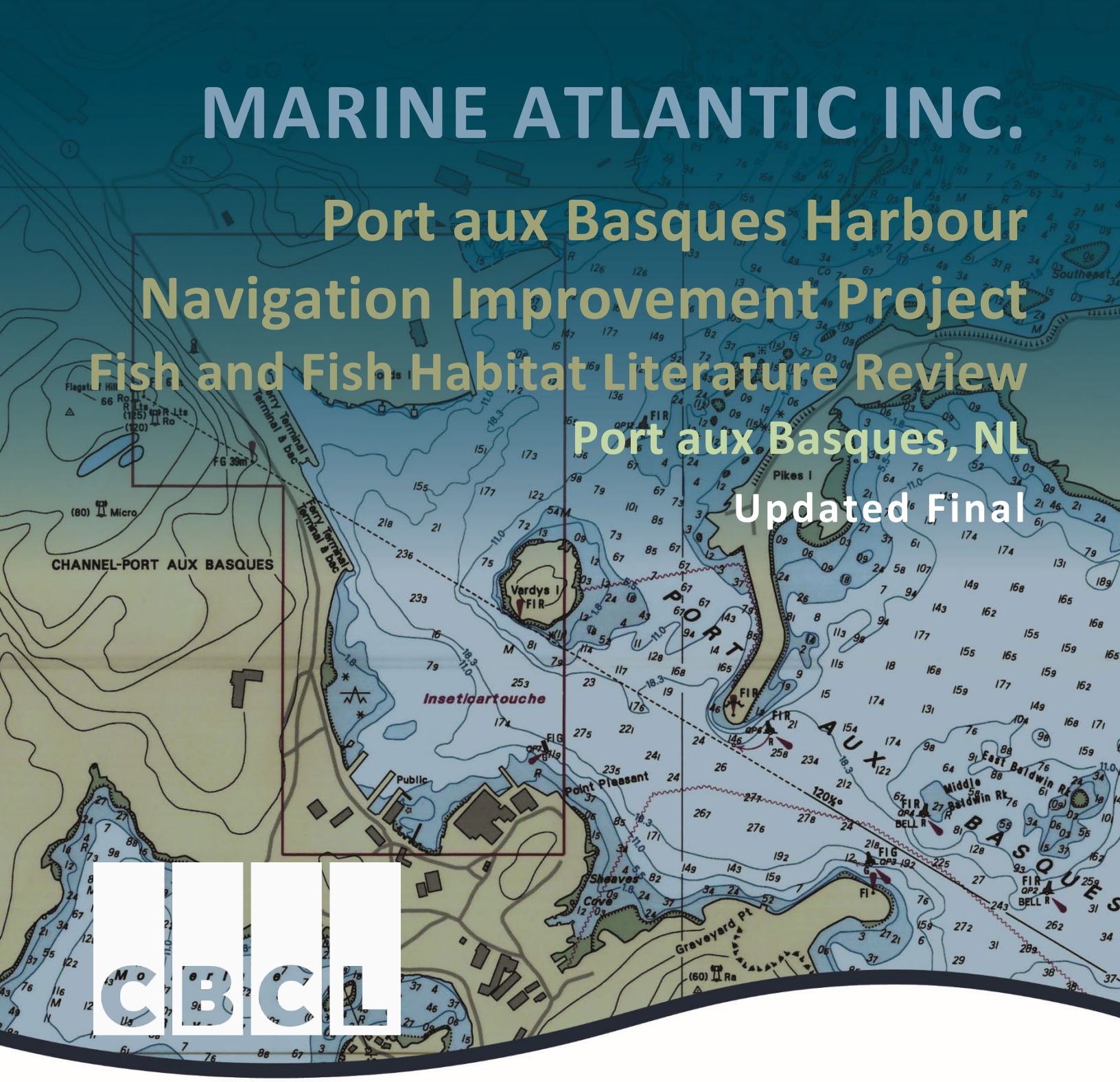
MARINE ATLANTIC INC.

Port aux Basques Harbour Navigation Improvement Project

Fish and Fish Habitat Literature Review

Port aux Basques, NL

Updated Final



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Acronyms List

AC CDC	Atlantic Canada Conservation Data Center
AIS	Aquatic Invasive Species
CBCL	CBCL Limited
CO	Conservation Objective
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
DFO	Fisheries and Oceans Canada
EBSA	Ecologically and Biologically Significant Area
ECCC	Environment and Climate Change Canada
EEZ	Exclusive Economic Zone
HADD	Harmful Alteration, Disturbance and Destruction
LOMA	Large Ocean Management Area
MAI	Marine Atlantic Inc.
MPA	Marine Protected Area
NAFO	Northwest Atlantic Fisheries Organization
NLESA	Newfoundland and Labrador Endangered Species Act
OBIS	Ocean Biogeographic Information System
OECM	Other Effective Area-based Conservation Measures
PAB	Port aux Basques
PBGB	Placentia Bay-Grand Banks
SAR	Species at Risk
SARA	Species at Risk Act
SoCC	Species of Conservation Concern
SSAC	Species Status Advisory Committee

Chapter 1 Introduction

Marine Atlantic Inc. (MAI) is proposing improvements to the navigation conditions in Port aux Basques Harbour, (the Project), on the southwestern tip of Newfoundland (Figure 1). The proposed navigational improvements in the harbour involve realignment of the navigation channel and the establishment of a new turning basin. Activities required to achieve these navigational improvements include deepening the realigned channel and new turning basin, removal of Vardy's Rock, partial removal of Baldwin Rock, and re-use and/or disposal of the dredged material.

To support the design of the Project and applications for environmental approvals, CBCL Limited (CBCL) completed a literature review of fish and fish habitat in a study area that encompasses Northwest Atlantic Fisheries Organization (NAFO) Subarea 3P, Division 3Pn on the southwest coast of Newfoundland, which includes Port aux Basques Harbour. The results of this literature review are discussed in the subsequent chapters of this report. The fish and fish habitat review included specific information for Port aux Basques Harbour wherever available; however, most of the available information was related to fish and fish habitat in the coastal waters of southwestern Newfoundland, rather than Port aux Basques Harbour.

This report has been organized and structured into the following chapters and appendices.

Chapter 1: Introduction – Provides a brief overview of the report.

Chapter 2: Methodology and Approach – Describes the methodology and approach to the literature review, the study area, and sources of information.

Chapter 3: Summary of Available Literature – Outlines the available literature for marine habitats in Atlantic Canada, focussing on coastal habitats in southwestern Newfoundland.

Chapter 4: Aquatic Species Profiles – Describes the aquatic species identified in the study area, including fisheries resources and aquatic species at risk.

Chapter 5: Closure – Provides a summary of the methods and sources, as well as limitations and disclaimer related to the report.

Chapter 6: Reference List – Provides the list of literature used to produce this report.

Appendix A: Figures – Provides figures and drawings of the study area, and managed areas, fishing areas, and known sensitive areas within the study area.

Appendix B: Aquatic SAR Reports – Provides a copy of the two aquatic species at risk reports generated for Port aux Basques Harbour and the study area using Fisheries and Oceans Canada (DFO) online aquatic Species at Risk mapping tool.

Appendix C: AC CDC Report – Provides a copy of the Atlantic Canada Conservation Data Center (AC CDC) data report generated for Port aux Basques Harbour.

Appendix D: Seasonal Occurrences – Provides a table of aquatic species at risk in the study area, and the times of the year these species are anticipated to occupy the study area.

Chapter 2 Methodology and Approach

The fish and fish habitat literature review used a variety of open data sources including peer-reviewed literature concerning fish and fish habitat, Fisheries and Oceans Canada (DFO) science advisory reports, DFO fisheries resources reports and statistics, federal and provincial species at risk and species of conservation concern databases, management areas, geographic spatial information on species observations and distributions, and general literature pertaining to coastal environments in southwestern Newfoundland.

The following chapter discusses the methodologies and information sources used to complete the literature review within the study area, as well as a brief overview of the pertinent federal and provincial legislations regarding fish and fish habitat.

2.1 Study Area Boundaries

The study area was defined as all waters within the boundaries of the Northwest Atlantic Fisheries Organization (NAFO) Subarea 3P, Division 3Pn (Appendix A, Figure 1). The literature review focussed on all fish and fish habitat identified within or with the potential to occur within the boundaries of NAFO 3Pn, particularly any available information pertaining to Port aux Basques Harbour and the nearshore coastal environment outside of the harbour.

The literature review includes a brief summary of the three marine bioregions in Atlantic Canada, including the Newfoundland and Labrador Shelves, Gulf of St. Lawrence, and Scotian Shelf. These bioregions are continuous without physical boundaries and interact with one another, and the southwest coast of Newfoundland is located in a transitional area between the three bioregions. The focus of attention, however, is the southwest coast of Newfoundland within the Newfoundland and Labrador Shelves bioregion, in particular Port aux Basques Harbour and nearby coastal areas.

Many migratory marine species inhabit the study area. These species include fish, invertebrates, marine mammals, and marine reptiles which permanently occupy the study area, or those which temporarily occupy the area during migrations or during larval stages, prior to their dispersal to habitats located outside of the study area. The literature review investigated the range and distribution of these motile species, and includes species, primarily marine mammals and reptiles, that spend only a portion of their lives within the study area.

2.2 Literature Review

CBCL compiled the relevant literature on fish and fish habitat in the study area and the southwestern coast of Newfoundland from publicly available data sources. Literature was obtained via DFO libraries,

eJournals, Google search engines, and from the literature cited sections of relevant source documents. The searches were conducted using combinations of primary search terms, which included:

- Port aux Basques or Port aux Basques Harbour, and Coastal Environment, Significant Areas, Sensitive Areas, Coastal Trends, Marine Habitat, Fisheries, Species at Risk, and Aquatic Invasive Species
- Port aux Basques or Port aux Basques Harbour, and Fish Habitat and Environmental Assessment
- Southwest Newfoundland or South Coast Newfoundland or NAFO 3Pn, and Coastal Environment, Significant Areas, Sensitive Areas, Coastal Trends, Marine Habitat, Fisheries, Species at Risk and Aquatic Invasive Species
- Southwest Newfoundland or South Coast Newfoundland or NAFO 3Pn, and Fish Habitat and Environmental Assessment

In cases where little to no relevant information was obtained from the search, additional search terms were used, including:

- Species name, and habitat, habitat range, Newfoundland, and Atlantic Canada
- Habitat type, and location, distribution, Newfoundland, and Atlantic Canada

Federally and provincially protected Species at Risk (SAR) and Species of Conservation Concern (SoCC) that may inhabit or occupy the study area during one or more life history stages were determined using the following sources of information:

- Atlantic Canada Conservation Data Center (AC CDC) Report: Port Aux Basques Point of Interest – Rare Taxa (2020)
- DFO Canadian aquatic SAR and critical habitat mapping tool
- *Species at Risk Act* (SARA) species at risk public registry database, including aquatic species at risk and species of conservation concern, critical habitats, and residence statements
- Committee on the Status of Endangered Wildlife in Canada (COSEWIC) status reports
- Newfoundland and Labrador Department of Fisheries and Land Resources SAR database

Geographic information regarding fish and fish habitat was obtained from open source data, including:

- Open Government Portal – Canadian federal government open geospatial data portal
- DFO Seafisheries Landings
- DFO Canadian aquatic SAR and critical habitat mapping tool
- Ocean Biogeographic Information System (OBIS) – OBIS Canada regional data node

Copies of the aquatic SAR maps generated in the study area, including a map of Port aux Basques Harbour, are provided in Appendix B. Geographic datasets for marine mammal and marine reptile distributions, as well as, the annual bottom trawls conducted by DFO in in the study area were requested by CBCL, however DFO had not provided the requested data at the time of the writing of this report.

2.3 Fish and Fish Habitat Inclusion Criteria

The new federal *Fisheries Act* (2019) includes provisions to prevent the death of fish in Canadian waters except by licensed and regulated fishing activities, and revised fish habitat to include any water frequented by fish and any other areas on which fish depend directly or indirectly to carry out their life processes, including spawning grounds and nursery, rearing, food supply and migration areas.

Furthermore, Section 35 of the Act states that no person shall carry on any work, undertaking or activity that results in the harmful alteration, disruption or destruction (HADD) of fish habitat. Therefore, it is important to identify all fish and fish habitat in a study area, and to do so in sufficient detail to effectively assess how a project or proposed project activities could affect aquatic species, or how the project / activities could affect their habitats.

CBCL undertook a review of available literature for the coastal waters of southwestern Newfoundland within the boundaries of NAFO 3Pn, in order to sufficiently describe fish and fish habitat. Within this area, the number of species and potential habitats, particularly rare species and niche habitats unlikely to occur in the harbour, grew to a level that was too expansive for this exercise. To control the level of detail in the report, we developed a series of inclusion criteria for species likely to reside in the study area (permanently or temporarily) and should therefore be included in the report, as well as the likely habitats in the study area.

For the review of fish and fish habitat, the inclusion criteria were based on the following:

- Aquatic marine or diadromous species that are part of an active commercial, recreational or Indigenous fishery in the study area
- Marine and diadromous species protected under the federal SARA and provincial *Wildlife Conservation Act* that permanently or temporarily inhabit the study area
- Species and habitats identified by AC CDC in the study area
- Species inhabiting managed areas within the study area
- Fish habitats known and with the potential to occur in the study area, particularly nearshore habitats such as those identified in Port aux Basques Harbour
- Any additional aquatic species or habitats identified in the study area that were deemed necessary to include based on the professional judgement of CBCL biologists

2.3.1 Atlantic Canada Conservation Data Centre

AC CDC data reports can be requested with respect to biodiversity, particularly sensitive species and habitats, in specified locations in Atlantic Canada. An AC CDC listing of rare and endangered species observations was acquired for an area within a 5 km radius centered on Vardy's Rock in Port aux Basques Harbour, NL. The data report did not include observations of marine fish or invertebrates, marine mammals or marine reptiles, nor any reference to sensitive aquatic habitats. A copy of this data report is provided in Appendix C.

2.4 Regulatory Consultation

Regulatory consultation is conducted during a literature review if data or information is anticipated to exist, but may not be released by the relevant regulatory agency to the public. MAI requested that CBCL limit regulatory consultation with applicable federal and provincial agencies due to the very preliminary nature of the navigation improvement project in Port aux Basques Harbour. However, MAI granted permission to request information within the study area. The regulatory consultation was limited to email and phone correspondence with staff at DFO regarding fish and fish habitat in southwestern Newfoundland. DFO staff contacted during the development of this report include the following personnel:

- Barter, Paul (personal communication, January 2020) – Field Supervisor, Port aux Basques, NL – Provided information regarding the status and locations of commercial and recreational fisheries and aquaculture operations in Port aux Basques Harbour and nearby coastal waters
- Drew, Mike (personal communication, February 2020) – Fisheries Officer, Harbour Breton, NL – Provided information regarding the status and locations of aquaculture operations on the south coast of Newfoundland
- Riggs-Power, Jodi (personal communication, December 2019) – Resource Management Division, Western and Southern Newfoundland, Marystown, NL – Provided information regarding the status and timing of commercial and recreational fisheries in NAFO 3P
- Wells, Nadine (personal communication, March 2020) – Aquatic Science Biologist, Marine Mammals Section, St. John's, NL – Contacted to request datasets for the incidental observations of marine mammals and marine reptiles on the south coast of Newfoundland, as well as trawl survey data for the annual spring surveys conducted in the study area

Please note that the data request for the marine mammals, marine reptiles and trawl data was submitted in late January 2020, and a response, including an official data request form, was not received until early March 2020. The official data request form was submitted in early March 2020; however, the requested data has not been provided to date. Data regarding the distributions of these species, as well as trawl data, was obtained from open sources where available (see Section 2.3).

Chapter 3 Summary of Available Literature

The following chapter highlights the general study area and is followed by detailed summaries of the potential habitats that could be located in Port aux Basques Harbour and nearby coastal areas. Several sources of information were obtained that describe the larger ecosystems of southwestern Newfoundland, and from these documents we were able to describe the environment of the study area. These sources of information describe larger marine areas in which the study area is situated, and therefore was applicable to the review of fish and fish habitat.

3.1 Bioregions

Bioregions are high-level spatial divisions of Canada's marine environment based on their biodiversity and natural ecological communities and systems. DFO established 13 ecologically-defined marine bioregions across Canadian waters in the Atlantic, Arctic and Pacific Oceans, which extend from the high intertidal zone to the limits of Canada's 200 nautical mile Exclusive Economic Zone (EEZ) (White, 2018) (Appendix A, Figure 3). Three established Atlantic Canadian bioregions include the Newfoundland and Labrador Shelves, the Gulf of St. Lawrence, and the Scotia Shelf. These bioregions are distinguished by their biogeographic, oceanic, bathymetric and physicochemical characteristics (Bernier et al., 2018), as well as their unique food web structures and associated benthic communities (DFO, 2009a). The study area is located on the western periphery of the Newfoundland and Shelves bioregion. Generally, however, the waters of the study area are located in a transitional area, or point of convergence, between the waters of the Newfoundland and Labrador Shelves and the Gulf of St. Lawrence bioregions (Appendix A, Figure 3). The nearby Scotian Shelf bioregion also contributes to the ecological and physicochemical environment of the study area. These transitional areas range from tens to hundreds of kilometers, and represent gradual transitions from one type of ecosystem to another (DFO, 2009a).

The study area is geographically situated near the western boundary of the Newfoundland and Shelves bioregion. The Newfoundland and Labrador Shelves area extends from Cape Chidley at the northern tip of Labrador to the southern Grand Banks, and west to Cape Ray on the south coast of Newfoundland, encompassing nearly one million km^2 of the Canadian EEZ (White, 2018). West of Cape Ray, the Newfoundland and Labrador Shelves transitions to the Gulf of St. Lawrence; the northern Gulf and the southern Newfoundland biogeographic units consequently share similar ecological community compositions. To the south of Newfoundland, the deep waters of the Laurentian Channel represent a permanent transitional zone between the Newfoundland and Labrador Shelves and the Scotian Shelf, with marked differences in their respective fish and plankton communities (DFO, 2009a). However, DFO states that the exact transitional area between these bioregions is uncertain, and that the respective slopes of the Laurentian Channel belong to the respective shelf units (DFO, 2009a). The bioregions of the study area, as well as the relevant subdivisions are discussed in Section 3.1.1.

