium-sized shorebird with a moderately long, fairly this-based bill and long wings. Males are larger and ~50% heavier than females. Adults are patterned brown, gold, and black above, with white belly and neat dark-brown rows of stipples on the breast that stop sharply at the white belly. Juveniles are similar but with some rusty-edged feathers above. The legs are yellowish. In flight, this species shows little to no wingstripe. Pectoral Sandpipers breed throughout the circumpolar Arctic. In Canada, they are found in wetlands of the low to mid Arctic. Estimates indicate that over 80% of the global population breed in Canada. [Pectoral Sandpiper](#).

The following data source was used to produce the map:

- Shorebird Science and Conservation Collective. 2023g. Pectoral Sandpiper tracking dataset.

Methodology

Argos PTT fixes (points) and interpolated track lines were mapped over the study area. Data was collected between 2016 and 2020 and included seven individuals tagged in Alaska, USA. The tags collected multiple daily detections.

Context and Interpretation

Spatial Distribution: Locations and tracks in the Atlantic Region are shown (Nova Scotia, Newfoundland and Labrador, New Brunswick, and Prince Edward Island); locations and tracks outside the region were removed. Pectoral Sandpiper undertook transoceanic migratory flights through the regional assessment study areas, travelling toward eastern USA or Central/South America. Though the sample size is limited, these data show spatial overlap of Pectoral Sandpiper migratory routes with potential offshore wind energy development areas.

Temporal Distribution: Includes southbound tracks during post-breeding (fall) migration and northbound tracks during pre-breeding (spring) migration.

Assumptions and Caveats

- This map shows migration tracks for a small number of individuals and is not representative of the entire population.
- The map only includes a single-track during spring migration. Therefore, data are biased toward fall migration.
- The map does not provide **any** information on key stopover locations for this species. Stopover sites are used for refuelling and resting during migration and high-quality stopover sites are critical for migratory shorebirds.
- All lines are interpolated migration tracks (straight lines between PTT fixes) and therefore should not be considered 'true' migration tracks.

3.2.6 Red Phalarope

Product Objective

This map provides information on Argos PTT locations and interpolated tracks of Red Phalarope (*Phalaropus fulicarius*, n=1) during migration. While this species is a small shorebird, it is the largest of the Phalaropes. Red

Phalarope has a relatively short and thick neck, and the bill is noticeably thicker than the other two species of phalarope. Breeding females have a bright reddish-cinnamon body; males are a duller orange-red. Breeders also have a white cheek, black crown, and yellow bill. Nonbreeding plumage is a smooth gray above and white below with a black eye patch. Juveniles are covered with buff tones. The Red Phalarope breeds in tundra wetlands across the circumpolar Arctic and is widely distributed in the High Arctic of northern Canada. Estimates indicate a large percentage of the global population breed in Canada. This species has been identified as a priority for conservation and/or stewardship in one or more Bird Conservation Region Strategies in Canada. [Red Phalarope](#).

The following data source was used to produce the map:

- Shorebird Science and Conservation Collective. 2023h. Red Phalarope tracking dataset.

Methodology

Argos PTT fixes (points) and interpolated track lines were mapped over the study area. Data were collected in 2019 and include one individual tagged in Nunavut, Canada. The tags collected multiple daily detections.

Context and Interpretation

Spatial Distribution: Locations and tracks in the Atlantic Region are shown (Nova Scotia, Newfoundland and Labrador, New Brunswick, and Prince Edward Island); locations and tracks outside the region were removed. The tagged phalarope was detected once in the northern portion of the study area, then travelled in a southeast direction to highly pelagic regions outside the study area. These data show a small degree of overlap with the potential offshore wind energy development areas off the coast of Labrador.

Temporal Distribution: Includes southbound tracks during post-breeding (fall) migration.

Assumptions and Caveats

- This map displays southbound fall migration routes only; ECCC-CWS-ATL has not acquired data on northbound spring migration routes in the study area.
- These data should be interpreted with caution. Although the tagged phalarope showed little spatial overlap with the study area, it is important to note that this migration track represents a single individual and is not representative of the entire population. Red Phalarope are known to occur in the study area during spring and fall migration.
- The map does not provide information on key stopover locations for this species. Stopover sites are used for refuelling and resting during migration and high-quality stopover sites are critical for migratory shorebirds.
- All lines are interpolated migration tracks (straight lines between PTT fixes) and therefore should not be considered 'true' migration tracks.