The Newfoundland and Labrador Shelves bioregion includes complex coastal areas, a broad continental shelf and slope, offshore banks, sea mounts, deep water channels and plains reaching depths of over

4 km. Six eco-units in the Newfoundland and Labrador Shelves bioregion were defined by the federal MPA Network Planning Team, which represent the biologically or ecologically distinct subdivisions of the larger bioregion (White, 2018). The six eco-units include:

- Newfoundland Shelves
- Labrador Sea
- Northern Grand Banks
- Southern Grand Banks
- Laurentian Fan
- Laurentian Channel / Newfoundland South Coast

The study area is located in the Laurentian Channel / Newfoundland South Coast eco-unit. This eco-unit extends outward from predominantly rocky coastal habitats on the south coast of Newfoundland to the deep waters of the Laurentian Channel (Park and Mercier, 2014). Two deep water channels to the east of the study area extend from the coasts of Burgeo and Hermitage and supply nutrient rich waters from the deep Laurentian Channel along the entire south coast of Newfoundland. This eco-unit also includes the northern slope of the Laurentian Channel, as the Newfoundland slope of the channel exhibits distinct biological and ecological communities compared to the Nova Scotian slope. In addition, the nutrient rich waters from the Gulf of St. Lawrence strongly influence the ecological and physical characteristics of the eco-unit along the west and southwest coasts of Newfoundland.

3.2 Coastal Environment in the Study Area

Coastal areas in the immediate vicinity of the study area include granite embayments such as Port aux Basques Harbour and extensive beaches and marshlands, such as those located in J.T. Cheeseman Provincial Park and Grand Bay West (White, 2018). These habitats are also found in the Burgeo sandbanks area to the east of Port aux Basques Harbour. These soft-sediment environments likely host extensive eelgrass beds (Rao et al., 2014). Three scheduled salmon rivers are located in the immediate vicinity of Channel-Port aux Basques, including the Isle aux Morts River, Grand Bay River, and North West Brook, Grand Bay. There are no direct connections or flow from these rivers into Port aux Basques Harbour; however, salmon and trout may forage in the harbour during seasonal foraging migrations in marine waters.

The coastal environment of the study area is strongly influenced by the cold nutrient rich Arctic waters of the Labrador Current, the warm waters of the Gulf Stream, and the substantial freshwater inputs from the Gulf of St. Lawrence. The mixing of these waters creates highly productive areas on the south coast Newfoundland (Bernier et al., 2018).

The waters of study area are strongly influenced by ocean currents, water temperature, and seasonal climatic events, which consequently influence the biological processes in these waters. The following sections briefly discuss and summarize current trends in the physicochemical and biological environment in the study area. Specific references to the south coast of Newfoundland (NAFO 3P) are provided, whenever they were available in the literature.

3.2.1 Physicochemical Environment

Biological systems depend on the physical and chemical properties of their environment. The physicochemical environment of the temperate coastal waters off southern Newfoundland varies depending on the depth, season, and ocean currents in the area under consideration. A wealth of data has been generated by DFO through two major programs measuring the ocean conditions of the Atlantic, including the Atlantic Zone Monitoring Program (AZMP) and the Atlantic Zone Offshore Monitoring Program (AZOMP), which study the physical and chemical properties on Canada's east coast. Coastal habitats in southern Newfoundland are subject to various degrees of ice and wave action, water depth, light availability, temperature and salinity and substrate compositions which create a diverse array of habitats populated by a wide range of marine organisms (AMEC, 2014).

3.2.1.1 TEMPERATURE

Temperature strongly effects physicochemical and biological processes. Surface water temperature correlates strongly with seasonal warming and cooling due to the transfer of heat from the atmosphere to the ocean and seasonally fluctuating air temperature. Variation in deeper water temperature is not strongly related to air temperature; in southern Newfoundland the mixing of waters from the cool Labrador Current and the warm Gulf Stream control bottom temperatures. Climate change is affecting the temperature of both surface and deeper waters in the study area, and the influences of the warm Gulf Stream waters is increasing relative to the influence of the Labrador Current.

Above-average surface and bottom temperatures were recorded between 2012 and 2016 across all of Atlantic Canada, including record highs of 20°C surface water (NAFO 3P) and 14°C bottom temperature (NAFO 3Ps) off southern Newfoundland (Bernier et al., 2018). Warming water temperatures effect sea ice cover, which provides habitat and foraging opportunities for organisms living atop and under the ice, and affects the timing of the annual spring phytoplankton bloom. Ice volume in Atlantic Canada has also been lower than average over the past decade; the Newfoundland and Labrador Shelves bioregion experienced record lows of ice through the winters of 2010 to 2016 (Bernier et al., 2018). Consequently, the timing of the spring phytoplankton bloom can occur earlier in the year, which can have cascading effects to higher trophic levels. This is further discussed in Section 3.2.2.3.

3.2.1.2 OCEAN ACIDITY

Ocean acidity is slowly increasing as oceans absorb atmospheric carbon dioxide (CO_2), and the waters of Atlantic Canada are increasing at a higher rate compared to other parts of the world. Human activities since the Industrial Revolution, such as deforestation, land use changes and combustion of fossil fuels, have contributed to increasing atmospheric CO_2, which increases the amount of CO_2 dissolving into oceanic surface waters. While it may seem beneficial that oceans act as carbon sinks and accumulate carbon-containing molecules, in reality this is problematic for many invertebrate organisms, including phytoplankton, zooplankton, crustaceans, molluscs and corals, which develop skeletons and shells composed primarily of calcium carbonate. Dissolved CO_2 forms carbonic acid, which corrodes calcium carbonate, and results in physiological strain on these organisms. The pH of ocean water across Atlantic Canada, including the south coast of Newfoundland, is decreasing on average 0.02 to 0.04 pH units per decade (Bernier et al., 2018). These increasingly acid waters may affect the growth and development of some organisms in the study area.

3.2.1.3 SEA LEVEL RISE

Sea-levels are rising in Atlantic Canada due to the melting glaciers and ice sheets and the thermal expansion of seawater as it warms. Sea-level rise is variable through Atlantic Canada, and is increasing by about 2 to 4 mm per year on the south coast of Newfoundland (Bernier et al., 2018). Higher sea-levels put important coastal habitats in danger of degradation or loss and can affect important habitat for fish and wildlife, as well as the distribution and abundance of habitat-forming species like eelgrass and kelps.

3.2.1.4 DISSOLVED OXYGEN

Dissolved oxygen concentrations, particularly the excessive depletion of dissolved oxygen (hypoxia), is an important factor to consider in regard to marine organisms, and can dramatically affect marine life and ecosystems. Low oxygen can retard growth and development and reproductive function, and can impact species distributions. Motile species avoid hypoxic waters, while sessile or slow-moving organisms suffer high mortality rates. The deep waters in the Gulf of St. Lawrence have been consistently hypoxic since the 1980s; however, hypoxic conditions were not reported in the study area (Bernier et al., 2018).

3.2.1.5 NUTRIENTS

Nutrient mixing remains relatively stable on the Newfoundland and Labrador Shelves and the Scotian Shelf, although the St. Lawrence Estuary is showing signs of inhibited mixing. Increasing freshwater run-off affects ocean stratification, since freshwater is less dense than saltwater. Ocean stratification can affect nutrient mixing in surface water, which influence phytoplankton blooms and ecosystem productivity. Nutrients important to photosynthetic phytoplankton include dissolved nitrogen, phosphorous and silica, in addition to light. In ocean waters, nitrogen is usually the limiting factor for phytoplankton growth. Nitrogen concentrations are not uniform across Atlantic Canada and fluctuate across years; the greatest declines in available nitrogen persisted on the Newfoundland Shelf until 2015, while concentrations in the Gulf of St. Lawrence and the Scotian Shelf are relatively stable (Bernier et al., 2018). Due to the importance of nutrients to phytoplankton, and generally downward trends in nutrient concentrations in Atlantic Canada, the magnitude of phytoplankton blooms may be negatively affected, which in turn can influence the overall productivity of these bioregions.

3.2.1.6 BATHYMETRY

Bathymetry on the south coast of Newfoundland is complex and varied with shallow shelf and bank areas, and steep slopes descending to the bottom of the Laurentian Channel. Coastal terrestrial and intertidal substrates are characterized by extensive barrens with granite bluffs and glacially formed fjords and embayments (White, 2018). These range from just west of Port aux Basques to the Burin Peninsula (NLDEC, 2008) and create sheltered habitats for a wide variety of marine species. Coastal waters descend the Laurentian Channel slope to depths of nearly 500 m at the bottom of the Laurentian Channel. The large, nearshore shallow Rose Blanch Bank is located to the east of Port aux Basques. Deep water channels at Burgeo and Hermitage transport warm, nutrient rich-saline waters from the Laurentian Channel into Hermitage and Fortune Bays, which attracts a variety of marine organisms to the south coast of Newfoundland, including ecologically sensitive species of marine mammals and reptiles (White, 2018). Coastal habitats on the south coast are also subject to the largest tides in Newfoundland (White, 2018).

3.2.2 Biological Environment

Atlantic Canadian marine environments are one of the most biologically productive in the world, with diverse communities of organisms ranging from microscopic phytoplankton to large mammals inhabiting a variety of coastal habitats (Bernier et al., 2018). Monitoring the marine environment allows researchers to record the physical and biological changes, including shifting species distributions and changing community compositions occurring across the region. DFO measuring the ocean conditions of the Atlantic which study the biological properties on Canada's east coast. According to the latest review of the Atlantic Ecosystems, all species in the marine ecosystem have experienced some degree of change, including phytoplankton and marine alga, invertebrate and fish communities, marine mammals, reptiles, and seabirds (Bernier et al., 2018). Habitat change is also placing negative stress on native species. Although climate change is a key driver of change, human activities including fishing, coastal development, untreated sewage and waste water, and resource exploitation are also driving change.

3.2.2.1 **PHYTOPLANKTON**

Phytoplankton are microscopic photosynthetic organisms that form the foundation of productive marine environments as they are a key food source for zooplankton, which are in turn food for higher trophic levels such as fish and marine mammals (Bernier et al., 2018). The general trend has been a decline in phytoplankton abundance in Atlantic Canada. Declining nutrient and chlorophyll levels indicate that the Atlantic Canadian ecosystem has a lower production potential compared to previous decades. The abundance of phytoplankton and concentrations of chlorophyll (chlorophyll is pigment and a main component of photosynthesis) are an indicator of biological productivity. Phytoplankton abundance typically increases drastically during the spring bloom and to a lesser extent during the fall bloom. Changes in the timing and decreasing abundance of phytoplankton blooms can result in a cascade of negative effects for other organisms in the ecosystem that are dependent on phytoplankton for foraging activities.

3.2.2.2 **ZOOPLANKTON**

Zooplankton are an ecologically significant grouping of small animals (0.2 to 20 mm) that feeds extensively on phytoplankton, in addition to bacteria and fungi in the water column. They in turn provide food for larger marine organisms. Zooplankton communities are strongly influenced by their physicochemical environment, in particular water depth, temperature and season. Copepods are a ubiquitous group of small crustaceans that constitute the bulk of marine zooplankton biomass in Atlantic Canada, in particular the large, energy-rich species *Calanus finmarchicus* and other small copepods of the genus *Pseudocalanus*. These species are nutritious and abundant, and their biomass forms an important component of the Atlantic Canadian marine food web. In recent years there has been a shift in the zooplankton community structure from the large *C. finmarchicus* to smaller copepods, as well as warm-water copepods and non-copepod species. Changes in the structure and abundance of zooplankton can affect larger organisms on higher trophic levels which consume these organisms as their primary food source (Bernier et al., 2018). Total abundance of zooplankton has increased in Atlantic Canada, including southern Newfoundland, since 2014; however, the shift toward smaller and warm-water species may have unanticipated effects on the overlying trophic community structure.

3.2.2.3 PHYSICOCHEMICAL AND BIOLOGICAL ENVIRONMENTS AND ECOSYSTEM PRODUCTIVITY

The interdependency of phytoplankton, zooplankton, and larger marine species on their physical environment is complex and linked to the timing of annual climatic conditions (Bernier et al., 2018). Research in Newfoundland provides an excellent example of how climate change is affecting tropic levels from the bottom up, and how these processes connect phytoplankton blooms to zooplankton abundance. Zooplankton abundance in turn affects the number of smaller fish, such as Atlantic herring or capelin, which are important dietary items for larger economically significant species like Atlantic cod, Greenland halibut, or sensitive species such as marine mammals and reptiles.

One of the key factors determining the timing of the spring phytoplankton bloom is the timing of the spring ice melt, which generates favourable oceanic conditions for phytoplankton. An early bloom can result in reduced zooplankton productivity that year, as an early bloom can cause zooplankton to miss their peak spring foraging opportunities, which is key for their growth and development and the production of zooplankton biomass for higher trophic levels. This results in fewer foraging opportunities for smaller fish like capelin and herring, which consequently affects the reproductive success and growth of these species. In turn, the available biomass of these small fish to larger predators is reduced. Capelin biomass, for example, is an important driver of the abundance of Atlantic cod and the reproductive success of harp seals.

This relationship between phytoplankton blooms and abundance of Atlantic cod demonstrates the importance of trophic levels and the cascading effects related to climate change and the alteration of annual climatic events.

3.3 Habitats in the Study Area

This section of the report provides an overview of the predominant coastal habitats found in the study area. Coastal habitats and benthic ecosystems are some of the most diverse and productive ocean areas, and the diverse habitats of southern Newfoundland are populated by a variety of organisms including plants and algae, fish and invertebrates, marine mammals and reptiles, and seabirds. Aquatic species often feature prominently in the social, cultural and economic well-being of Canadians.

The following report focuses on habitats and communities in intertidal and nearshore continental shelf areas (<200 m deep) in NAFO 3Pn; however, this section of the report will refer to the habitats that could be found on the Newfoundland slope of the Laurentian Channel, as appropriate. The habitat types on the southwest coast of Newfoundland discussed herein include:

- Rocky habitat
- Soft-sediment habitat
- Benthic biogenic habitat:
    - Kelp beds
    - Eelgrass beds
    - Coral habitats
    - Sponge habitats
    - Other biogenic habitats

3.3.1 Rocky Habitat

Rocky shorelines are the most abundant nearshore coastal habitats in Newfoundland and the study area and are likely the predominant habitat type in Port aux Basques Harbour. Coastal rocky habitats are primarily bedrock and combinations of large boulders and cobbles, and form through land-based processes such as erosion, volcanic and tectonic processes, and glacial activity. The various rock formations and compositions, including the type of rock, hardness, slope and orientation create niche habitats and unique physical and biological characteristics (Butler et al., 1996). Rocky shores persist in areas with a low supply of sediment that are subject to long-term erosive forces to overburden and bedrock such as wind and wave action, changing sea levels (tidal and climate change), ice scour and historic glacial scour (Butler et al., 1996). As they erode, rocky shores contribute nutrients and supply sediment for other coastal ecosystems, such as soft-sediment habitats.

Rocky dominant habitats provide interstitial cover and foraging opportunities, act as substrate for dens and burrows for benthic and demersal species, and provide attachment points for sessile organisms including biogenic habitat forming invertebrates and algal species. The ecological significance of biogenic habitats, including kelp and eelgrass beds, coral and sponge habitats, and other biogenic habitats are discussed in Section 3.4. An ecologically significant function of rocky habitat is the provision of substrate for the attachment and proliferation of algae, in particular the brown alga of biogenic kelp beds. These habitats are discussed in Section 3.4.1.

Although the literature review did not identify sources of information regarding fish habitat in Port aux Basques Harbour, based on a review of available literature, including Canadian Hydrographic Charts and open source bathymetry, it is anticipated that the coastal habitats within the harbour primarily consist of rocky intertidal and subtidal habitats.

3.3.1.1 INTERTIDAL AND SUBTIDAL ROCKY HABITAT

Coastal rocky shorelines provide intertidal and subtidal habitats for marine macroflora and faunal species. Intertidal rocky habitats are transitional zones on the fringe of the seabed between the lowest and highest tides, and feature biological banding and zonation due to the consequent effects of extreme temperature variation (submerged and exposed periods), oxygen depletion, and desiccation (Butler, 1996). Organisms that are more tolerant of regular temperature variation and desiccation are found in the upper intertidal zones, whereas those less tolerant are found in lower areas. Diverse communities of macroalgae serve important roles in the intertidal and shallow subtidal coastal habitats (≤30 m) in the study area, and the greatest abundance and diversity of non-estuarine algal species are found on the south coast of Newfoundland (LGL, 2010). Intertidal habitats provide foraging opportunities to fish and seabirds during high tide. Foraging invertebrates resistant to desiccation, terrestrial mammals, and shorebirds also utilize intertidal habitats at low tide, wading amongst macroflora and foraging on organisms seeking refuge in algal stands and tide pools (Butler, 1996).

Subtidal rocky habitats are below the intertidal zone and are continuously covered by water. Environmental conditions are more stable here than the intertidal zone, as temperature, oxygen levels, and light energy are constant. Organisms are not subject to desiccation as water levels do not vary as they do in intertidal habitats (Butler, 1996).

3.3.2 Soft-Sediment Habitats

Soft-sediment habitats are those environments in which the bottom consists of fine-grain sediments, including sand, clay and silt (2 to 4 mm diameter). These habitats may contain smaller quantities of coarse-grained substrates, such as gravel and small cobbles. The biodiversity and productivity of soft-sediment environments depends on a variety of abiotic factors, including depth, light exposure, water temperature, sediment grain size composition and distribution, and biotic factors, including flora and fauna.

In Atlantic Canada, soft-sediment environments, including sandy beaches, salt marshes and tidal mudflats, are mainly found in on the Atlantic coast of Nova Scotia, the Bay of Fundy, and in the Northumberland Strait, and are relatively rare in Newfoundland (Butler, 1996). Small pockets of mudflats and tidal beaches occur in unvegetated coastal and estuarine habitats within the study area. Examples of important soft-sediment tidal habitats include the J.T. Cheeseman Provincial Park, Channel-Port aux Basques and Grand Bay West, which contain sandy beaches, barachois and salt marshes (Well et al., 2019; White, 2018). These areas provide nursery, rearing habitats and foraging opportunities for fish and invertebrates, and provide foraging opportunities seabirds such as the SARA listed piping plover. Further to the east, there are extensive intertidal habitats in the Sandbanks Provincial Park at Burgeo. Intertidal and submerged soft-sediment environments hosting eelgrass meadows are discussed in Section 3.4.2. Based on the review of available literature, marine charts and open source bathymetry, it is anticipated that soft-sediment habitats in Port aux Basques Harbour are limited to deeper undisturbed areas, such as the harbour bottom, or sheltered areas in and around Vardy's Rock and Money Island.

These habitats are more dynamic compared to bedrock and coarse rocky substrates, and exhibit much greater plasticity over time since fine-substrates are easily mobilized and can be redistributed by coastal processes such as wind, wave action and currents. The larger particles (sand) are generally found in the upper intertidal area as these are less prone to movement, and transition to finer, smaller particles (silt and clay) in the lower intertidal and subtidal portions of these habitats (Bernier et al., 2018). The formation of this fine sediment zonation depends on the slope and exposure level of the shoreline, and this sediment zonation consequently influences the distribution patterns of species inhabiting these zones.

Substantial and diverse marine communities thrive on and within the sediments of beaches and intertidal flats (Bernier et al., 2018), although these environments are limited on the south coast of Newfoundland and are generally devoid of vegetation in the intertidal and shallow subtidal zones (Butler et al., 1996). Epifauna are species that reside above the surface and forage within the available intertidal habitats during the high tide. These species include predatory crustacean (crabs and lobster) and pelagic and demersal finfish (Atlantic cod, flounders, etc.), as well as marine birds. Infauna permanently live within sediments and include a wide variety of marine invertebrates, such as molluscs (bivalves and gastropods), polychaetes, nemerteans, cnidarians and crustaceans. These organisms are active during high tide and feed by filtering organic and inorganic particulates from the water column. During low tide, these organisms retreat into the sediment to avoid the physical stresses of desiccation and overheating. Predators, including seabirds and coastal mammals, forage on infauna during low tide.

3.4 Benthic Biogenic Habitats

Biogenic habitats are those that are created by plants and animal species. These habitats can be created by the presence of organisms, such as algae beds, or by structures created by organisms, such as piles of shell debris. Biogenic habitats can increase the overall diversity and abundance of organisms in an area, and different types of biogenic habitats are beneficial to different species assemblages. A wide variety of benthic biogenic habitats occur in the North Atlantic. Kenchington (2014) provided a summary of types present on the Scotian Shelf; however, a similar summary does not appear to exist for Newfoundland, other than the Grand Banks and Labrador Slope. A number of benthic biogenic habitats are expected to occur within Zone 3Pn and are discussed briefly in the following subsections, by species and habitat type. These include kelp beds, eelgrass meadows, and coral and sponge habitats in the study area, including within or near Port aux Basques Harbour (Sections 3.4.1 to 3.4.4). Other biogenic habitats with the potential to occur in the study area are briefly described in Section 3.4.5.

3.4.1 Kelp Beds

Atlantic Canadian kelp beds flourish in rocky intertidal and subtidal habitats (≤30 m) and generally consist of aggregations of a small number of prostrate brown alga (Phaeophyta) of the *Laminaria*, *Saccharina*, *Alaria*, *Fucus* and *Agarum* genera (Bernier et al., 2018). Rocky intertidal and subtidal habitats are prevalent on the south coast of Newfoundland, and extensive kelp beds are anticipated to occur in depths less than 30 m in the study area, including in Port aux Basques Harbour. Other species of brown algae are observed to a lesser degree, along with a wide variety of red (*Rhodophyta*) and green (*Chlorophyta*) algae. Algal communities on the south coast of Newfoundland are similar to those found further south in Nova Scotia and New England when compared to the rest of Newfoundland (LGL, 2010).

Kelp beds are important biogenic habitat formers in lower intertidal and shallow subtidal rocky coastal areas in temperature waters, including the south coast of Newfoundland (Teagle et al., 2017; Bernier et al., 2018). Kelp habitats offer protection and foraging opportunities, and serve as important nursery grounds for juveniles of a variety of marine species, including commercially important and ecologically sensitive fish species, such as Atlantic cod (*Gadus morhua*), Atlantic herring (*Clupea harengus*), Atlantic tomcod (*Microgadus tomcod*), white hake (*Urophycis tenuis*), American lobster (*Homarus americanus*), rock crab (*Cancer irroratus*) and Jonah crab (*Cancer borealis*) (Bernier et al., 2018; Seitz et al., 2013). Kelp represent a major photosynthesizer in coastal areas, and promote secondary productivity by adding upright, complex habitat structures to rocky coastlines (Teagle et al., 2017). Kelps transform habitats by creating dynamic water flows and influencing rates of detrital settlement and sedimentation. They also influence the availability of the substratum for settlement, recruitment and colonization by other algal and invertebrate organisms, and provide direct foraging opportunities for herbivorous species such as green sea urchins (Teagle et al., 2017). Kelp beds support increasing biodiversity by increasing the volume of available habitat and creating areas of heterogeneity and complexity through which niche habitats are derived, and directly provide food and shelter (Teagle et al., 2017). Kelp beds fuel food webs by providing organic material in deeper offshore waters as they decompose (Bernier et al., 2018).

Kelp bed distributions are influenced by several environmental factors. Their maximum depth generally aligns with the maximum depth of light penetration (≤ 30 m) required for photosynthesis. Nutrients are necessary for their growth and survival, particularly dissolved nitrogen, which is limited in marine waters. Kelp beds flourish in cold water environments. High water temperatures reduce the quantity and quality of kelp habitat by increasing mortality and reducing the recruitment and growth rates of

kelps. Kelps on the south coast of Newfoundland grow rapidly during the winter and spring, but slow during the warmer summer months. Wave action and exposure influence the proliferation of kelp beds (Bernier et al., 2018; Teagle et al., 2017). Sheltered embayments and coves, such as those found on the south coast of Newfoundland and in Port aux Basques Harbour, offer excellent opportunities for the establishment and proliferation of kelp beds.

Kelp habitats are threatened by a range of anthropogenic pressures, including increasing seawater temperature, which alters the distribution and structure of algal communities from kelp beds to algal turfs (Bernier et al., 2018; Connell et al., 2014). Algal turfs are low-lying forms of algae found in intertidal and subtidal habitats. Although native turf forming algal species are ecologically important, their encroachment into kelp bed habitats represent an ecological shift to less complex and productive habitats. Turfs are expanding globally on rocky coasts and are increasingly used as indicators of anthropogenic habitat degradation (Connell et al., 2014).

Bernier et al. (2018) note that increasing water temperature and aquatic invasive species (AIS) represent two major threats to kelp beds for all of Atlantic Canada. Warming water temperatures also encourage the settlement and growth of the invasive bryozoan *Membranipora membranacea* on kelp blades, which stiffen algal blades and increases blade breakage during storms. This species is known to occur in Port aux Basques Harbour (see Section 3.10). In Nova Scotia, warming waters have led to kelp defoliation, which facilitates colonization by turfs or other species, such as the invasive alga *Codium fragile*. Specific references to this process weren't identified during the literature review, therefore the south coast of Newfoundland may undergo similar habitat shifts. Sea urchin barrens are also common on the south coast of Newfoundland, where mass aggregations of green sea urchin forage extensively on large kelps. As these aggregations pass through an area, the kelp beds are consumed, leaving little behind aside from crustose coralline algae and exposed rock. Green sea urchins are known to inhabit Port aux Basques Harbour and nearby coastal areas; therefore, it is likely urchins consume kelps in the harbour and may periodically create urchin barrens.

3.4.2 Eelgrass Meadows

Eelgrass meadows are common and highly productive habitats formed by the marine flowering plant *Zostera marina* in soft sediment estuaries, lagoons and coastal embayments throughout Atlantic Canada. Eelgrass is recognized as a key ecological species in intertidal and subtidal coastal environments and provides nursery and other critical habitat functions for a variety of marine species, including species at risk and commercially important species (Rao et al., 2014). Eelgrass grows best in unconsolidated bottoms in estuaries and coastal areas, and form habitats limited to small discrete patches upward to extensive meadows covering several hectares (Rao et al., 2014). It also plays an important role in stabilizing seashores and buffering shorelines, and provides nutrients to organisms by filtering the water column (DFO, 2009b).

Eelgrass meadows occur along the coast of Newfoundland, with extensive meadows found on the southwest coast between Cape Ray and Channel-Port aux Basques (DFO, 2019a; Bernier et al., 2018). Eelgrass is a perennial angiosperm and reproduces primarily through flowering and seeds, but may also reproduce by means of their rhizomes (Bernier et al., 2018). In shallow areas subject to ice scour, plants overwinter as seeds before growing during the spring and summer following the annual ice melt. Shoot density and plant biomass are greatest during the spring and summer, due to abundance light and

nutrients in the water column. In the fall, eelgrass density and biomass decrease and meadows die back (Bernier et al., 2018).

Eelgrass distributions are related to depth and light penetration through the water column (DFO, 2009b). The maximum depths eelgrass can colonize depend on the depth of light penetration; due to the clarity of coastal waters in southern Newfoundland, light can penetrate deeper and eelgrass can be found in depths of 12 m. This is nearly twice the average depth of eelgrass located in elsewhere in Atlantic Canada (DFO, 2009b). Optimal salinity tolerance lay between 20 and 26 ppt; however, they are tolerant of salinity levels ranging from nearly fresh to fully marine (Bernier et al., 2018). Eelgrass can survive temperatures from freezing to 35^{o}C in Atlantic Canada (DFO, 2009b); they begin growing when water temperatures rise above 10^{o}C and thrive in temperatures upward of 28^{o}C (DFO, 2009b).

Threats to eelgrass distributions include coastal habitat loss (infilling), wave exposure, ice scour, desiccation, eutrophication due to excessive nutrient loading (e.g. fertilizers, sewage, and aquaculture) and invasive aquatic species such as the European green crab (*Carcinus maenas*) and colonial tunicates (Bernier et al., 2018; DFO, 2009b). In the 1930's a slime mould (*Labyrinthula zosterae*) reduced eelgrass distributions by 90% on the Atlantic coast, and populations did not recover until the 1960's. Eelgrass beds can also be damaged by excessive wave exposure, sediment deposition and erosion (DFO, 2009b), and prolonged exposure to water temperatures above 28^{o}C can reduce plant growth and survival and promote the proliferation of disease (DFO, 2009b).

3.4.3 Coral Habitats

Corals are colonial invertebrates that occur in temperate and tropical oceans. The term is generally used to refer to any of the numerous, sessile marine polyps of the Class Anthozoa that typically secrete calcareous skeletons and attach themselves to bottom substrates (CSAS, 2010). While tropical corals tend to form symbiotic relations with algal species to utilize photosynthesis, deep water corals are beyond the reach of sunlight and utilize suspension feeding to prey on small plankton species.

Cold-water corals and sponges are being increasingly recognized as being important components of marine ecosystems. In addition to their own contribution to species richness, they increase local biodiversity in seafloor habitats by providing shelter, food, and/or substrate for epifaunal species (Watanabe et al., 2009; Buhl-Mortensen et al., 2010) including commercial fish (Gilkinson and Edinger, 2009). Cold-water (deep water) coral habitats are known to create areas with high densities of fish (Auster, 2005) and provide nursery areas for larvae (Baillon et al., 2012).

The majority of cold-water coral species are typically found attached to hard substrates on hard or soft bottoms. In general, most cold-water corals are found at depths between 200 and 1,000 m (Hebbeln et al., 2019), though there is variation across groups. Some soft coral species, such as *Duva florida* and *Drifa glomerata* prefer depths between 200 and 1,500 m. Wareham and Edinger (2009) found that coldwater coral species in Newfoundland were broadly distributed along the continental shelf edge and slope, with most species occurring at depths greater than 200 m. Only nephtheid soft coral species, were found on the continental shelf.

They are generally found in areas where temperatures remain between 4 and 12 degrees (Roberts et al., 2006). Bottom temperature ranges established from a DFO ground fish survey showed ideal temperatures just outside of Port aux Basques Harbour (Colpron et al., 2010). Many cold-water coral

species require hard substrate for attachment, but certain species found in the western Atlantic region can use fine substrate for attachment. The area outside of Port aux Basques Harbour may be suitable habitat for some cold-water coral species as it transitions from a coastal area to the Laurentian Channel.

Edinger et al. (2007) outlined the coral species known to occur off Newfoundland into five functional groups, based on size, structure, and ecology, as outlined below.

- **Large gorgonian or antipatharian corals** are tall branched long-lived corals with generally rigid calcium carbonate and or protein which can reach over 1 m in height.
- **Small gorgonian corals** have carbonate or protein skeletons and are less than 1 m in height, they frequently occur on mud bottoms.
- **Cup corals** are solitary corals belonging to the Scleractinia or hard coral family, which occur on sand or mud bottoms or attached to rocky substrates.
- **Pennatulaceans or sea pens** are flexible organisms with a foot that anchors them in soft sediments.
- **Soft corals** do not have skeletons and can fully retract when disturbed.

Coldwater coral species belonging to four of these functional groups have been reported within the study area (3Pn). Table 3.1 lists the coral species and groups that have been reported to occur off Port aux Basques or within NAFO zone 3Pn. Known distributions of corals in the study area are provided in Appendix A, Figure 5.

Table 3.1: Corals Recorded in NAFO 3Pn during DFO Annual Spring Trawl Surveys

Functional Group	Coral Species	Data Source
Large gorgonian or antipatharian corals	*Acanthogorgia armata*	Colpron et al. (2010)
	Keratoisis ornata	Colpron et al. (2010), Gass and Willison (2005), Cogswell et al. (2009) Kenchington et al. (2016)
	*Primnoa resedaeformis**.	Colpron et al. (2010)*
	Paramuricea spp.	Wareham and Edinger (2009) Gilkison and Edinger (2010)
Cup corals	*Flabellem alabastrum*	Wareham and Edinger (2009)
	Javania cailleti	Gilkison and Edinger (2010)
Sea pens	*Crassophylum spp.,* *Funiculinidae sp.* *Anthoptilium grandiflorum* *Haliopteris finnmarchica* *Haliptereis sp.* Unidentified Pennatulaceans	Cogswell et al. (2009)
	Pennatula grandis	Gilkison and Edinger (2010)
	Undetermined species	Colpron et al. (2010) Kenchington et al. (2016) Gilkison and Edinger (2010)
Soft corals	Neptheid soft corals, likely *Gersemia rubiformis* and *Duva florida*	Colpron et al. (2010) Wareham and Edinger (2009) Gilkison and Edinger (2010)

*Reported as being present off Port-Aux-Basques, however the mapping provided shows it outside the 3Pn boundary.

Knowledge of the occurrence and distribution of coldwater corals is greatly hampered by the depths at which they occur, with the accompanying logistical issues, and the paucity of reliable reports. Nephtheid soft corals and sea pens have been said to be the most common corals along the continental margins of Newfoundland and Labrador (Wareham & Edinger, 2007). DFO has stated that deep water corals and their associations require further study in the Laurentian Channel and other areas (DFO, 2014; King and Atkinson, 2013).

Several types of coral-related biogenic habitats have been recognized in the Maritimes (Kenchington, 2014). At least three of these habitat types occur within NAFO 3Pn. These are discussed in the following subsections.

3.4.3.1 LARGE CORALS ON HARD SUBSTRATES

As listed in Table 3.1, *Keratoisis ornata* and *Acanthogorgia armata* are two species of large gorgonians that have been reported from the area off of Port aux Basques harbour through DFO bottom trawling surveys and interviews with fishermen in the NAFO 3Pn area (Colpron et al., 2010). Note that Colpron et al., 2010 also reported a third large species of gorgonian coral*, Primnoa resedaeformis,* as occurring off Port aux Basques; however, the mapping provided in that document shows it outside the 3Pn boundary. Large gorgonians require hard substrate for attachment, warmer bottoms then other species and strong currents for feeding opportunities (Colpron et al., 2010). These conditions are present south of Port aux Basques Harbour at the beginning of the Laurentian Channel slope, though not in close vicinity to the harbour.

3.4.3.2 SEA PEN FIELDS

Sea pens are able to grow in soft sediments, where they provide structure in otherwise featureless habitats. In addition to altering local water flow, areas of high sea pen concentration can provide refuge for invertebrates, small fish, and larvae, which can serve as prey for larger fish (Kenchington et al., 2016). Fishermen from Port aux Basques have indicated that areas with high densities sea pens are good fishing grounds for Atlantic cod (*Gadus morhua*) and Atlantic halibut (*Hippoglossus hipposglossus*) (Colpron et al., 2010).

As outlined above, at least six (6) species of sea pens have been reported from NAFO 3Pn (Table 3.1) and sea pen fields presumably occur, though they are not expected to occur in the vicinity of Port aux Basques Harbour.

3.4.3.3 SOFT CORAL GARDENS

The term soft coral generally refers to small corals of the family *Alcyonacea,* which do not produce rigid internal structures. In eastern Canada, they are typically members of the families Nephtheidae and Alcyoniidae, and are found in shallow subtidal areas to the continental slopes (Kenchington, 2014). Soft corals attach to hard substrate and can be found on bedrock or on cobbles embedded in muds or sands. Areas of abundant soft corals are sometimes referred to as ‘soft coral gardens’. Soft coral gardens can also increase structure and provide microhabitats for small fish and invertebrates.

At least three species of soft corals have been reported from NAFO 3Pn (Table 3.1), and it is possible that dense aggregations known as soft coral gardens may occur. They are not expected to occur in the vicinity of Port aux Basques Harbour.

3.4.4 Sponges Habitats

Like cold-water corals, sponges are being increasingly recognized as important ecological components of marine habitats. The term sponge generally refers to sessile marine invertebrates belonging to the phylum Porifera, which grow attached to bottom substrates and characteristically have a porous skeleton composed of siliceous or calcareous spicules (CSAS, 2010). They feed mainly on phytoplankton and filter vast quantities of water daily, resulting in the transfer of nutrients between pelagic and benthic ecosystems. In Atlantic Canada, at least 34 species of sponge have been identified to date (Kenchington et al., 2016), throughout all ocean depths. Areas of high sponge abundance have been identified; Kenchington et al. (2016) reported a few locations of sponges along the southwest coast of Newfoundland, though there was no information provided on species. Known distributions of sponge aggregations in the study area are provided in Appendix A, Figure 5.

Abundant sponge congregations can create areas known as sponge aggregations or sponge beds, which are discussed in the following subsections.

3.4.4.1 SPONGE AGGREGATIONS

Areas of high sponge abundance, known as sponge beds or sponge aggregations, modify bottom currents and create habitat for other species. Fish may use them for feeding, reproduction and resting. Sponge beds are known to occur off Newfoundland, though most of this data is from the Labrador Slope and Grand Banks areas (Murillo et al., 2012; Kenchington et al., 2016b). Kenchington et al. (2016) provide a habitat suitability model, which determined there is a high probability of deep-sea sponge presence off the southwest coast of Newfoundland; however, no data could be found on the specific deepwater sponge species occurring in this area, other than general references to the common shallow water bread-crumb sponge (*Halichondria panicea*) occurring along the coast. On the Scotian Shelf, sponge grounds are typically composed of one or two large, structure-forming species and many smaller, but abundant species.

Sponges presumably occur in NAFO 3Pn, and it is possible that sponge aggregations could occur within 3Pn. They are not expected to occur in the vicinity of Port aux Basques Harbour.

3.4.5 Other Biogenic Habitats

Three other biogenic habitat types known to occur on the Scotian Shelf also have the potential to occur in the study area. These are briefly discussed in the following subsections.

3.4.5.1 TUBE-DWELLING ANEMONE FIELDS

Some cerianthid anemone species, such as *Pachycerianthus borealis*, are rather large and solitary tube-dwelling anemones with elongated bodies adapted for burrowing in soft bottoms. Bits of debris and sand particles adhere to their tube. While their biology is poorly known, the large size and tendency of cerianthid anemones to occur in clusters results in them being important structure-forming species. Fish such as juvenile redfish have reported to associate with these patches (Kenchington, 2014).

Tube-dwelling anemone fields may be present within NAFO 3Pn, but are not expected to occur in the vicinity of Port aux Basques Harbour.