3.2.7 Pre-breeding and Post-breeding Movement Track Density

Product Objective

These maps provide a summary of shorebird tracks over the regional assessment studies, split into seasons; pre-breeding movement (individuals moving north to breeding areas) and post-breeding movements (individuals moving south to non-breeding areas). The density surface show where potential movements may be happening in the offshore. This product summarizes track data for 7 species of shorebird and does not include any integration of Motus data. [Shorebird pre- and post-breeding](#).

The following data source was used to produce the map:

- Data compiled and standardized by the Shorebird Science and Conservation Collective (Version 2023-10-10), Migratory Bird Center, Smithsonian's National Zoo and Conservation Biology Institute.

Methodology

Argos PTT fixes (points) and interpolated track lines were mapped over the study area. Data were collected in 2019 and include one individual tagged in Nunavut, Canada. The tags collected multiple daily detections.

Context and Interpretation

Spatial Distribution: Locations and tracks in the Atlantic Region are shown (Nova Scotia, Newfoundland and Labrador, New Brunswick, and Prince Edward Island); locations and tracks outside the region were removed.

Temporal Distribution: Includes southbound tracks during post-breeding (fall) migration. Includes northbound tracks during pre-breeding (spring) migration.

Assumptions and Caveats

- These data should be interpreted with caution. It is important to note that migration tracks represent a single individual and is not representative of the entire population. Red Phalarope are known to occur in the study area during spring and fall migration.
- The map does not provide any information on key stopover locations for this species. Stopover sites are used for refuelling and resting during migration and high-quality stopover sites are critical for migratory shorebirds.
- All lines are interpolated migration tracks (straight lines between PTT fixes) and therefore should not be considered 'true' migration tracks.

3.3 Marine Bird Foraging Areas

The Committees have requested information on **other known areas of importance for seabirds, including Migratory Bird Sanctuaries, foraging areas, migration corridors, etc.**

This section describes key marine bird **breeding season** foraging areas in the study area. Foraging areas during other periods of the annual cycle (migration, non-breeding) are not described here.

3.3.1 Breeding Seabird Foraging Distributions

Product Objective

This series of maps shows foraging distributions of certain colonially-breeding seabirds in Atlantic Canada. [Breeding Seabird Foraging Distribution](#).

The following data source was used to produce the maps:

- [Ronconi et al. 2022. Predicting seabird foraging habitat for conservation planning in Atlantic Canada: integrating telemetry and survey data across thousands of colonies.](#)

Colony and foraging distribution maps are provided for the following species:

- Atlantic Puffin
- Black Guillemot
- Black-legged Kittiwake
- Common Murre

- Great Black-backed Gull
- Herring Gull
- Northern Gannet
- Razorbill
- Roseate Tern
- Thick-billed Murre
- Arctic Tern and Common Tern

Methodology

These maps display the locations of bird colonies, by species, along with foraging distributions. The Atlantic seabird colony database was used to extract the largest colony for each species between 1996 and 2016. Each species' existing tracking data (GPS, PTT) was obtained from 2005-2016. All tags were deployed on breeding adults. Analysis was limited to breeding seasons. Colony-centered distribution models were built.

These maps were developed only for species with sufficient tracking data, as per Ronconi et al., 2022. Colony size is indicated by green circles, with circle size representing the maximum number of individuals per colony as a percentage of the total number of individuals in the region. Foraging distribution is represented by a colour gradient standardized from 0 – 1.

The results for Leach's Storm-petrel were not included because the foraging distribution model for storm-petrels does not capture the foraging levels of the smaller colonies. Leach's Storm-petrel foraging distributions will be shown in a future data product (see [Section 4.4](#)). Razorbill and Atlantic Puffin are being redisplayed at the Nova Scotia and Newfoundland and Labrador Study Area scale, to account for high density breeding colonies.