3.4.5.2 BRITTLE STAR BEDS

Brittle stars are echinoderms with resemble seastars with five long thin arms. They can occur in great densities in areas of soft sediment, creating patches known as brittle star beds, which can cover hundreds of square metres of sea floor and containing millions of individuals (Kenchington, 2014; Guijarro et al., 2016). They create biogenic habitats via their bioturbation activities. The locomotion and feeding activities of brittle stars reshape the sediment surface, thereby influencing the distribution of other organisms. Brittle stars are also an important food source for several flatfish species (Kenchington, 2014; Guijarro et al., 2016).

Brittle star beds may occur in the deeper areas of NAFO 3Pn but are not expected to occur in the vicinity of Port aux Basques Harbour.

3.4.5.3 SAND DOLLAR BEDS

Sand dollars are flattened circular echinoderms. In the North Atlantic they occur on sand bottoms with strong currents from the low intertidal to a depth of 1,500 m (Kenchington, 2014). They are covered in short spines, which they use to burrow through sediments. They can occur at very high densities in some areas. Sand dollars are known to play a large role in bioturbation of surficial sediments on offshore banks (Kenchington, 2014).

Sand dollar beds may be present within NAFO 3Pn but are not expected to occur in the vicinity of Port aux Basques Harbour. It is possible they could occur in nearby coastal areas with accumulations of sandy sediments.

3.5 Legislated and Sensitive Areas

Canada's federal government committed to the United Nations Convention on Biological Diversity, which establishes targets for the conservation of at least 30 percent of terrestrial, inland water, coastal, and marine areas in participating nations by 2030. To reach these goals, the federal government is using two approaches, establishing marine protected areas (MPAs), and using other effective area-based conservation measures (OECMs).

MPAs are legally protected areas of the ocean that are managed for conservation under various statutes. They may be *Oceans Act* MPAs established under the *Oceans Act* by DFO, National Marine Conservation Areas (NMCAs) established under the *Canada National Marine Conservation Areas Act* by Parks Canada, or Marine National Wildlife Areas established under the *Canada Wildlife Act* by Environment and Climate Change Canada (ECCC). OECMS use area-based measures other than MPAs and are governed and managed in ways that achieve positive outcomes for biodiversity conservation. The only type of OECM in Canada to date are marine refuges, which are fisheries-areas closures established under the *Fisheries Act*; however, there are opportunities to establish other types of OECMs, for example, applications of the *Species at Risk Act* (SARA) critical habitat prohibition, or Indigenous-led protection or conservation of marine areas.

Five of 12 Canadian marine bioregions were recognised as priority regions for the establishment of Marine Protected Areas (MPAs) under the *Oceans Act*, including all three Atlantic Canadian bioregions (Section 3.1). One method to identify a potential MPA under the *Oceans Act* is to identify an area of the

ocean as an Ecologically and Biologically Significant Area (EBSA). An EBSA is an area of the ocean that has been identified through formal scientific assessment as having biological or ecological importance when compared to the surrounding ocean. A framework for identifying EBSAs in Canada was established by DFO in 2004 (DFO, 2004a). This framework allows EBSAs to be identified using five criteria, including the uniqueness and rarity of the habitat, a high density of benthic habitat and high density of species, fitness consequences of the habitat, resiliency of the habitat, and habitat naturalness. Within the study area, there are three EBSAs, as depicted in Appendix A, Figure 2.

MPAs can be organized into networks, an MPA network being defined as "a collection of MPAs and other conserved areas that operate cooperatively to safeguard important ecological components of the ocean and marine biodiversity as a whole" (DFO, 2018a). The primary goal of an MPA network is the long-term protection of marine biodiversity, ecosystem function and special natural features in EBSAs important for sustaining biodiversity and ecosystem services. This is done through legislated prohibitions against human activities that compromise the conservation objectives of the area (DFO, 2016a). DFO established five Integrated Oceans Management Areas (IOMAs) in the five priority bioregions, including the creation of the Placentia Bay-Grand Banks (PBGB) IOMA in the Newfoundland and Labrador Shelves bioregion. A major management objective of IOMAs include the identification and evaluation of Conservation Objectives (COs) based on four conservation priorities, including EBSAs, depleted and rare species and degraded areas. The specific objectives of the Placentia Bay-Grand Banks IOMA are discussed in Section 3.5.1. The PBGB IOMA is directly relevant to this report, as the study area occurs within this area (see Appendix A, Figure 3).

There are significant overlaps between the bioregions and IOMAs, and within these areas exist the EBSAs and MPAs. DFO also regulates Marine Refuges under the *Fisheries Act*; these areas are subject to temporary or permanent closures to human activities, with permits or licenses required for activities. Primarily, these prohibitions are related to fishing activities, especially those that impact benthic habitats, such as bottom contact fishing gear. There are currently no Marine Refuges in the study area, and therefore these are not further described in this report.

The PBGB IOMA, three EBSAs, and Laurentian Channel MPA all occur in or near the study area, and are further described in Sections 3.5.1, 3.5.2, and 3.5.3, respectively.

3.5.1 Placentia Bay-Grand Banks Integrated Oceans Management Area

The study area occupies the westernmost portion of the PBGB IOMA, which encompasses an area of approximately 550,000 m^2 from Cape Ray (west of Port aux Basques) to the Laurentian Channel and east to the Grand Banks of Newfoundland at the limit of Canada's EEZ (Appendix A, Figure 3) (DFO, 2012a). The profoundly productive waters of the Grand Banks and associated species abundance and diversity, paired with the potential economic resources (e.g. resource extraction, marine shipping) and proximity to Newfoundland, make this management area of particular concern to the socioeconomic and cultural well-being of Newfoundlanders (DFO, 2012a).

Several priority conservation actions were established based on the existing COs for the PBGB IOMA. These actions include those regarding Atlantic cod and marine mammal populations, AIS (specifically invasive green crab), sensitive habitats, and corals and sponges (DFO, 2012a). Within the IOMA, the Atlantic cod Laurentian North Designatable Unit 3Pn mix with nearby stocks (Units 3L and 3Ps) and thus

it has been recommended that fisheries management consider the mixing of these stocks rather than managing them independently (DFO, 2012a). The south coast of Newfoundland has the highest density and species diversity of marine mammals observed during targeted surveys in Newfoundland (DFO, 2012a), particularly during the late summer and early fall. SARA-listed species observed include blue whale (*Balaenoptera musculus*), North Atlantic right whale (*Eubalaena glacialis*) and fin whale (*Balaenoptera physalus*). In addition, the entire south coast of Newfoundland is a rich summer foraging area for the SARA listed leatherback sea turtles (*Dermochelys coriacea*), as well as the ocean sunfish (*Mola mola*) due to the high abundance of jellyfish throughout this large area.

Significant habitats within the PBGB IOMA are discussed under the relevant EBSAs in Section 3.5.2. Ecologically significant species identified in this IOMA include eelgrass and corals (DFO, 2012a). Eelgrass has a demonstrably significant influence on the ecology of marine habitat in eastern Canada, whereas deep-sea corals are important features of benthic habitats, as corals provide structural complexity and increase species diversity in deeper water habitats (DFO, 2012a).

AIS in the PBGB IOMA include violet tunicate (*Botrylloides violaceus*), golden star tunicate (*Botryllus schlosseri*), coffin box bryozoan (*Membranipora membranacea*) and the European green crab. One of the priority COs in the PBGB IOMA is the control of green crab populations. The vase tunicate (*Ciona intestinalis*) was identified in the central south coast of Newfoundland, but were not reported for southwestern Newfoundland or Port aux Basques (McKenzie et al., 2016). AIS in the study area are discussed in Section 3.10.

3.5.2 Ecologically and Biologically Significant Areas (EBSAs)

DFO evaluated the available data for habitats and species occupying the PBGB IOMA and derived 11 EBSAs in 2007 (Templeman, 2007); however, these 11 areas are no longer recognized and therefore are not described in this report. Beginning in 2011, DFO undertook a re-evaluation of the existing data for habitats and species in the PBGB IOMA to identify EBSAs within this management area (DFO, 2019a). Three EBSAs were identified within or in close proximity to the study area. Two are part of the Newfoundland and Labrador Shelves bioregion and are located within the PBGB IOMA, including the South Coast EBSA and a large portion of the nearby Laurentian Channel EBSA. A third EBSA is located to the west of the study area within the adjacent Gulf of St Lawrence bioregion, along the west coast of Newfoundland. Burgeo Bank had previously been identified as an EBSA in 2007, but was not listed as an EBSA in the re-evaluation of the PBGB IOMA (Wells et al., 2019). This former EBSA would have been relevant to the report as it was located within the study area, however, approximately 18 percent of the Burgeo Bank EBSA is contained within the South Coast EBSA boundary near Ramea Island (Wells et al., 2019).

The three EBSAs located within or near to the study area are further described in Sections 3.5.2.1 to 3.5.2.3.

3.5.2.1 **SOUTH COAST EBSA**

The South Coast EBSA includes all coastal habitats and extends outward 35 to 40 km to deeper offshore waters along the southwest coast of Newfoundland. The EBSA stretches from Cape Ray (west of Port aux Basques) to just east of Ramea Island and Burgeo Bank (Wells et al., 2019). The division between NAFO Divisions 4R and 3Pn serves as the western boundary, while the southern boundary is offshore along the

northwest portion of the Laurentian Channel and Rose Blanche Bank (Appendix A, Figure 2). This EBSA covers an area of approximately 7,030 km^2.

The South Coast EBSA provides important habitats for the endangered blue whale and other marine mammals, including hooded and grey seal. Important areas for Atlantic cod, redfish and shrimp are also located in the EBSA; habitat for cod and redfish are predominantly located in the western portion (including the study area) while shrimp habitats are located to the east on Rose Blanche and Burgeo Banks. The area also provides important habitat for three fish functional groups, including forage species that feed on plankton (e.g. capelin and Atlantic herring), predatory piscivores (fish eaters) that consume forage species (e.g. Atlantic cod and redfish), and omnivorous species (e.g., white hake). These functional groups are based on general size characteristics and known foraging habitats (Wells et al., 2019). The large black dogfish area extends into the west of the EBSA from the Laurentian Channel, and the smooth skate area covers nearly the entire EBSA (Kulka, 2006; Kulka et al., 2006).

The South Coast EBSA also contains several large eelgrass meadows, with the largest areas located between Cape Ray and Channel-Port aux Basques (Rao et al., 2014). Sensitive benthic areas for sea pen (Appendix A, Figure 2) and sponge are also found in this EBSA. The largest sea pen area is located at the northern end of the Laurentian Channel southwest of Rose Blanche Bank, while the sponge area is located about 7 km southwest of Port aux Basques (DFO, 2019a). Benthic megafauna such as coral, sea pen and sponges are known as important benthic features providing shelter and protection from predators, foraging opportunities, and enhanced biodiversity for a variety of marine fish and invertebrates, particularly as nursery areas for juveniles (Bernier et al., 2018).

In addition, the South Coast EBSA includes two Important Bird Areas (IBAs) for the endangered piping plover (*Charadrius melodus*). Although seabirds are outside of the scope of this report, it is important to note that these areas are located in close proximity to Channel-Port aux Basques. One IBA is located in Grand Bay West / J.T. Cheeseman Provincial Park, immediately west of Channel-Port aux Basques, and the second is in Big Barasway near Burgeo.

3.5.2.2 LAURENTIAN CHANNEL EBSA

The Laurentian Channel EBSA is located offshore of southern Newfoundland in a portion of the Laurentian Channel, which extends into the southeastern boundary of the study area. The northwest boundary of the EBSA extends into NAFO 3Pn and runs southeast to the St. Pierre and Burgeo Banks, including the channel slope and the relatively flat channel bottom, which can be up to 500 m deep in places (DFO, 2019a). The southern boundary is located far from the study area, just north of the Laurentian Fan (Appendix A, Figure 2). The Laurentian Channel EBSA is relatively large and covers an area of approximately 21,484 km^2, although only a small portion of this extends into the study area.

The key feature of this EBSA are the high primary productivity (phytoplankton and zooplankton) in the channel and extensive aggregations of Greenland halibut, witch flounder, all six fish functional groups (planktivores, plankpiscivores, piscivores, and small, medium and large benthivores), and blue whale. Important areas for at-risk species are located throughout the EBSA, including areas for smooth, thorny and winter skate, white hake and blue whale. In addition, there are significant benthic areas of small gorgonian corals and sea pens. The bottom of the Laurentian Channel is primarily composed of fine substrate mud, clay, sand and gravel (DFO, 2010), which helps to support high concentrations of sensitive

benthic sea pen areas. The Laurentian Channel also has a high occurrence of black dogfish and northern wolffish, and there is evidence to suggest the EBSA may be a black dogfish pupping area (DFO, 2010; Kulka, 2006). Smooth skate also utilize the area as juvenile / nursery grounds (Kulka et al., 2006). The northern portion of the EBSA is an important area for small benthivores such as flounder and skates (DFO, 2019a).

The Laurentian Channel is an important overwintering habitat for Atlantic cod in the Laurentian North Designatable Units, as well as redfish and white hake (DFO, 2014). The area is also an important migratory route for several species of groundfish, marine mammals and leatherback sea turtles (DFO, 2014). Porbeagle and basking sharks are also known to migrate into the area and congregate during the spring (Campana et al., 2012), and one of only two known Porbeagle shark mating grounds occurs toward the north of the EBSA (DFO, 2010).

3.5.2.3 WEST COAST OF NEWFOUNDLAND EBSA

The West Coast of Newfoundland EBSA is located in coastal waters along the west coast of Newfoundland from the Cabot Strait southwest of Cape Ray to the Esquiman Channel in the north. The EBSA covers an area of nearly 18,238 km^2, although only the southernmost portion of the EBSA is relevant, as this area abuts and partially overlaps the western boundaries of the study area (DFO, 2007b), and species and habitat distributions continue into the western portion of the South Coast EBSA (Appendix A, Figure 2).

The West Coast of Newfoundland EBSA is recognized for the important role it plays as a nursery area for groundfish, including juvenile Atlantic cod, redfish, American plaice and Atlantic wolffish (DFO, 2007b). The west coast also acts as a migration corridor for entire populations of Atlantic cod and redfish entering habitats in the Gulf of St. Lawrence during the spring and fall (DFO, 2007b). The EBSA is also a significant migration corridor and provides critical overwintering habitat for several species of pelagic fish including the Gulf population of capelin and the northern Gulf Atlantic herring population. The southern portion of the area also provides summer foraging opportunities for large aggregations of herring, capelin, spiny dogfish, silver hake and pollock (DFO, 2007b). The significance of the EBSA is also reflected by the abundance of meroplankton, which are temporarily planktonic organisms such as fish and invertebrate larvae, in the area. The northern Gulf stock of Atlantic cod spawn in the area during the spring, producing a large number of eggs and consequently a high component of meroplankton (DFO, 2007b). In addition, capelin and Atlantic herring larvae concentrate in these waters, although their concentration areas are north of the Port-au-Port Peninsula, which is located far outside of the study area. The southern portion of the EBSA also provides important ice-free overwintering habitat for blue whale and other marine mammals (DFO, 2007c).

3.5.3 Laurentian Channel Marine Protected Area (MPA)

The Laurentian Channel Marine Protected Area (MPA) was established off southwestern Newfoundland in April 2019 and covers an area approximately 11,648 km² (Appendix A: Figure 2). This MPA protects about half of the Laurentian Channel EBSA, and includes all habitats within the boundaries of the MPA, including the seabed, subsoils to a depth of 5 m, and the entire water column above the seabed. The area is subject to the Laurentian Channel Marine Protected Area Regulations under the *Oceans Act*. These regulations prohibit activities that disturb, damage, destroy or remove living marine organisms or their habitats in the MPA, unless the activities are listed as exceptions under the Regulations or are approved by the Minister of Fisheries, Oceans and the Canadian Coast Guard. Activities prohibited under

the Regulations include all commercial and recreational fishing, oil and gas exploration and exploitation, anchoring, and the laying of submarine cables.

The MPA provides important habitat for a variety of marine species. The stated conservation objectives of the Laurentian Channel MPA are outlined below.

- Protect corals, including significant concentrations of sea pens, from harm due to human activities such as fishing, oil and gas exploration, submarine cable installation and anchoring.
- Protect black dogfish, smooth skate, and Porbeagle shark, from human induced mortality as to by-catch in commercial fisheries and seismic activities.
- Promote the survival and recovery of the Northern wolffish (e.g. bycatch in commercial fishery) and leatherback sea turtles (e.g. entanglement in commercial fishing gear and seismic activities) in the Laurentian Channel.

The ecological and biological significance of the Laurentian Channel is described in Section 3.5.2.2.

3.6 Aquatic Species in the Study Area

A wide diversity of marine species occurs in NAFO Zone 3Pn, due to its location near the confluence of three marine bioregions and the range of depths present in this area. Many of these are species are harvested or otherwise utilized by humans, and many others are forage species upon which harvested species rely for food. Common or otherwise notable species occurring within Zone 3Pn are discussed by major taxonomic groupings in the following subsections, and a summary table of species is provided for each group.

3.6.1 Marine and Anadromous Fishes

Table 3.2 lists the species of marine and anadromous fishes with known distributions and habitat ranges in the study area. While some of these species may rarely occur, or are not widely reported in the available literature, they still have potential to utilize the habitats present in the study area, and so are included here. Species confirmed in Port aux Basques Harbour are indicated in the table column 'Location within Study Area' as 'PAB'.

Fish species which are subject to harvesting within or near the study area, or are listed under SARA and/or COSEWIC are indicated in Table 3.2. These species are discussed in more detail in Section 3.7 and Section 3.9, while species descriptions are provided in Chapter 4. Empty cells in the table indicate that the specified information was not available or was not applicable. For instance, the demersal alligator fish (*Aspidophoroides monopterygius*) is part of a subpopulation in Atlantic Canada, therefore the 'Population' cell for this species is empty in the table.

Appendix D provides an overview of when many harvested fish species and species of conservation concern are expected to occur in the study area, as well as information on which life history events they may be undergoing while present.