Context and Interpretation

Spatial Distribution: Includes colony location and foraging distribution data for select species in Atlantic Canada (Nova Scotia, Newfoundland and Labrador, New Brunswick, and Prince Edward Island). The risks of impacting foraging locations of the species represented on the map are higher in areas shaded yellow. Colony location and size (maximum counts of each species at a given colony) is indicated as a red circle, with larger circles indicating higher counts of individuals at that colony.

Temporal Distribution: Analysis was done using data collected during the breeding season. Birds were tagged at and tracked from their breeding colonies.

Assumptions and Caveats

- The modelling approach assumes that foraging patterns at one or more colonies are representative of the species more generally. However, seabirds can show intraspecific specificity in foraging behaviour.
- The modelling approach assumes that seabird census data is complete and accurate. However, many colonies are monitored opportunistically and therefore counts may not be accurate.
- These models should be further refined prior to making local and project-specific management action.
- Newer and more accurate GPS data exist for terns, which would allow for more precise modelling; however, these data were not available before the November 30, 2023 deadline.

- Some species have large colonies in certain geographic locations in the region. This affects the predictive densities of the foraging distributions. Rescaling the distributions to within the individual study areas may help to reveal more informative patterns.
- Some species have poor data outputs due to insufficient tracking data. Therefore, additional tracking data should be collected for these species, including Common Tern, Arctic Tern, Black Guillemot, Black-legged Kittiwake, and Great Black-backed Gull.

3.3.2 Colony Locations and Foraging Radii

Product Objective

This series of maps show the colony locations and foraging radius of species with insufficient tracking data to produce foraging distribution models (as described above). Offshore areas within colony foraging ranges represent high potential exposure to offshore wind. This is due to the potential increased risk of collision, the increased risk of repeated displacement, and the additional energetics required for foraging. Offshore wind energy development within foraging areas of colonial seabird have shown high displacement from known foraging areas during the breeding season (e.g., Peschko *et al.* 2020). Table 2 contains buffered foraging distances for each species. Data used to create the map were collated from a literature review of many sources.

Table 2: Buffered foraging radii for species included in analyses.

Common name	Scientific name	Mean Max Foraging Distance (km)	Max Foraging Distance (km)
Arctic Tern	<i>Sterna paradisaea</i>	27.8	35
Atlantic Puffin	<i>Fratercula arctica</i>	82.8	119
Black Guillemot	<i>Cephus grylle</i>	5	11.6
Black-headed Gull	<i>Chroicocephalus ridibundus</i>	18.5	60
Black-legged Kittiwake	<i>Rissa tridactyla</i>	9.6	16.5
Common Eider	<i>Somateria mollissima</i>	1.2	3.7
Common Murre	<i>Uria aalge</i>	29.9	70.2
Common Tern	<i>Sterna hirundo</i>	27.5	31
Glaucous Gull	<i>Larus hyperboreus</i>	61.1	92
Great Black-backed Gull	<i>Larus marinus</i>	22.5	75.4
Great Blue Heron	<i>Ardea herodias</i>	7	30
Herring Gull	<i>Larus argentatus</i>	129.9	212
Laughing Gull	<i>Leucophaeus atricilla</i>	16.6	30
Northern Gannet	<i>Morus bassanus</i>	330	616
Razorbill	<i>Alca torda</i>	62.6	99
Ring-billed Gull	<i>Larus delawarensis</i>	38.6	63
Thick-billed Murre	<i>Uria lomvia</i>	65.1	65.1
Terns (Common, Arctic, Caspian, Roseate)	Combined Terns	27.8	35

Maps produced include:

- Colony location buffered with average maximum foraging range and maximum foraging range for all species: [Mean Max and Max range](#).
- Colony locations buffered with average maximum foraging range weighted by colony density in the buffered area: [Mean Max range with Density](#).
- An aggregated map of weighted density buffer across all species: [Mean Max Range with Density - All Species](#).

Methodology

The potential foraging radii of colonial birds were gathered from existing literature and collated into a summed product.

Mean Max and Max Range maps: The colony database was queried based on species present at each colony, and those colonies were buffered by both the mean maximum foraging radius and the maximum foraging range. Mean maximum foraging radius is the average of maximum foraging ranges for a species over multiple colonies. Each species buffer was then converted to raster format for mapping. Colony location and size were added to the map using graduated symbols. Maximum foraging is the longest foraging range recorded for species. Foraging ranges for colonies in Atlantic Canada were given more weight than those ranges in other parts of the world.

Mean Max Range with Density maps: Where possible the mean max value was used as a buffer distance. If no mean max value was calculated, the median value of ranges was used. The colony database was queried based on species present at each colony, and those colonies buffered by the foraging radii. Each species buffer was then converted to raster. Buffers were also weighted with colony density (maximum count of individuals at that colony/ area of the buffer cropped by landmass). Colonies' location and size were added to the map using graduated symbols. Maps were created for each species. One aggregate map was created for the whole study area adding all species rasters together.

Context and Interpretation

Spatial Distribution: Includes seabird colonies for select species in Eastern Canada (Nova Scotia, Newfoundland and Labrador, New Brunswick, Prince Edward Island, and Quebec). Species-specific products are available if needed; these include the maximum foraging range and are weighted by colony importance scores (i.e., the proportion of a species population nesting at a particular colony).

Temporal Distribution: Applies to breeding season while birds are present at colonies.

Assumptions and Caveats

- This product is meant to provide context of where foraging birds might occur but does not provide the same information as the foraging distribution models (as described above), or the Leach's Storm-petrel products under development. Individuals of these species could forage beyond the buffered foraging radii.
- Colony importance weights were not used in the summed product, as the weighted values obscured the foraging areas of smaller colonies for more common species.

3.4 Waterfowl Habitat Suitability

Product Objective

These maps present the results of waterfowl habitat suitability modelling for five species of sea ducks in eastern North America. The objective is to identify potential key areas and habitat features where large numbers of individuals and species may congregate during various periods of the annual cycle. The areas between highly suitable areas within a season, and areas between different seasonal habitats, represent areas of directed movement, and therefore potential exposure risk to offshore wind. [Waterfowl Habitat Suitability](#)

The following data source was used to produce the map:

- [Lamb et al. 2020. Assessing year-round habitat use by migratory sea ducks in a multi-species context reveals seasonal variation in habitat selection and partitioning. *Ecography*, 43\(12\), pp.1842-1858.](#)

Methodology

Habitat suitability rasters were mapped for five species of sea ducks (Common Eider, Black Scoter, Surf Scoter, White-winged Scoter, and Long-tailed Duck) during three periods of the annual cycle (non-breeding, pre-breeding [spring] migration, post-breeding [fall] migration). The habitat suitability models used to create the maps were derived 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.

The individual species maps present species-specific habitat suitability scores projected across the 95% kernel density of individual locations across the project study area; the habitat suitability that include marine areas (winter, spring, fall) are shown only within the RA Study Areas and the Gulf of St. Lawrence. The suitable breeding areas are shown over terrestrial areas. Multi-species habitat suitability maps indicate the number of species with overlap between the top 10% and 25% of suitable habitat over all five species.

The modelling approach used the outlying mean index as a measure of habitat suitability, which corresponds to a distance in multivariate space between a given grid cell and the mean of all the habitat variables in occupied grid cells. A distance of zero means that conditions in a cell are essentially identical to the average niche space occupied by the species, while larger values indicate cells that are farther from preferred habitat characteristics. Therefore, lower scores (in yellow) correspond to higher suitability. Conversely, higher scores (in purple) correspond to lower suitability.

See the Materials and Methods section of Lamb *et al.* 2022 for additional details on data collection and modelling approaches.

Context and Interpretation

Spatial Distribution: In general, all species preferred shallow, nearshore habitats with high productivity. Sea ducks selected most strongly for preferred habitats during post-breeding migration, which includes a flightless molt period, and selected least strongly during pre-breeding migration and the breeding season. These species showed moderate selection for preferred habitats during the non-breeding period. Habitat selection during the breeding season was restricted to terrestrial habitats near or above the northern limits of boreal forest.

Temporal Distribution: Data include habitat suitability models for non-breeding, pre-breeding, breeding, and post-breeding periods.