Table 3.2: Marine Fish Species Known to Occur in or Near the Study Area, with Notes on Harvesting and Conservation Status

Group	Species	Scientific Name	Population	Harvesting / Conservation Status	Reported Location Within Study Area
Demersal	Acadian redfish	*Sebastes fasciatus*	Atlantic	Harvested in Commercial Unit I (3Pn) and Commercial Unit II (3Pn); SARA / COSEWIC - listed Species	NAFO 3Pn
Demersal	Alligator fish	*Aspidophoroides monopterygius*		Forage species	NAFO 3Pn
Demersal	American plaice	*Hippoglossoides platessoides*	Maritimes Population & Newfoundland and Labrador Population	SARA / COSEWIC-listed Species	NAFO 3Pn
Demersal	Atlantic cod	*Gadus morhua*	Laurentian South	Harvested Species; SARA / COSEWIC-listed Species	NAFO 3Pn, Port aux Basques Harbour (PAB)
Demersal	Atlantic cod	*Gadus morhua*	Laurentian North	Harvested Species; SARA / COSEWIC-listed Species	NAFO 3Pn, PAB
Demersal	Atlantic hagfish	*Myxine glutinosa*			NAFO 3Pn
Demersal	Atlantic halibut	*Hippoglossus hippoglossus*		Harvested Species	NAFO 3Pn
Demersal	Atlantic softpout	*Melanostigma atlanticum*			NAFO 3Pn
Demersal	Atlantic sturgeon	*Acipenser oxyrinchus*	St. Lawrence Population / Maritimes Population	SARA / COSEWIC-listed Species	NAFO 3Pn
Demersal	Atlantic wolffish	*Anarhichas lupus*	Atlantic Ocean	SARA / COSEWIC-listed Species	NAFO 3Pn, PAB
Demersal	Black dogfish	*Centroscyllum fabricii*		Only pupping are in Laurentian Channel	NAFO 3Pn
Demersal	Cunner	*Tautogolabrus adspersus*			NAFO 3Pn, PAB
Demersal	Deepsea cat shark	*Apristurus profundorum*			NAFO 3Pn
Demersal	Deepwater redfish	*Sebastes mentella*	Gulf of St. Lawrence - Laurentian Channel Population	Harvested in Commercial Unit I (3Pn) and Commercial Unit II (3Pn); SARA / COSEWIC - listed Species	NAFO 3Pn

Group	Species	Scientific Name	Population	Harvesting / Conservation Status	Reported Location Within Study Area
Demersal	Fourbeard rockling	*Enchelyopus cimbrius*			NAFO 3Pn, PAB
Demersal	Great lantern shark	*Etmorpterus princes*			NAFO 3Pn
Demersal	Greater eelpout	*Lycodes esmarki*			NAFO 3Pn
Demersal	Greenland halibut/ Turbot	*Reinhardtius hippoglossoides*		Harvested Species	NAFO 3Pn
Demersal	Haddock	*Melanogrammus aeglefinus*		Harvested Species	NAFO 3Pn
Demersal	Lumpfish	*Cyclopterus lumpus*		SARA / COSEWIC-listed Species	NAFO 3Pn, PAB
Demersal	Longfin hake	*Urophycis chesteri*			NAFO 3Pn
Demersal	Marlin-spike	*Nezumia bairdi*			NAFO 3Pn
Demersal	Monkfish/ Goosefish	*Lophius americanus*			NAFO 3Pn
Demersal	Moustached sculpin	*Triglops murrayi*			NAFO 3Pn
Demersal	Northern sand lance	*Ammodytes dubius*			NAFO 3Pn
Demersal	Northern wolffish	*Anarhichas denticulatus*	Atlantic Ocean	SARA / COSEWIC-listed Species	NAFO 3Pn
Demersal	Portuguese shark	*Centroscymnus coelolepis*			NAFO 3Pn
Demersal	Sea raven	*Hemitripterus americanus*			NAFO 3Pn
Demersal	Silver hake	*Merluccius bilinearis*			NAFO 3Pn
Demersal	Smooth skate	*Malacoraja senta*			NAFO 3Pn
Demersal	Spiny dogfish	*Squalus acanthias*	Atlantic	SARA / COSEWIC-listed Species	NAFO 3Pn
Demersal	Spotted wolffish	*Anarhichas minor*	Atlantic	SARA / COSEWIC-listed Species	NAFO 3Pn
Demersal	Thorny skate	*Amblyraja radiata*		SARA / COSEWIC-listed Species	NAFO 3Pn
Demersal	White hake	*Urophycis tenuis*		SARA / COSEWIC-listed Species	NAFO 3Pn
Demersal	Windowpane flounder	*Scophthalmus aquosus*			NAFO 3Pn, PAB
Demersal	Winter skate	*Leucoraja ocellata*		Commercial / SARA / COSEWIC-listed Species	NAFO 3Pn
Demersal	Witch / Greysole flounder	*Glyptocephalus cynoglossus*		Commercial	NAFO 3Pn, PAB
Demersal	Yellowtail flounder	*Limanda ferruginea*			NAFO 3Pn
Pelagic	American eel	*Anguilla rostrata*		Recreational Coastal fishery /SARA / COSEWIC-listed Species	NAFO 3Pn, PAB
Pelagic	Atlantic argentine	*Argentina silus*			NAFO 3Pn
Pelagic	Atlantic bluefin tuna	*Thunnus thunnus*	Atlantic Population	SARA / COSEWIC-listed Species	NAFO 3Pn

Group	Species	Scientific Name	Population	Harvesting / Conservation Status	Reported Location Within Study Area
Pelagic	Atlantic herring	*Clupea harengus harengus*		Harvested Species - Bait 3Pn, Commercial 3Pn	NAFO 3Pn
Pelagic	Atlantic mackerel	*Scomber scombrus*		Recreational Coastal fishery	NAFO 3Pn, PAB
Pelagic	Atlantic salmon	*Salmo salar*	Southern Newfoundland	Harvested Species; SARA / COSEWIC-listed Species	NAFO 3Pn, PAB
Pelagic	Atlantic saury	*Scomberesox saurus*			NAFO 3Pn
Pelagic	Banded killifish	*Fundulus diaphanus*	Newfoundland Population	SARA / COSEWIC-listed Species	NAFO 3Pn
Pelagic	Blue shark	*Prionace glauca*	Atlantic Population		NAFO 3Pn
Pelagic	Brook trout	*Salvelinus fontinalis*		Sea-run trout - Recreational Coastal Sea-run trout - Recreational Insular NL	NAFO 3Pn, PAB
Pelagic	Butterfish	*Peprilus triacanthus*			NAFO 3Pn
Pelagic	Capelin	*Mallotus villosus*		Commercial	NAFO 3Pn
Pelagic	Pollock	*Pollachius virens*			NAFO 3Pn
Pelagic	Porbeagle	*Lamna nasus*	Atlantic	SARA / COSEWIC-listed Species	NAFO 3Pn
Pelagic	Rainbow smelt	*Osmerus mordax*		Recreational Harvest	NAFO 3Pn
Pelagic	Shortfin mako shark	*Isurus oxyrinchus*	Atlantic	SARA / COSEWIC-listed Species	NAFO 3Pn
Pelagic	White barracudina	*Notolepsis rissoi*		Forage Species	NAFO 3Pn
Pelagic	White shark	*Carcharodon carcharias*	Atlantic	SARA / COSEWIC-listed Species	NAFO 3Pn

3.6.2 Marine Invertebrates

Table 3.3 provides a list of the larger or more ecologically and economically significant species of marine invertebrates that are known to occur in the study area. Other species of marine invertebrates were excluded from the report, as there are thousands of species of marine invertebrates across several phyla that occupy the waters of Atlantic Canada. While some of these included species may only rarely be reported from the area, they still have potential to utilize the habitats present, and so are included in this section of the report. Species confirmed in Port aux Basques Harbour are indicated in the table column 'Location within Study Area' as 'PAB'.

Marine invertebrate species which are subject to harvesting within or near the study area are provided in Table 3.3, while species descriptions are provided in Chapter 4. Appendix D provides an overview of when some notable marine invertebrate species are expected to occur in the study area, as well as information on which life history events they may be undergoing while present. This is focussed mainly on species which are of commercial importance (such as snow crab) or are considered habitat-forming (such as coldwater corals and sponges).

There are currently no marine invertebrate species listed under SARA or COSEWIC known to occur in or near the study area.

Table 3.3: Marine Invertebrate Species Likely Occurring in or Near the Study Area, with Notes on Harvesting and Conservation Status

Group	Common Name	Scientific Name	Harvesting / Conservation Status	Location within Study Area
Bivalve	Blue mussels	*Mytilus* spp.		NAFO 3Pn, PAB
	Iceland scallop	*Chlamys islandica*		NAFO 3Pn, PAB
	Sea scallop	*Placopecten magellanicus*		NAFO 3Pn, PAB
	Propellor clam	*Cyrtodaria siliqua*		
	Surf clam	*Spisula solidissima*		
	Northern horse mussel	*Modiolus modiolus*		NAFO 3Pn
Mollusc	Longfin squid	*Doryteuthis pealeii*	Recreationally Harvested Species	NAFO 3Pn
	Northern shortfinned squid	*Illex illecebrosus*	Recreationally Harvested Species	NAFO 3Pn
	Waved whelk	*Buccinum undatum*	Commercial fishery in Zone 4R3Pn.	NAFO 3Pn
	Moon snail	*Euspira heros*		NAFO 3Pn
	Dogwinkle	*Nucella lapillus*		NAFO 3Pn, PAB
	Periwinkles	*Littorina littorea*		NAFO 3Pn, PAB
Cnidaria	Common jellyfish	*Aurelia aurita*		NAFO 3Pn, PAB
	Lions mane jellyfish	*Cyanea capillata*		NAFO 3Pn, PAB
	Soft corals	Nepthidae, such as *Gersemia rubiformis* and *Duva florida*		NAFO 3Pn
	Cup corals	*Flabellem alabastrum* *Javania cailleti*		NAFO 3Pn
	Large gorgonian or Antipatharian corals	*Acanthogorgia armata* *Keratoisis ornata* *Primnoa resedaeformis*.* *Paramuricea* spp.		
	Sea pens	*Crassophylum* spp. *Funiculinidae* sp. *Anthoptilium grandiflorum* *Haliopteris finnmarchica* *Haliptereis* sp. *Pennatula grandis* Unidentified *Pennatulacean*	Aggregations of sea pens occur along the Laurentian Channel.	NAFO 3Pn
	Sea anemones	*Cerianthus borealis*		NAFO 3Pn, PAB

Group	Common Name	Scientific Name	Harvesting / Conservation Status	Location within Study Area
		Metridium senile		
Porifera	Sponges	*Geodia* spp.		
Crustacea	American lobster	*Homarus americanus*	Commercially fished in LFA 12 (NAFO 3Pn)	NAFO 3Pn, PAB
	Northern shrimp	*Pandalus borealis*	Commercial Gulf of St. Lawrence	NAFO 3Pn
	Snow crab	*Chionoecetes opilio*	Commercial fishery	NAFO 3Pn
	Toad crab	*Hyas araneus;* *Hyas coarctatus*	Recreational fishery	NAFO 3Pn, PAB
	Krill	*Meganyctiphanes norvegica*; *Thysanoessa inermis*; *Thysanoessa* longicaudata	Important prey for whale, fish, and seabirds	NAFO 3Pn
	Calanoid copepods	*Calanus glacialis* *Calanus finmarchicus*	Important prey for whale, fish, and seabirds	NAFO 3Pn
	Rock crab	*Cancer irroratus*		NAFO 3Pn, PAB
	Amphipods, various species	Amphipoda		NAFO 3Pn, PAB
	Isopods	Various species		NAFO 3Pn, PAB
	Hermit crabs	*Pagarus acadianus* *Pagarus arcuatus* *Pagarus pubescens*		NAFO 3Pn, PAB
Echinoderms	Green sea urchin	*Strongylocentrotus droebachiensis*		NAFO 3Pn, PAB
	Orange-footed sea cucumber	*Cucumaria frondosa*		NAFO 3Pn
	Sea stars	*Asterias* spp.		NAFO 3Pn, PAB
	Sand dollar	*Echinarachnius parma*		NAFO 3Pn, PAB
	Brittlestars (various species)	*Ophiura sarsi* *Ophiopholis aculeate* *Amphipholis squamata*		NAFO 3Pn, PAB
	Basket star	*Gorgonocephalus arcticus*		NAFO 3Pn, PAB
	Heart urchin	*Brisaster fragilis*		NAFO 3Pn
	Mud star	*Ctenodiscus crispatus*		NAFO 3Pn
Porifera	Sponges	*Haliclona* spp. *Geodia* spp.		NAFO 3Pn

3.6.3 Marine Mammals

Table 3.4 lists marine mammals that are known or considered to have the potential to occur in the study area. Some of these species only temporarily occupy the study area, while others are rarely reported from the area. However, these species still have the potential to utilize habitats present on the south coast of Newfoundland, and so are included here. Species confirmed in Port aux Basques Harbour are indicated in the table column 'Location within Study Area' as 'PAB'. Appendix D provides an overview of when many marine mammal species are expected to occur in the study area, as well as information on which life history events they may be undergoing while present.

Marine mammal species which are listed under SARA and/or COSEWIC, or are subject to harvesting within or near the study area, are indicated in Table 3.4. These species are discussed in more detail in Section 3.7 and Section 3.9, while species descriptions are provided in Chapter 4. Observations of marine mammals in the study area, including Port aux Basques Harbour, are provided in Appendix A: Figure 7.

Table 3.4: Marine Mammal Species Occurring off the Southern Coast of Newfoundland

Common Name	Scientific Name	Population	Status	Location within Study Area
Mysticetes (Baleen Whales)				
Blue whale	*Balaenoptera musculus*	Atlantic	SARA / COSEWIC listed	NAFO 3Pn
Fin whale	*Balaenoptera physalus*	Atlantic	SARA/COSEWIC listed	NAFO 3Pn
Humpback whale	*Megaptera novaeangliae*	Atlantic		NAFO 3Pn
North Atlantic right whale	*Eubalaena glacialis*	North Atlantic	SARA/COSEWIC listed	NAFO 3Pn
Sei whale	*Balaenoptera borealis*	Atlantic		NAFO 3Pn
Odontocetes (Toothed Whales)				
Atlantic white-sided dolphin	*Lagenorhynchus acutus*	Atlantic		NAFO 3Pn
Bottle-nosed dolphin	*Tursiops truncatus*			NAFO 3Pn
Common dolphin	*Delphinus delphis*			NAFO 3Pn
Harbour porpoise	*Phoecena phoceana*	Northwest Atlantic	SARA/COSEWIC listed	NAFO 3Pn, PAB
Long-finned pilot whale	*Globicephala melas*			NAFO 3Pn
Minke whales	*Balaenoptera acutorostrata*			NAFO 3Pn
Sowerby's beaked whale	*Mesoplodon bidens*	Atlantic		NAFO 3Pn
Sperm whale	*Physeter macrocephalus*			NAFO 3Pn
Killer whale	*Orcinus orca*	Northwest Atlantic / Eastern Arctic	SARA/COSEWIC listed	NAFO 3Pn
White-beaked dolphin	*Lagenorhynchus albirostris*			NAFO 3Pn
Short-beaked common dolphin	*Delphinus delphis*			NAFO 3Pn

Common Name	Scientific Name	Population	Status	Location within Study Area
Pinnipeds (Seals)				
Gray seal	*Halichoerus grypus*		Harvested species	NAFO 3Pn
Harbour seal	*Phoca vitulina*			NAFO 3Pn
Harp seal	*Phoca groenlandica*		Harvested species	NAFO 3Pn
Hooded seal	*Cystophora cristata*		Harvested species	NAFO 3Pn

3.6.4 Marine Reptiles

Table 3.5 lists the species of marine reptiles that are known or considered to have potential to occur in the study area. While some of these species may only rarely be reported from the area, they still have potential to utilize the habitats present, and so are included here. Species confirmed in Port aux Basques Harbour are indicated in the table column 'Location within Study Area' as 'PAB'.

Marine reptile species which are listed under SARA and/or COSEWIC, are indicated in Table 3.5. These species are discussed in more detail in Section 3.9, while species descriptions are provided in Chapter 4. Observations of marine reptiles in the study area, including Port aux Basques Harbour, are provided in Appendix A, Figure 7.

Appendix D provides an overview of when marine reptile species are expected to occur in the study area, as well as information on which life history events they may be undergoing while present.

Table 3.5: Marine Reptile Species Occurring Off the Southern Coast of Newfoundland

Common Name	Scientific Name	Population	Status	Location within Study Area
Leatherback sea turtle	*Dermochelys coriacea*	Atlantic	SARA/COSEWIC listed	NAFO 3Pn
Loggerhead sea turtle	*Caretta caretta*	Atlantic	SARA/COSEWIC listed	NAFO 3Pn
Kemp's Ridley	*Lepidochelys kempii*	Atlantic		NAFO 3Pn

3.7 Fisheries in the Study Area

The study area is situated in the NAFO convention area 3Pn on the southern coast Newfoundland (Appendix A, Figure 1). Fisheries in NAFO 3Pn, including fisheries occurring within Port aux Basques Harbour, were determined through consultation with DFO resource managers and fisheries officers in Newfoundland (Barter, *pers. comm*., 2020, Riggs-Power, *pers. comm*., 2020). The information gathered was primarily associated with commercial and recreational fisheries, and regulated fishing areas in NAFO 3Pn are provided in Appendix A, Figure 4. The status of Aboriginal and Indigenous fishing activities in the study area was not available at the time of the writing of this report.

A total of 25 species were through consultation with DFO identified as harvested in a commercial or recreational fishery in the study area (Table 3.6). One crustacean, three finfish and two molluscan species were identified as part of active and on-going commercial and recreational fisheries inside Port aux Basques Harbour. Available opening and closing dates for fisheries in the study area are provided in Table 3.7. Temporal constraints and sensitivity rankings for species harvested as part of commercial and recreational fisheries in the study area are provided in Appendix D.

The European green crab (*Carcinus maenus*) has established thriving populations throughout the coastal waters of Newfoundland, including coastal habitats in the study area. Consultation with DFO indicated that experimental commercial fishing licenses are available to fishers interested in pursuing a novel green crab fishery, in part to control the further spread of this species; however, at present there are no known fishers harvesting green crab in the study area (Barter, *pers. comm*., 2020). This species of crab is further discussed with other AIS in Section 3.10.