Assumptions and Caveats

- Habitat suitability was assessed only within areas used by tracked individuals; it was not assessed across the full range of these species.
- Marine areas outside the study areas and Gulf of St. Lawrence are not mapped and available, upon request to ECCC-CWS-ATL.

3.5 Waterfowl Coastal Density

Product Objective

These maps provide waterfowl coastal densities derived from aerial survey data. The final maps give an indication of an area's potential to support a given population of birds, and in turn, identify areas with potential exposure risk to offshore wind. [Waterfowl Density - Triennial Surveys](#)

The following data source was used to produce the map:

- CWS. 2018. Triennial Common Eider Survey Data. ECCC-CWS Quebec Region. Internal Data.

Methodology

Since 2003, a triennial winter coastal survey led by ECCC-CWS Quebec Region occurs along the east coast of Quebec and in the Atlantic Region. This survey targets Common Eider but also records incidental observations of other species encountered during the surveys. The following species were included in the analysis:

- Atlantic Brant
- Common Eider
- Goldeneye spp.
- King Eider
- Long-tailed Duck
- Red-breasted Merganser
- Scoter spp.
- White-winged Scoter

For each species with at least 10 recorded encounters, point data density rasters were calculated. If several encounters were recorded at the same location, only the maximum count recorded was retained for the analysis. Point density analysis was done using the density function of the spatstat package of the R programming language. Density estimates were calculated using a cell size of 500 m and a sigma of 5,000 m. Density values were rescaled between 0 and 1 and very low values ($< 10e-4$) set to 0 to remove modelling artifacts. Data values of "0" were excluded from the classification and a colour ramp of blue to yellow was used.

Context and Interpretation

Spatial Distribution: The entire spatial extent of the Triennial Survey is included (eastern Quebec and Atlantic Canada). Common Eider were observed coastally throughout the study area, with higher densities in northern Newfoundland. Higher density areas for other species include northern Newfoundland; Eastern Coast of Labrador and Quebec; Estuary and Gulf of St. Lawrence; southern Nova Scotia; and the northeast coast of Cape Breton Island, Nova Scotia.

Temporal Distribution: Surveys are conducted in early February to early March. Data from 2003 to 2018 are included.

Assumptions and Caveats

- These maps include data collected during the non-breeding (winter) period only. They do not include densities during other important periods of the annual cycle (breeding, pre-breeding [spring] migration, and post-breeding [fall] migration)
- Coastal blocks are no longer searched using a standard methodology (see [Section 2.2.6.1](#) for historical data using the standardized approach). Rather, coastal areas are surveyed and locations and counts of sea ducks are recorded.
- Survey tracks were not available and are therefore not depicted on the map. Consequently, areas with low sea duck densities or areas where sea ducks appear to be absent could be an artifact of sampling effort.
- Common Eider are prioritized during these surveys. Densities of other species are based on incidental observations and therefore may be less accurate.

4.0 Products Under Development

This section provides product descriptions and context for products currently under development or to be developed as information is provided to ECCC-CWS-ATL through various contracts and collaborations. **These products will not be ready for the Committees by November 30, 2023 and will be provided by March 31, 2024.**

4.1 Offshore AeroFauna Species Summary Table

This spreadsheet contains summary information on key aeroFauna species known to occur in the offshore environment of Canada's Atlantic Region (**DRAFT** species list available here: [Offshore AeroFauna Species Summary Table](#)). Specifically, the table includes the following information for each species (where available): species group and family; common and scientific names; AOU code; conservation status; province(s) of occurrence in the Atlantic region; breeding status while in the region; relative seasonal abundance in the region; timing of occurrence in the region; spatial distribution within the study area; marine bird foraging guild; and scores for collision and displacement risk as well as population vulnerability.

Bird species are grouped in separate tabs of the spreadsheet based on their primary habitats while in the region. These include Marine Birds; Shorebirds; Waterfowl; Inland and Coastal Waterbirds; and Terrestrial Birds. There is also a category for Non-Avian species (migratory bats and Monarch).

Note that not all cells within the spreadsheets contain information. Some aspects of the summary table are not relevant to all species, while others will continue to be updated throughout the course of the RA.