Table 3.6: Fish Species Currently Harvested in Port aux Basques Harbour and Nearby Coastal Areas, and NAFO Zone 3P as Part of an On-going Fishery, including Commercial, and Recreational Fisheries

Taxon	Common Name	Species Name	Harvesting Area	Fishery Type
Crustacean	American lobster	*Homarus americanus*	Port aux Basques Harbour / Nearby Coastal Areas	Commercial
			LFA 12; NAFO Zone 3P	Commercial
	Northern shrimp	*Pandalus borealis*	NAFO Zone 3P	Commercial
	Snow crab	*Chionoecetes opilio*	CRA 12; NAFO Zone 3P	Commercial
	Toad crab / Lyre crab	*Hyas araneus,* *Hyas coarctatus*	NAFO Zone 3P	Recreational
Finfish	Atlantic cod	*Gadus morhua*	Port aux Basques Harbour / Nearby Coastal Areas	Recreational
			NAFO Zone 3P	Commercial
			NAFO Zone 3P	Recreational
	Atlantic herring	*Clupea harengus harengus*	Port aux Basques Harbour / Nearby Coastal Areas	Commercial
			HFA 12; NAFO 3P	Commercial
	Atlantic mackerel	*Scomber scombrus*	Port aux Basques Harbour / Nearby Coastal Areas	Commercial/ Recreational

Taxon	Common Name	Species Name	Harvesting Area	Fishery Type
			MFA 12; NAFO 3P	Commercial
	Atlantic halibut	*Hippoglossus hippoglossus*	NAFO Zone 3P	Commercial
	Capelin	*Mallotus villosus*	CFA 12, NAFO Zone 3P	Commercial
	American eel	*Anguilla rostrata*	NAFO Zone 3P	Recreational
	Redfish	*Sebastes fasciata, Sebastes mentella*	NAFO Zone 3P	Commercial
	Sea run trout, inland trout	*Salvelinus fontinalis*	NAFO Zone 3P	Recreational
	Winter skate	*Leucoraja ocellata*	NAFO Zone 3P	Commercial
	Thorny skate	*Amblyraja radiata*	NAFO Zone 3P	Commercial
	Winter flounder	*Pseudopleuronectes americanus*	Port aux Basques Harbour / Nearby Coastal Areas	Commercial
	Witch flounder (Greysole)	*Glyptocephalus cynoglossus*	NAFO Zone 3P	Commercial
	Atlantic salmon	*Salmo salar*	NAFO Zone 3P	Recreational
Mollusc	Longfin inshore squid	*Doryteuthis pealeii*	Port aux Basques Harbour / Nearby Coastal Areas	Recreational
	Northern shortfin squid	*Illex illecebrosus*	Port aux Basques Harbour / Nearby Coastal Areas	Recreational
	Whelk	*Buccinium undatum*	NAFO Zone 3P	Commercial
Marine Mammal	Seals	*Halichoerus grypus, Phoca groenlandica, Cystophora cristata*	NAFO Zone 3P	Recreational

Table 3.7: Typical Opening and Closing Dates for Commercial and Recreational Fisheries in Study Area

Species	Fishery Status	Opening and Closing Dates (Anticipated 2020)	Fishing Area
American lobster	Commercial	April 21 – June 30	LFA 12, inclusive of Port aux Basques Harbour
		April 1 to July 2	LFA 13A
Atlantic cod	Commercial	Summer: July 01 – Aug 01	NAFO 3Pn
		Fall 1: September – 2 weeks, Fall 2: October – 1 week	NAFO 3Pn
		July 1 – Feb 28	NAFO 3Pn
	Recreational	Summer: June 30 – Sept 3	All NL
		Fall: Sept. 22 - 30	All NL
		Open weekends June 29 – Sept.2 and Sept. 21 – 29	Port aux Basques Harbour
Atlantic halibut	Commercial	April 30 to May 5	NAFO 3Pn
Atlantic herring	Commercial Bait	January 1 to December 31	Port aux Basques Harbour
Atlantic mackerel	Commercial	August 1 – no set close	Port aux Basques Harbour
	Commercial Bait	January 1 to December 31	Port aux Basques Harbour
Atlantic mackerel	Recreational	No season	Port aux Basques Harbour
Atlantic salmon	Recreational	June 04 till quota reached	Insular Newfoundland
Capelin	Commercial	June 15 till quota reached	NAFO 3Pn
Eel	Recreational	June 01 till quota reached	Coastal Newfoundland
Northern shrimp	Commercial	April 01 till quota reached	Gulf of St. Lawrence
Redfish	Commercial	July 14 – March 31 (Note Spawning closure April 1- June 30)	NAFO 3Pn
Seal	Commercial/ Personal	When ice conditions are suitable	Port aux Basques Harbour
	Recreational	April 09 till quota reached	Sealing Areas 4-23, 25-27
Sea-run trout	Recreational	Year-round in coastal waters No closed season	Coastal Newfoundland
Trout	Recreational	Winter: Feb 1 to Apr 15	Insular Newfoundland
Skate	Commercial	April 1 to March 31	NAFO 3Pn
Snow crab	Commercial	April 9 to ~ June 22	NAFO 3Pn
Squid	Recreational	No season (mostly present in August and September)	Port aux Basques Harbour
Toad crab / Lyre crab	Recreational	May 08 till quota reached	NAFO 3Pn
		Summer May 15 – Sept 7	
Whelk	Commercial	May 28 until quota reached	NAFO 4R3Pn
Winter flounder	Commercial Bait	January 1st to December 31st	Port aux Basques Harbour
Witch flounder / Greysole	Commercial	April 1 to March 31	NAFO 3Pn

3.8 Aquaculture in the Study Area

There are no active aquaculture operations on the southwest coast of Newfoundland or NAFO 3Pn (Barter, *pers. comm*., 2020) and there have been no recent attempts to develop aquaculture operations in this region. The nearest aquaculture operations are located in the Bay de Vieux area along the southwest coast of Newfoundland near Grey River (NL Department of Fisheries and Aquaculture (DFA), *pers. comm*., 2026). Mussel (*Mytilus* sp.) and seaweed (kelps) aquaculture operations had previously been attempted on the southwest coast near Burgeo and Grey River, however these operations were not deemed commercially viable (Barter, *pers. comm*., 2020).

3.9 Aquatic Species Listed under SARA / COSEWIC

Several aquatic Species at Risk listed under SARA and/or the Newfoundland and Labrador *Endangered Species Act* (NLESA) have potential to occur in the study area at some point during their life cycle. Thirty-six marine and anadromous species or populations were identified as occupying the waters of southwestern Newfoundland and are listed under SARA, COSEWIC, or the provincial NLESA. Eleven species are listed under SARA; ten species are listed under Schedule 1, and one species is listed under Schedule 2. Two species are listed under the provincial NLESA. Twenty-three species were assessed by COSEWIC as at risk, but have not been listed under SARA or the NLESA. These species, along with their conservation ranks, are listed in Table 3.8. Observations of aquatic SAR and SoCC within the study area are provided in Appendix A, Figure 8.

The AC CDC data report (Appendix C) did not identify aquatic SAR or provincial SoCC in the 5-km radius around Port aux Basques Harbour. The AC CDC primarily tracks terrestrial observations; therefore, this should not be taken to indicate that aquatic SAR or SoCC are not present in the harbour. Temporal constraints for aquatic SAR in the study area are provided in Appendix D.

Descriptions of these species and overviews of their general ecology are provided in Chapter 4.

Table 3.8: Aquatic Species Listed Under SARA and/or COSEWIC Potentially Occurring in the Study Area. SARA Listed Species are Indicated in Bold Text

Common Name	Scientific Name	COSEWIC Population	SARA		COSEWIC Status	NLESA Status
			Status	Schedule		
Marine, Anadromous, and Coastal Fish						
Acadian redfish	*Sebastes fasciatus*	Atlantic population	No Status	No schedule	Threatened	
American eel	*Anguilla rostrata*		No Status	No schedule	Threatened	Vulnerable
American plaice	*Hippoglossoides platessoides*	Maritime population	No Status	No schedule	Threatened	
		Newfoundland and Labrador population	No Status	No schedule	Threatened	
Atlantic bluefin tuna	*Thunnus thynnus*	Atlantic	No Status	No schedule	Endangered	
Atlantic cod	*Gadus morhua*	Laurentian North population	No Status	No schedule	Endangered	
		Laurentian South population	No Status	No schedule	Endangered	
Atlantic salmon	*Salmo salar*	South Newfoundland West population	No Status	No schedule	Endangered	
Atlantic wolffish	***Anarhichas lupus***	**Atlantic**	**Special Concern**	**Schedule 1**	**Special Concern**	
Banded killifish	***Fundulus diaphanous***	**Newfoundland**	**Special Concern**	**Schedule 1**	**Special Concern**	**Vulnerable**
Basking shark	*Cetorhinus maximus*	Atlantic population	No Status	No schedule	Special Concern	
Lumpfish	*Cyclopterus lumpus*	Atlantic	No Status	No schedule	Threatened	
Northern wolffish	***Anarhichas denticulatus***	**Atlantic**	**Threatened**	**Schedule 1**	**Threatened**	
Porbeagle	*Lamna nasus*	Atlantic	No Status	No schedule	Endangered	

Common Name	Scientific Name	COSEWIC Population	SARA		COSEWIC Status	NLESA Status
			Status	Schedule		
Shortfin mako	*Isurus oxyrinchus*	Atlantic	No Status	No schedule	Endangered	
Smooth skate	*Malacoraja senta*	Laurentian-Scotian population	No Status	No schedule	Special Concern	
Spiny dogfish	*Squalus acanthias*	Atlantic	No Status	No schedule	Special Concern	
Spotted wolffish	***Anarhichas minor***	**Atlantic**	**Threatened**	**Schedule 1**	**Threatened**	
Thorny skate	*Amblyraja radiata*	Atlantic	No Status	No schedule	Special Concern	
White hake	*Urophycis tenuis*	Atlantic and Northern Gulf of St. Lawrence	No Status	No schedule	Threatened	
		Southern Gulf of St. Lawrence	No Status	No schedule	Endangered	
White shark	***Carcharodon carcharias***	**Atlantic**	**Endangered**	**Schedule 1**	**Endangered**	
Winter skate	*Leucoraja ocellata*	Eastern Scotian Shelf - Newfoundland	No Status	No schedule	Endangered	
		Gulf of St. Lawrence population	No Status	No schedule	Endangered	
Atlantic sturgeon	*Acipenser oxyrinchus*	Maritimes	No Status	No schedule	Threatened	
		St. Lawrence	No Status	No schedule	Threatened	
Marine Mammals						
Blue whale	***Balaenoptera musculus***	**Atlantic**	**Endangered**	**Schedule 1**	**Endangered**	
Fin whale	***Balaenoptera physalus***	**Atlantic**	**Special Concern**	**Schedule 1**	**Special Concern**	
Harbour porpoise	***Phocoena phocoena***	**Northwest Atlantic**	**Threatened**	**Schedule 2**	**Special Concern**	
Humpback whale	*Megaptera novaeangliae*	Western North Atlantic	No Status	No schedule	Not at Risk	

Common Name	Scientific Name	COSEWIC Population	SARA		COSEWIC Status	NLESA Status
			Status	Schedule		
Killer whale	*Orcinus orca*	Northwest Atlantic / Eastern Arctic	No Status	No schedule	Special Concern	
North Atlantic right whale	***Eubalaena glacialis***	**North Atlantic**	**Endangered**	**Schedule 1**	**Endangered**	
Sei whale	*Balaenoptera borealis*	Atlantic	No Status	No schedule	Endangered	
Sowerby's beaked whale	***Mesoplodon bidens***	**Atlantic**	**Special Concern**	**Schedule 1**	**Special Concern**	
Marine Reptiles						
Leatherback sea turtle	***Dermochelys coriacea***	**Atlantic**	**Endangered**	**Schedule 1**	**Endangered**	
Loggerhead sea turtle	***Caretta caretta***	**Atlantic**	**Endangered**	**Schedule 1**	**Endangered**	

3.9.1 Critical Aquatic Habitats

The federal Species at Risk Public Registry, Critical Habitats and Residence statements for federally protected SAR and SoCC were investigated during the review of aquatic critical habitats, in addition to DFO's critical habitat and distribution mapping tool for aquatic habitats and species protected under the federal SARA. The aquatic species at risk mapping tool allows users to query DFO's critical habitat and distribution data within a specified area and determine whether critical habitats have been identified in the outlined area. No critical habitats or residences were identified in Channel-Port aux Basques study area, however, critical habitat was identified for the Northern wolffish and Spotted wolffish in the NAFO 3Pn study area (Appendix B).

The aquatic SAR report generated for the Channel-Port aux Basques study area indicated that these eight aquatic SAR could temporarily inhabit the harbour area:

- Atlantic wolffish
- Blue whale – Atlantic population
- Fin whale – Atlantic population
- Leatherback sea turtle – Atlantic population
- North Atlantic right whale
- Northern wolffish
- Spotted wolffish
- White shark – Atlantic population

In addition to these eight aquatic SAR, the aquatic SAR report generated for the larger NAFO 3Pn study area indicated that Banded Killifish (the Newfoundland population) are present in two locations. These species are discussed in more detail in Chapter 4, and the two Aquatic SAR Reports are provided in Appendix B.

3.10 Aquatic Invasive Species

AIS are an ongoing threat to native species inhabiting coastal and oceanic ecosystems throughout Atlantic Canada, and habitats within the study area are no exception to this rule (Bernier et al., 2018). AIS are species of fish, invertebrates and algae that have been transported outside of their natural ranges into novel aquatic environments. Several AIS have been documented in southern Newfoundland, including the study area. These include the invasive European green crab, two colonial tunicates (*Botrylloides violaceus* and *B. schlosseri*), a vase tunicate (*Ciona intestinalis*) and the coffin box bryozoan (*Membranipora membranacea*) (Bernier et al., 2018; McKenzie et al., 2016; DFO, 2026).

Established AIS populations grow quickly in the absence of natural predators, outcompete native species, alter aquatic community structures, and even result in alterations to habitats which favour AIS rather than native species. For example, the invasive European green crab has unfortunately been found to adversely impact eelgrass meadows, which are an ecologically important habitat for many marine species. The green crab destroys eelgrass as a result of the voracious foraging on small invertebrates buried amongst the shoots and rhizomes of eelgrass (DFO, 2011a). As the green crab

forages, the shoots are uprooted and the rhizomes can be damaged, resulting in long-term harm to these habitats. Overtime, the unchecked populations of green crab can eventually wipe out entire eelgrass meadows in an area. Unsurprisingly, aquatic SAR populations are particularly vulnerable in aquatic habitats with established AIS, as SAR are even less able to cope with competition from AIS when compared to healthy natural populations.

Two other AIS have been identified in coastal waters to the east of the study area. The solitary vase tunicate *(Ciona intestinalis*) and the invasive alga oyster thief *(Codium fragile*) were identified during AIS surveys in Fortune Bay and Placentia Bay between 2006 and 2013 (McKenzie et al., 2016; DFO, 2013a). While it is unknown if these species have spread to southwestern habitats, there exists the potential for eventual introduction, especially in light of warming water temperatures due to a changing climate for AIS adapted to warmer climates. The AIS identified in southern Newfoundland are provided in Table 3.9.

Table 3.9: Aquatic Invasive Species Known to Occur in the Waters of Southern Newfoundland

Common Name	Scientific Name	Location
European green crab	*Carcinus maenas*	Coastal Newfoundland, including Port aux Basques Harbour and coastal NAFO 3Pn
Vase tunicate	*Ciona intestinalis*	Southeastern coastal waters of Newfoundland
Violet tunicate	*Botrylloides violaceus*	Coastal Newfoundland, including Port aux Basques Harbour and coastal NAFO 3Pn
Golden star tunicate	*Botryllus schlosseri*	Coastal Newfoundland, including Port aux Basques Harbour and coastal NAFO 3Pn
Coffin box bryozoan	*Membranipora membranacea*	Coastal Newfoundland, including Port aux Basques Harbour and coastal NAFO 3Pn
Oyster thief algae	*Codium fragile* spp. *fragile*	Southeastern coastal waters of Newfoundland

Chapter 4 Aquatic Species Profiles

Aquatic species profiles including major life history stages and habitat requirements are provided in the following sections. The selected species were identified during the literature review as inhabiting the study area. Species noted in Sections 4.1 and 4.2 were determined through consultation with DFO resource managers and fisheries officers (Barter, *pers. comm*., 2020; Riggs-Power, *pers. comm*., 2020). Information on potential utilization of habitats within the study area is provided where available, and the utilization of Port aux Basques Harbour is briefly discussed. Temporal constraints and sensitivity rankings for species harvested as part of commercial and recreational fisheries and for aquatic SAR in the study area are provided in Appendix D.

4.1 Port aux Basques Harbour

Aquatic species harvested as part of an ongoing commercial or recreational fishery in Port aux Basques Harbour are discussed in the following subsections. The spatial boundaries of Port aux Basques Harbour were defined after consultation with DFO fisheries officers (Barter, *pers. comm.* 2020). According to DFO, fisheries inside of Port aux Basques Harbour are defined as those occurring within the sheltered waters inside of a line drawn between Shoal Point and Channel Head. Inside the harbour, the Pikes Island breakwater is used as a point of reference to define the sheltered waters inside of the breakwater, and the more exposed waters outside of the breakwater.

4.1.1 American Lobster (*Homarus americanus*)

The American lobster is a common and widespread decapod crustacean species with a wide distribution in coastal nearshore waters throughout the northwest Atlantic Ocean, including the waters of southern Newfoundland. An inshore commercial fishery is currently active for this species in Lobster Fishing Area (LFA) 12 in NAFO 3P (Riggs-Power, *pers. comm*., 2020) and lobster are harvested within Port aux Basques Harbour (Barter, *pers. comm*., 2020) annually between April 21 and June 30.

Lobster generally prefer rocky habitats with abundant macroalgae, where the natural crevices act as burrows and the algal coverage provides shelter and foraging opportunities (Pezzack et al., 2009). Juvenile lobsters colonize rocky habitats soon after stage settling out of the water column and rarely leave the safety of their shelters; as they grow larger, juveniles and young adults forage up to 300 m from their burrows (Pezzack et al., 2009). Adult lobsters seek foraging opportunities move more freely and undergo seasonal migrations upward of 20 km between shallow foraging habitats in the summer and deeper overwintering habitats. Evidence suggests overwintering migrations from shallow, inshore waters to deeper overwintering habitats occur in the fall (den Heyer et al., 2009); seasonal migrations may depend on the availability of hard-substrate habitat (Bowlby et al., 2007) or other physical characteristics of their environment (Watson et al., 1999).

Although rocky substrates are preferable, lobsters can also be found in fines-dominated habitats during foraging migrations and seasonal movements, and will excavate shallow burrows in fine habitats in the absence of natural burrows (Lawton, 2009; Pezzack et al., 2009). Mating occurs during the summer months after females undergo a moult; the soft-shelled female is protected by the male until her shell hardens, after which she carries the fertilized eggs under her tail until the following summer (DFO, 2009c). After hatching, larvae are passively transported in the water column for 30 to 60 days and undergo several transformations (Pezzack et al., 2009; DFO, 2009c) after which larvae descend out of the water column and moult into the juvenile form.

The highest abundance of lobster occurs in coastal waters as growth and reproduction are positively influenced by warmer water temperatures (Squires, 1990; DFO, 2009c). Dietary preferences vary by location and availability; juvenile and adult lobsters are primarily omnivorous with diets consisting of crustaceans, echinoderms, gastropods, bivalves, marine polychaetes, finfish, plant detritus and algal debris. Predation on juvenile and adult lobsters primarily include larger demersal finfish and occasional crustaceans, including conspecifics.

4.1.2 Atlantic Cod (*Gadus morhua*)

Atlantic cod is a large, demersal finfish inhabiting the Northwest Atlantic from Greenland to North Carolina, which has played a significant role in historical Newfoundland fisheries and culture. A commercial fishery is currently active for this species in NAFO zone 3Pn (Riggs-Power, *pers. comm*., 2020), as is a recreational fishery (Barter, *pers. comm*., 2020). Table 3.7 in Section 3.7 provides the timing of commercial and recreational fisheries in the study area.

High densities of Atlantic cod are found off Newfoundland, in the Gulf of St. Lawrence and on the Scotian Shelf (Lough, 2004; Swain et al., 2001). Atlantic cod concentrate within the Cabot Strait south of the Laurentian Channel and off the coast of southern Newfoundland and are known to overwinter within the Cabot Strait and the Laurentian Channel. Several cod stocks or populations occur around Newfoundland and in the Gulf of St Lawrence. Populations potentially occurring in the study area, which are considered to be of conservation concern are discussed in Section 3.9. Known redfish spawning habitats are provided in Appendix A, Figure 6.