Product Objective

The objective of this product is to provide high-level, 'quick reference' information for each species assessed in the regional assessment. The information therein should be used in conjunction with the other data products described throughout this document, many of which are more detailed in scope than this summary table. Additionally, ECCC-CWS-ATL notes that this document should be considered "evergreen" and will be updated as new data are available and more research related to impacts of offshore wind energy development is conducted.

4.2 Atlantic Canada Collision and Displacement Vulnerability and Population Vulnerability

ECCC-CWS-ATL is producing collision and displacement risk models and population vulnerability assessments for select aerofauna known to occur in the offshore environment of Canada's Atlantic region. The metrics used for these assessments are based on previous risk modelling approaches (i.e., Garthe and Hüppop 2004; Furness *et al.* 2013; Robinson Willmott *et al.* 2013; Adams *et al.* 2016; Kelsey *et al.* 2018) with updates relevant to the Atlantic region. This includes updating metrics related to understanding flight behaviour, flight altitudes, habitat associations, and recent evidence of collision or avoidance of wind energy developments through post-construction aerofauna assessments. ECCC-CWS-ATL has contracted the Biodiversity Research Institute (BRI) who are providing input on these metrics and will soon have a draft version of collision and displacement risk for review. These metrics will be included in the Offshore Aerofauna Summary Table (described in [Section 4.1](#) above).

The following resources are being used to support development of this product:

- [Robinson Willmott et al. 2013. The relative vulnerability of migratory bird species to offshore wind energy projects on the Atlantic Outer Continental Shelf: An assessment method and database.](#)
- [Adams et al. 2016. Collision and displacement vulnerability among marine birds of the California Current System associated with offshore wind energy infrastructure.](#)
- [Kelsey et al. 2018. Collision and displacement vulnerability to offshore wind energy infrastructure among marine birds of the Pacific Outer Continental Shelf.](#)
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- [Garthe and Hüppop. 2004. Scaling possible adverse effects of marine wind farms on seabirds: developing and applying a vulnerability index.](#)

Product Objective

The objective of this product is to provide a species-specific assessment of aerofauna vulnerability to offshore wind energy development in Atlantic Canada.

4.3 Extralimital Marine Birds

The Newfoundland and Labrador RA Committee requested information on marine and migratory birds that are generally known to occur in the study area, including **species considered extralimital (e.g., White-tailed Tropicbird)**.

4.3.1 Bermuda Petrel Spatial Habitat Predictions During Foraging

Product Objective

This map will show potentially important foraging areas for Bermuda Petrel (*Pterodroma cahow*) within the RA study areas.

The following data source will be used to produce the map:

- [Raine et al. 2021. Marine Distribution and Foraging Habitat Highlight Potential Threats at Sea for the Endangered Bermuda Petrel Pterodroma Cahow.](#)

Methodology

The map will indicate foraging distributions for six Bermuda Petrels tagged using GPS during the 2019 breeding season in Bermuda. Foraging locations (n = 2449) were used to produce a habitat suitability model during the study period (11 April to 4 June 2019) within their defined foraging domain. The final model will include four

covariates: distance to colony, sea surface temperature smoothed by latitude, water depth, and daily sea surface height. The probability of occurrence of Bermuda Petrels foraging at sea within their domain was predicted using a grid of 0.08°. The final predictive map corresponds to the average daily probability of occurrence of foraging Bermuda Petrels and summarizes the error of the spatial prediction by calculating the pixel specific standard deviation.

Context and Interpretation

Spatial Distribution: The map predicts more suitable foraging habitat for Bermuda Petrel off the shelf in the southern portion of the study area.

Temporal Distribution: The map provides habitat suitability for six birds foraging during the chick-rearing period in 2019.

Assumptions and Caveats

- Does not include any data outside the chick-rearing period; ECCC-CWS-ATL is working to acquire additional data and will provide summary information to the Committees when/if it becomes available.
- Data for additional tracked individuals are available from an external partner, to be provided to ECCC-CWS-ATL conditional upon a data sharing agreement.

4.4 Additional Products

There are additional products that ECCC-CWS-ATL anticipates providing to the Committees by March 31, 2024. A summary of these products is available here: [ECCC-CWS-ATL-RA Products in Progress](#).

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