Atlantic cod leave deep oceanic waters where they overwinter to migrate to summer feeding areas near shore (Lough, 2004). Specific habitat requirements for the Atlantic cod are not well known; available data suggests food availability and water temperature drive habitat selection, and varies over temporal and spatial scales (COSEWIC, 2010a). Cod typically spawn at depths ranging from tens (Smedbol and Wroblewski, 1997) to hundreds of metres (Brander 1994; Morgan et al., 1997). Despite its commercial and ecological importance, the spawning behavior of Atlantic cod is poorly understood, though has been suggested to occur throughout the year (Scott, 1983). Spawning has rarely been observed in the field. Recent studies have shown that successful reproduction involves complex behaviour between the sexes, involving sound production by males, which occurs most frequently during the peak spawning period (Rowe and Hutchings 2006).

It is believed that sound communication is an important measure by which females discriminate between males from different cod populations, and that the chorus of sounds produced by large

aggregations of males may serve as a long-range signal to attract females to the spawning area (Nordeide and Kjellsby 1999, in Rowe and Hutchings, 2006). Once the pelagic eggs hatch, the larvae inhabit the upper 10 to 15 m of the water column. As juveniles, cod live on the ocean bottom for one to four years and may favour eelgrass in nearshore waters and macroalgae and other deep-water emergent structures in deeper water.

Important habitat for Atlantic cod includes vertical structures on the ocean floor such as plants, rocks and corals. These structures not only provide protection from predators, they also provide habitat for small fish and invertebrates that cod eat (COSEWIC, 2010a). Adult cod forage on a wide variety of species including pelagic and benthic finfish, cephalopods, crustaceans, bivalve and gastropod molluscs, echinoderms and polychaetes. Juveniles primarily forage on small crustaceans (COSEWIC, 2010a).

4.1.3 Atlantic Herring (*Clupea harengus*)

Atlantic herring are a pelagic schooling fish species, occurring in temperate waters of the North Atlantic waters at depths between 0-200 m (DFA n.d.). In Atlantic Canadian waters, herring range from the coasts of Nova Scotia to Labrador (DFO, 2016b) and congregate in large schools that undergo extensive migrations during feeding, spawning and overwintering periods (Reid et al., 1999). Commercial bait fisheries are currently active for this species in the vicinity of the study area, within NAFO zone 3Pn. (Barter, *pers. comm*., 2020). Table 3.7 in Section 3.7 provides the timing of the commercial bait fishery in the study area.

Atlantic herring overwinter in deeper waters offshore and migrate to nearshore areas in the summer and fall to spawn. Gravels are their preferred spawning substrate, but females will deposit their eggs on a variety of substrates, including boulders, rocks, sand, shell pieces and macrophytes, generally at water depths between 10 to 80 m in areas with strong tidal currents (Reid et al., 1999). The eggs hatch after approximately two weeks and the pelagic free-floating larvae remain in this life stage for four to eight months, depending on the time of spawning; some larvae will remain at the spawning site while others are dispersed with currents (Reid et al., 1999). The following spring, juveniles form large schools and migrate away from nearshore waters in the summer and fall to overwinter. Herring feed primarily on plankton, such as copepod, fish eggs, mollusc, fish larvae and euphausiids. Predators of herring include fish and marine mammals, such as seals, porpoises and whales (DFA n.d.).

4.1.4 Atlantic Mackerel (*Scomber scombus*)

The Atlantic mackerel is a migratory, schooling fish species which leads a pelagic lifestyle (Studholme et al., 1999) and are widely distributed on both sides of the north Atlantic. In the western Atlantic Ocean mackerel inhabit coastal waters from the Gulf of St. Lawrence to North Carolina. Commercial and bait fisheries are currently active for this species in the vicinity of the study area (Barter, *pers. comm*., 2020). Table 3.7 in Section 3.7 provides the timing of the commercial and recreational fisheries in the study area.

Mackerel inhabit nearshore waters during the spring and summer (DFO, 2007d; DFO, 2012b) at depths of 10 to 180 m, with the majority between 50 to 70 m (Studholme et al., 1999). In late fall and winter, they inhabit deeper, warmer waters (DFO, 2007d; DFO, 2012b) at depths between 10 to 270 m, with the majority between 20 to 30 m (Studholme et al., 1999). Atlantic mackerel overwinter in deep water along

the continental shelf from Sable Island Bank off of Nova Scotia to the Chesapeake Bay region (Studholme et al., 1999). Within Canada, Atlantic mackerel spawn primarily in the southern Gulf of St. Lawrence from June-July at water temperatures ranging from 9 to 12°C (DFO, 2007d) and an ideal salinity of greater than 30 ppt (Studholme et al., 1999). Females spawn multiple times within this period and do so at or near the surface of the water column, and the resulting pelagic larvae feed constantly to promote rapid growth (Studholme et al., 1999) and develop into juveniles after roughly two months (DFO, 2007d).

Once juveniles, Atlantic mackerel resemble adults and form highly mobile, obligate swimming schools characteristic of this species due to absence of a swim bladder (Studholme et al., 1999; DFO, 2000). Larvae feed primarily on zooplankton and juveniles feed primarily on small crustaceans and small pelagic mussels; adults feed on zooplankton, crustaceans and fish larvae (Studholme et al., 1999). Growth rate and age at maturity are variable in Atlantic mackerel, possibly due to differences in year-class size and adult stock size. Sexual maturity typically ranges from two to four years of age, and Atlantic mackerel lifespan can exceed 15 years (DFO, 2000). Main causes of mortality include fishing activities and predation (DFO, 2007d). Predators include, but are not limited to, cetaceans and grey seals (DFO, 2007d), harbor seals, porpoises, squid, other fish (e.g., hake, mackerel, pollock, Atlantic cod, etc.) and seabirds (Studholme et al., 1999).

4.1.5 Winter Flounder (*Pseudopleuronectes americanus*)

The winter flounder is a marine flatfish, which occurs from Labrador to Georgia, where it occurs from the subtidal zone to the continental shelf edge in depths up to 150 m (Scott and Scott, 1988). A commercial fishery is currently active for this species in the study area (Barter, *pers. comm*., 2020). Table 3.7 in Section 3.7 provides the timing of the commercial bait fishery in the study area.

In Atlantic Canada, this species moves to inshore waters during the summer months and returns to deeper offshore waters during the cooler winter months (Scott and Scott, 1988). Coastal populations tend to spawn in or near the mouths of estuaries during March and April over sandy or muddy bottoms. Juveniles prefer to remain in estuaries with warm temperatures and shallow sandy substrates for a period of two to three years while foraging on a variety of small crustaceans (primarily amphipods). Adults prefer sandy or muddy bottoms, but can also be found in areas with pebbly and gravelly substrate (USFWS, 2001). Adults feed on polychaetes, crustaceans, bivalves, fish eggs, small fish and conspecifics if available (Pereira et al., 1999). They are important prey species for a number of larger fish and marine mammal species.

4.1.6 Shortfin Squid (*Illex illecebrosus*)

The Shortfin Squid is a small schooling species of squid, which occurs in the northwestern Atlantic Ocean, with its highest abundance in the region between the Gulf of St. Lawrence/Newfoundland and Cape Hatteras (Stephen, 1982). A recreational fishery is currently active for this species in the vicinity of the study area (Barter, *pers. comm.*, 2020). Table 3.7 in Section 3.7 provides the timing of the recreational fishery in the study area.

From April to June, young squid (3 to 6 months) migrate from the slope waters beyond the edge of the continental shelf onto the Grand Banks, the Scotian Shelf, Georges Bank and the mid-Atlantic Bight shelf

areas to feed. During the summer July to September, Short-Finned Squid are found over large areas of the continental shelf, sometimes including the Gulf of St. Lawrence (Rowell, 1989). In October and November, the larger, maturing squid leave the shelf areas. The adults are suspected to migrate to a spawning area near Cape Hatteras or even further (Dawe and Hendrickson, 1998) and die after spawning. The adult females produce large, clear, almost neutrally buoyant egg masses by releasing a gel-like substance along with the fertilized eggs. These eggs generally hatch two weeks after fertilization, and larvae are most abundant in late January to February in the nutrient rich waters of the Gulf Stream/Slope Water zone and the warmer water (> 13°C) above the thermocline (Christian et al., 2010).

The larvae feed on small zooplankton and are a food source for larger planktivores. Juvenile Short-Finned Squid live in the Gulf Stream frontal zone and the Slope Water off the edge of the continental shelf until they reach about 10 mm mantle length, and then move to the adult feeding areas on the shelf (Christian et al., 2010). Both adults and juveniles are thought to undergo daily vertical migrations within the water column in search of prey. Juveniles feed mostly on small plankton crustaceans, while adult squid eat larger crustaceans, a variety of fish, and other squid. Squid in turn are preyed upon by a wide range of larger species, such as tunas, swordfish, haddock, cod, pollock, sharks, pilot whales, dolphins, shearwaters, fulmars, gannets and gulls.

4.1.7 Longfin Squid (*Doryteuthis pealeii*)

The longfin squid is a schooling species, which occurs in the North Atlantic, in continental shelf and slope waters from Newfoundland to the Gulf of Venezuela (Stephen, 1982; Dawe et al., 2007). A recreational fishery is currently active for this species in the study area (Barter, pers. comm., 2020). Table 3.7 in Section 3.7 provides the timing of the recreational fishery in the study area.

Like many other squid species, they can manipulate their colour, thought they often have a reddish hue. Large males can reach a dorsal mantle length of 50 cm, while females are smaller. They occur around Newfoundland and on the Scotian Shelf, but in low abundance compared to the southern end of its range (Black et al., 1987), although Dawe et al. (1990) described a major extension of the geographic range of the long-finned squid based on its occurrence in Newfoundland inshore trap samples in the autumn of 1986. Dawe et al. (1990) also determined that long-finned squid may spawn in Nova Scotia, but not Newfoundland waters. In early winter, they migrate offshore to avoid colder coastal waters, to overwinter in submarine canyons and areas along the edge of the continental shelf at depths of 100 to 250 m with warmer water temperatures (9 to 12°C). In spring, they migrate inshore to the continental shelf and coastal waters (< 100 m) where they spawn and feed, with spawning occurring primarily between Cape Cod and Cape Hatteras. (Christensen et al., 2010).

Each female lays 20 to 30 egg capsules on the bottom, in clusters 50 to 60 cm wide. These clusters are often laid on rocks, small boulder, sand/mud substrates, or algae. Both males and breeding pairs have been reported to guard the eggs. This species grows very rapidly and completes its life cycle in less than one year (Brodziak and Macy, 1996; Brodziak, 1998). Adults are primarily demersal, while juveniles migrate vertically upward in the water column at night to avoid predators or to find prey. The larvae are pelagic in the near surface waters (Christensen et al., 2010).

Long-finned squid are a valuable food source for many fish species, such as mackerel, cod, haddock, pollock, hake, dogfish and flounder, marine mammals such as the Pilot Whale and Common Dolphin, and diving birds. They are also an important commercial resource in the northwestern Atlantic Ocean.

4.2 Additional Fisheries Occurring in Zone 3Pn

Several additional invertebrate, fish and marine mammal species may be harvested within NAFO 3Pn. This may include commercial and recreational fisheries. Brief descriptions of these species and their current harvest status in the study area are provided in the following subsections.

4.2.1 Atlantic Halibut (*Hippoglossus hippoglossus*)

Atlantic halibut is the largest of all flatfish (Cargnelli et al., 1999a), exceeding 2.5 m in length and 300 kg in weight. It is the most commercially valuable and widely distributed groundfish in the Atlantic Ocean, with populations in the northwest ranging from Virginia to the Arctic Ocean (DFO, 2016c). A commercial fishery is currently active for this species in NAFO zone 3P (Riggs-Power, *pers. comm*., 2020). Table 3.7 in Section 3.7 provides the timing of the commercial fishery in the study area.

Atlantic halibut populations occur along the coasts of Newfoundland and Labrador, the Gulf of St. Lawrence, the eastern shore of Nova Scotia, and the Bay of Fundy (Cargnelli et al., 1999a; DFO, 2016c). Atlantic halibut distribution also include the deep waters bordering the Laurentian Channel during the spring (Scott and Scott, 1988; Kulka et al., 2003). Halibut are demersal, generally living on or near the bottom (DFO, 2016c), and their specific habitat preferences vary by age. Juveniles inhabit well-defined nursery grounds in coastal waters between 20 to 60 m deep with sandy bottoms from which they emigrate at approximately 3 to 4 years of age. While juveniles are capable of surviving in waters below 0°C, they prefer water temperatures above 2°C. Adult Atlantic halibut prefer depths of 100 to 700 m with sand, gravel or clay substrate, and typically prefer water temperatures above 4°C (Cargnelli et al., 1999a).

Age at maturity is unknown in Atlantic halibut, but females tend to mature at larger sizes (115 cm) than males (75 cm) (Cargnelli et al., 1999a; DFO, 2016c). Atlantic halibut spawn annually during late winter and early spring, with peak spawning between November and December. In the western Atlantic, spawning occurs on the slopes and offshore banks of the continental shelf. Spawning typically takes place at depths between 183 to 700 m, temperatures between 4 and 7°C and salinities between 33.8 and 35.0 ppt over harder substrates, such as sand, gravel, clay and rock. The larvae are pelagic and thrive in salinities between 30 and 34 ppt (Cargnelli et al., 1999a).

The diet of Atlantic halibut shifts from invertebrates to fish with increasing body size. Crustaceans (mostly decapods) dominate the diet of smaller (<30 cm) halibut. Halibut 30 to 80 cm in length feed on both crustaceans and fish, while halibut larger than 80 cm feed almost exclusively on fish, including cod, haddock, herring, capelin, flounder, mackerel, sculpin, ocean perch, skate, silver hake, flatfish, redfish and pollock (Cargnelli et al., 1999a; DFO, 2016c).

4.2.2 Capelin (*Mallotus villosus*)

Capelin are small, slender schooling fish, typically 13 to 20 cm in length (DFO, 2016d). They have a circumpolar distribution in the north Pacific and Atlantic oceans (Rose, 2005). In the northwest Atlantic, capelin occur along the coast of Newfoundland and Labrador, the Grand Banks and in the Estuary and Gulf of St. Lawrence (DFO, 2011b), with the largest stocks reported around Newfoundland (Huse, 1998). A commercial fishery is currently active for this species in NAFO zone 3P (Riggs-Power, *pers. comm*., 2020). Table 3.7 in Section 3.7 provides the timing of the commercial fishery in the study area.

Capelin reach maturity at 2 to 3 years of age and generally have one spawning season annually (Huse, 1998). Newfoundland stocks overwinter offshore, but will migrate inshore to spawn either on sand-gravel beaches of the intertidal area or in deep coastal waters between 15 to 40 m (Winters, 1982). Capelin prefer to spawn in water temperatures between 2 to 12^{o}C and have been found to spawn on Newfoundland beaches in early July when water temperatures are <2^{o}C, switching to demersal spawning in late July when beaches become warmer than 12^{o}C (Crook et al., 2017). They also prefer to spawn at night. Upon release, eggs adhere to the substrate and hatch in approximately 15 days (at 10°C), after which the larvae remain near the water's surface until winter (DFO, 2011b). Nearly 100% of males die following reproduction (DFO, 2011b), while females will leave spawning grounds and return the following year (Huse, 1998). Capelin feed primarily on copepods, but also larval fishes, crustaceans, polychaetes and euphausiids. They are an important food source for over 50 species of fish, marine mammals and seabirds (WDFW, 2017).

4.2.3 American Eel (*Anguilla rostrata*)

The American eel is a snakelike fish species native to coastal, estuarine and fresh waters connected to the western Atlantic Ocean (COSEWIC, 2012a). This species is not federally listed as a species at risk, however COSEWIC has designated the Atlantic Canadian population 'threatened'. The American eel has supported major commercial and recreational fisheries and is important both culturally and historically to Aboriginal and Indigenous groups and communities across Canada (COSEWIC, 2012a). Commercial and recreational fisheries for this species are active in NAFO zone 3P (Riggs-Power, *pers. comm*., 2020), although they are considered to be species of conservation concern. Details on the federal and provincial conservation status of American eel are provided in Section 3.9. Table 3.7 in Section 3.7 provides the timing of the recreational fishery in the study area.

Adults undergo extensive spawning migrations to the Sargasso Sea, a large body of warm oceanic water off the coast of the southeastern United States and the only known spawning grounds for American eel. Exactly how the Sargasso Sea accommodates the spawning and incubation requirements for American eel is unknown (COSEWIC, 2012a). Spawning, egg hatching and the emigration of larvae occurs sometime over the winter and early spring, possibly between February and April (COSEWIC, 2012a); larvae borne upon Gulf Stream currents are passively transported out of the Sargasso Sea before undertaking their own migration over the continental shelf to coastal waters of eastern North America. Juvenile eels arrive in estuarine waters between May and July in the Gulf of St. Lawrence (COSEWIC, 2012a), and soon after migrate to estuarine, brackish, and upstream freshwater habitats wherein they spend the remainder of their adult lives. Adults typically burrow in sediment or seek refuge in interstitial spaces before nightly foraging activities; shallow, protected waters with rocks, fine sediment, woody debris and aquatic vegetation, including eelgrass, are important habitat characteristics (COSEWIC,

2012a). Overwintering typically occurs in muddy bottoms in shallow bays and estuarine habitats in which adults enter a state of torpor; however, their winter habitats are poorly understood.

Adult eel forage on a variety of organisms, including small fish, molluscs, crustaceans, insect larvae, surface-dwelling insects, worms, and occasionally plants; some evidence suggests periodic foraging occurs through the winter months (COSEWIC, 2012a). After a period of time (upward of 20 years) adult American eel migrate back to the Sargasso Sea to spawn and complete their lifecycle (COSEWIC, 2012a; Murua and Saborido-Rey, 2003).

4.2.4 Northern Shrimp (*Pandalus borealis*)

The Northern shrimp is a medium-sized crustacean, which is found throughout the North Atlantic, North Pacific and Arctic oceans (ASMFC, n.d.). A commercial fishery is currently active for this species in the Gulf of St. Lawrence (Riggs-Power, *pers. comm*., 2020). This species is known to spawn in the shallow waters along south coast of Newfoundland near Rose Blanche Bank and Burgeo Bank (Parsons, 1993). Table 3.7 in Section 3.7 provides the timing of the commercial fishery in the study area.

They are typically found in habitats with soft mud and silt substrates or occasionally gravel/rock or sand substrates (Christian et al., 2010). The distribution of adult northern shrimp is correlated with seasonal changes in water temperature (ASMFC, n.d.). The areas of the North Atlantic where northern shrimp are the most abundant range in temperature from 1 to 6°C. Distribution within the water column also varies temporally, as northern shrimp feed on worms, small crustaceans, detritus and vegetation near the bottom during the day and migrate upwards to feed on copepods and euphausiids at night (Christian et al., 2010).

Spawning occurs annually in offshore waters during late summer (ASMFC, n.d.). Upon release, eggs adhere to the female's abdomen. Egg-bearing females migrate to cooler coastal waters in late autumn-early winter, where they remain until the eggs hatch, from February to April. After the eggs hatch, the females return offshore, while the larvae develop nearshore into juvenile males before migrating to deeper waters to continue development at around 20 months of age. After one to several years as males, northern shrimp will then sexually transition into females by their fourth year (ASMFC, n.d.).

4.2.5 Snow Crab (*Chionoecetes opilio*)

The snow crab is a large decapod crustacean species with a flat, roundish carapace and five (5) pairs of long legs. They occur in the Northwest Atlantic from Greenland south to the Gulf of Maine (Christian et al., 2010). Snow crab supports a major fishery in Newfoundland, and there is an active commercial fishery for this species in NAFO zone 3P (Riggs-Power, *pers. comm*., 2020). Table 3.7 in Section 3.7 provides the timing of the commercial fishery in the study area.

Adult snow crabs are found primarily on muddy-sandy substrates at depths ranging from 50 to 280 m and water temperatures from -1 to 11°C (Hébert et al., 2011), while smaller crabs prefer more complex habitat and may also utilize harder, rocky substrates (Christian et al., 2010). Individuals molt annually until they reach adulthood, which for males occurs when they have developed large claws on their front legs and for females when their carapace has grown large enough to hold eggs (DFO, 2013b). Mating occurs in the spring, during the female's final moult, when males assist females with moulting and

protect her during the vulnerable softshell stage. Once extruded, the eggs adhere to the female's abdomen, and she carries them for up to two years before they hatch (DFO, 2013b). The eggs hatch in the late spring or early summer, and the resulting larvae spend 12 to 15 weeks in the water column before settling to the seabed and metamorphosing into juvenile snow crabs (Christian et al., 2010).

Snow crabs feed on fish, bivalves and gastropods, polychaete worms, sea urchins, brittle starts, shrimp, large zooplankton and smaller snow crabs (Hébert et al., 2011; DFO, 2013b). Their predators include halibut, skates, cod, seals, squids, American plaice and larger crabs (Hébert et al., 2011). Migratory behaviour for this species is poorly known, although nearshore populations in Bonne Bay, on the west coast of Newfoundland, have been observed migrating to shallow water in the spring; an event which coincides with moulting and mating (Lovrich et al., 1995; Hooper, 1986; Ennis et al., 1990).

4.2.6 Toad / Lyre Crab (*Hyas araneus, Hyas coarctatus*)

The term toad crab or lyre crab is applied to two species of *Hyas* crabs, the *H. araneus* and *H. coarctatus*. These species are widespread on both sides of the North Atlantic Ocean, ranging from shallow subtidal areas to depths to 1,650 m (DFO, 1996). Toad crab has recently been the target of exploratory commercial fisheries in Newfoundland and Nova Scotia. This crab species has been targeted in Newfoundland waters since 1994, and a recreational fishery is currently active for this species in the vicinity of the study area (Barter, *pers. comm*., 2020). Table 3.7 in Section 3.7 provides the timing of the commercial fishery in the study area.

Toad crab tends to be found in slightly shallower water than lyre crab (Miller and O'Keefe, 1981). Lyre crab are very common near most of the coastline of Newfoundland and Labrador, sometimes occurring in tide pools, and on the continental slopes from Labrador to the Grand Banks (Christian et al., 2010). Both species have a triangular carapace, which narrows towards the front, five pairs of long walking legs and a well-developed pair of pincers on the front pair of legs. The carapace terminates in a two-pronged rostrum that extends between the eyes. They generally prefer gravel, sand or mud substrates. Their diet includes amphipods, euphausiids, copepods, polychaetes, hydroids, bivalves, brittle stars, gastropods, chitons, sea urchins, small crabs, and scavenged fish (Squires, 1965). They in turn are preyed upon by various groundfish species and decapod crustaceans (DFO, 1996).

Like snow crab, lyre crabs do not reach sexual maturity until after their final moult. Females are thought to carry eggs for about 10 months (Squires, 1990). Like all marine crab species, they have pelagic larval stages. Eggs typically hatch during the warmer summer months and larvae remain in the upper water column for one to several months as they molt through three larval stages before settling to the bottom and metamorphosing into juvenile crabs (Roff et al., 1984a). The larvae feed on plankton and in turn are preyed up on by larger zooplankton and planktivorous fish.

4.2.7 Waved Whelk (*Buccinum undatum*)

The waved whelk, also known as the common or rough whelk, is a species of carnivorous marine snail native to the North Atlantic, where it occurs from Labrador south to New Jersey, including the Gulf of St. Lawrence (Christian et al., 2010). A small commercial fishery is currently active for this species in NAFO zones 3Pn and 4R (Riggs-Power, *pers. comm*., 2020). Table 3.7 in Section 3.7 provides the timing of the commercial fishery in the study area.

This gastropod is very common in cold water from tidal level to depths of 180 m. They are found from the intertidal zone up to depths of 180 m (Kenchington and Glass, 1998), primarily on soft sediments, where they often bury themselves (Himmelman, 1988). Individuals grow to a shell length of 15cm and feed primary on bivalves, although they are also known to behave as scavengers, resulting in them being caught as bycatch in the lobster fishery (Kenchington and Glass, 1998). Waved whelk aggregate in mid-May for mating, and in some cases, migration occurs into shallow areas (Lanteigne and Davidson, 1992). Eggs are laid in clusters on exposed surfaces, boulders, and kelp (Martel et al., 1986), and take between five to eight months to hatch into juvenile snails (Martel et al., 1986), there is no planktonic stage (Gendron, 1992). An edible species, waved whelks are the focus of a small fishery on Canada's east coast, although whelks can be toxic to humans if they consume contaminated shellfish (Caddy and Chandler, 1968).

4.2.8 Witch Flounder (*Glyptocephalus cynoglossus*)

Witch flounder is a deep-water marine flatfish also known as greysole. Ranging from the Gulf of St. Lawrence south to Cape Hatteras, this species is usually found offshore in moderately deep water, from depths of 45 to 275 m. A small commercial fishery is currently active for this species in Newfoundland (Riggs-Power, *pers. comm*., 2020). Table 3.7 in Section 3.7 provides the timing of the commercial fishery in the study area.

They appear to prefer mud or sand-mud substrates and water temperatures of 2 to 6°C (Scott and Scott, 1988; Cargnelli et al., 1999b). They do not appear to migrate (Scott and Scott, 1988; Cargnelli et al., 1999b). Witch flounder are a slow growing, long lived species that have been aged over 20 years old (Maddock- Parsons, 2005a). Spawning occurs from March to November in temperatures of 0 to 10°C; the eggs are buoyant and hatch seven to eight days later in the upper water column at temperatures of 7.8-9.4°C. Witch flounder utilize the entire water column: upper as larvae, deep water as juveniles, and benthic zone as adults. Preferred benthic substrate consists of mud, clay, silt, or muddy sand. Prey consists of polychaetes, crustaceans, mollusks, echinoderms, and tunicates (Cargnelli et al., 1999b).

4.2.9 Atlantic Salmon *(Salmo salar*)

Atlantic salmon are an anadromous fish species native to the northern Atlantic Ocean and Baltic Sea. In the western Atlantic, salmon range from Labrador and northern Quebec to the Gulf of St. Lawrence and south to New York State (COSEWIC, 2010b). A recreational fishery is currently active for Atlantic salmon in insular NL, as well as a limited recreational fishery in coastal areas of NAFO zone 3Pn (Riggs-Power, *pers. comm*., 2020). Table 3.7 in Section 3.7 provides the timing of the insular recreational fishery in the study area.

Atlantic salmon undertake extensive seasonal migrations; long foraging migrations at sea give way to spawning migrations and a return to natal freshwater spawning grounds. Spawning adults move upriver from spring through fall with egg deposition generally occurring in October and November in gravelly substrates near the head of riffles or the tail of a pool (COSEWIC, 2010b). Adults return to sea after spawning or remain in freshwater habitats until the following spring, whereas juveniles develop in freshwater habitats over a period of two to eight years prior to emigrating to marine waters for further development and foraging migrations. Newly emigrated salmon typically return to their natal streams for spawning after a development period of one to two years at sea. Physicochemical parameters influencing

the productivity of spawning habitats are strongly linked to temperature, water flow and pH; temperature and water flow preference fluctuates depending on life history stage, whereas pH lower than 5.0 negatively impact all life history stages (Elliott and Elliott, 2010; COSEWIC, 2010b). Juvenile salmon feed on a variety of aquatic insects, invertebrates and plankton. Adults prefer a diet rich in pelagic and demersal finfish, in addition to small crustaceans and other invertebrates (COSEWIC, 2010b).

Atlantic salmon spend part of their life feeding and growing during long migrations at sea and then returning to reproduce in their natal freshwater streams. Spawning Atlantic salmon move upriver from spring through fall. Spawning occurs from October to November usually in gravelly substrates near the head of riffles, or the tail of a pool. Salmon parr usually live in shallow riffle areas that have gravel, cobble, or boulder bottoms (Page and Burr, 1991). Spawned out adults immediately return to sea or overwinter in freshwater until returning to sea in spring. The preferred freshwater habitats for each life stage of Atlantic salmon are riffles and pools with high percentages of pebble and gravel substrate.

Several salmon stocks or populations occur around Newfoundland and in the Gulf of St. Lawrence. Populations potentially occurring in the study area, which are considered to be of conservation concern are discussed in Section 3.9.

4.2.10 Deepwater Redfish (*Sebastes mentella*)

Like most redfish species, the deepwater redfish is a spiny-rayed fish with distinct red coloration, a bony protrusion on the lower jaw, large eyes, and a fan of bony spines around the gill covers (COSEWIC, 2010c). Table 3.7 in Section 3.7 provides the timing of the commercial fishery in the study area.

Deepwater redfish live on both sides of North Atlantic, primarily along continental slopes and in deep channels, from 350 to 500 m (Atkinson, 1987). Redfish are a long lived and slow growing species living up to 75 years. Breeding occurs between September and December. Unlike most marine fish species, deepwater redfish give birth to live young. These larval fish inhabit surface waters, where they feed in copepods and fish eggs. Adults and juveniles feed on larger copepods and euphausiids and occur in deep cold water (5°C), where they undertake daily vertical migrations in search of prey (COSEWIC, 2010c).

Two species of redfish with overlapping habitats occur along the southern coast of Newfoundland, the deepwater redfish and the very similar Acadian redfish (*S. fasciatius*). These two species can be difficult to differentiate, and they are often treated together as simply ‘redfish’ (COSEWIC 2010). They are also known to hybridize in the GOSL and the Laurentian Channel (Roiques et al., 2001, Vaneltin, 2006). A commercial fishery is currently active for ‘redfish’ in NAFO zone 3P (Riggs-Power, *pers. comm.*, 2020).

In Canadian waters, there are two deepwater redfish populations: the Northern stock, and the Gulf of St. Lawrence and Laurentian Channel stock. The latter population occurs within the deeper waters of the study area. Deepwater redfish populations potentially occurring in the study area, which are considered to be of conservation concern are discussed in Section 3.9. Known redfish spawning habitats are provided in Appendix A, Figure 6.

4.2.11 Atlantic / Acadian Redfish (*Sebastes fasciatus*)

The second species of redfish occurring in the study area, the Acadian redfish or ocean perch, is very similar to the deepwater redfish discussed previously, but generally occurs in shallower waters than the deepwater redfish, at depths between 150 and 300 m deep (Atkinson and Melteff, 1986). Table 3.7 in Section 3.7 provides the timing of the commercial fishery in the study area.

Redfish are a long lived and slow growing species living up to 75 years. Breeding occurs between September and December. Female Acadian redfish give birth to live young, with larval release occurring from late spring to early summer. The larvae spend time around the surface before descending to the depths with the adults. This species only has a strong breeding year every 5 to 12 years (COSEWIC, 2010c). The closely related deepwater redfish (*S. mentella*) has a similar appearance and an overlapping range, and is challenging to distinguish from the Acadian redfish without DNA testing (COSEWIC, 2010c). A commercial fishery is currently active for 'redfish' in NAFO zone 3P (Riggs-Power, *pers. comm*., 2020). In Canadian waters, there are two Acadian Redfish populations: the Atlantic, and the Bonne Bay stocks. The former population occurs within the deeper waters of the study area. Acadian redfish populations potentially occurring in the study area, which are considered to be of conservation concern are discussed in Section 3.9. Known redfish spawning habitats are provided in Appendix A, Figure 6.

4.2.12 Brook Trout (*Salvelinus fontinalis*)

Brook trout are an anadromous or freshwater species native to the western Atlantic Ocean with populations dispersed throughout Canada, including Labrador and northern Quebec, through the Great Lakes and Atlantic Canada to the northeastern United States (Raleigh, 1982). A recreational fishery for brook trout occurs in much of insular NL, while sea-run brook trout are targeted by anglers in in coastal areas of in NAFO zone 3P (Riggs-Power, *pers. comm*., 2020). Table 3.7 in Section 3.7 provides the timing of the recreational fishery in the study area.

Brook trout life history alternates between the northern and southern range of the species; populations in the northerly range are longer lived and make foraging migrations into estuaries and near-shore coastal waters, whereas more southerly populations have shorter lives and do not migrate into marine waters (Raleigh, 1982). Brook trout residing in freshwater systems require a year-round supply of cold, clear water and cover from overhanging branches, logs and rocks. Streams with cool, quiet pools between runs of fast water and rapids are typical habitat, as are clear, cold lakes and beaver ponds (OMNR, 2011). Spawning occurs in late summer and fall within stream riffle habitats, where the female deposits fertilized eggs in a depression she excavates in the gravel substrate (Scott and Scott, 1988; Raleigh, 1982). During winter, trout seek shelter from freezing and ice within deep pools, ponds, lakes, around instream debris and undercut banks (Huusko et al., 2007). Sea-run trout have been reported to make month long forays into coastal waters on foraging migrations (Raleigh, 1982). These migrations occur periodically through the spring, as well as the fall and early winter; summer and midwinter migrations are rarely observed (Raleigh, 1982). Sea-run brook trout also reportedly overwinter in estuaries and nearshore coastal waters (Raleigh, 1982). They are aggressive carnivores feeding primarily on aquatic macroinvertebrates and terrestrial insects in addition to small fish, bivalves, gastropods, frogs and salamanders (NSDFA, 2007).

4.2.13 Winter Skate (*Leucoraja ocellata*)

Winter skate are a demersal species endemic to the northwest Atlantic ranging from the Gulf of St. Lawrence and southern Newfoundland to North Carolina (COSEWIC, 2015). This species is not federally listed as a species at risk; however, COSEWIC has designated it 'endangered' in Atlantic Canadian waters. A commercial 'skate' fishery is currently active in NAFO zone 3P, (Riggs-Power, pers. comm., 2020), and likely harvests winter skate. Table 3.7 in Section 3.7 provides the timing of the commercial 'skate' fishery in the study area.

Winter skate are generally found on sand and gravel substrates in depths less than 110 m at temperatures between 5 and 16°C (COSEWIC, 2015). In the summer and autumn, winter skate found in the southern Gulf occupy very shallow inshore areas before dispersing to the Magdalen Shallows and Laurentian Channel in winter (COSEWIC, 2015). Spawning winter skate deposit 40 to 70 egg cases annually. Juveniles emerge after up to 22 months of development in the egg case. Some evidence suggests hatched juveniles spend time in very shallow nearshore habitats (COSEWIC, 2015). Adults forage on a variety of species including American sandlance, Atlantic rock crab and squid, in addition to annelid worms, amphipods, shrimp, razor clams and conspecifics. Juveniles primarily feed on small crustaceans (COSEWIC, 2015). This species is preyed upon by several species of sharks, skates and seals (COSEWIC, 2015). COSEWIC reports that the population of winter skate in the southern Gulf of St. Lawrence has decreased precipitously with reductions of 95-99% since the 1970's; the likeliest cause for this decrease is historic overfishing and accidental mortality as by-catch of groundfish fisheries (COSEWIC, 2015).

There are three populations of winter skate occurring in eastern Canadian waters (COSEWIC, 2015). Winter skate populations potentially occurring in the study area, which are considered to be of conservation concern are discussed in Section 3.9.

4.2.14 Thorny Skate (*Amblyraja radiata*)

The thorny skate is a slow-growing, late-maturing skate species, which occurs on both sides of the Atlantic Ocean. A commercial 'skate' fishery is currently active in NAFO zone 3P, (Riggs-Power, *pers. comm*., 2020), and likely harvests thorny skate. Table 3.7 in Section 3.7 provides the timing of the commercial 'skate' fishery in the study area.

Like all skates, it has a flattened body with large disk-like pectoral fins and a long narrow tail ending in two small dorsal fins. Adult thorny skates can reach 110 cm in length. This species is identifiable by the row of 11 to 19 large thorns running down the middle of the back and along the tail. Adults are usually brown in colour, while younger individuals may have darker spots (COSEWIC, 2012b). In Canada, it is found from Baffin Bay, to the Grand Banks, Scotian Shelf, and the Bay of Fundy, including the Gulf of St. Lawrence, over a wide range of depths. They are found in a wide range of depths (primarily 18-1200 m), on a variety of bottom types including sand, gravel, mud and broken shells, typically in water temperatures of 0 to 10°C. Once mature at about 11 years of age, they produce up to 40 egg capsules per year, which hatch in up to 22 months as fully formed juvenile skates.

As summarized in COSEWIC (2012b), thorny skates are known to feed on decapod crustaceans, euphausiids, fish, cephalopods, and polychaetes. There is little information regarding predation on

Thorny Skate, although a few fish and shark species have been reported to prey on them (COSEWIC, 2012b).

4.2.15 Smooth Skate (*Malacoraja senta*)

The smooth skate is endemic to the northwest Atlantic, where it occurs from the mid-Labrador coast (Hopedale Channel) to southern Georges Bank. A commercial 'skate' fishery is currently active in NAFO zone 3P, (Riggs-Power, *pers. comm*., 2020), and may harvest smooth skate. Table 3.7 in Section 3.7 provides the timing of the commercial 'skate' fishery in the study area.

Smooth skate are one of the smallest skates in the northwest Atlantic (maximum length of 66 cm), and can be identified by its long tail, which is longer relative to its body length than other sake species in the region (COSEWIC, 2012c). A demersal species, they prefer soft mud and clay substrates and appear to prefer temperatures between 3 and 10°C. They grow relatively slowly, are slow to reproduce (40 to 100 large egg capsules per year) and live a relatively long time (COSEWIC, 2012c). Smooth Skate in the southern Gulf of St. Lawrence are distributed primarily along the slopes of the Laurentian Channel (Swain and Benoît, 2012). They mostly feed on small crustaceans. Reproduction occurs throughout the range, with females producing up to 100 egg capsules per year (McPhie and Campana, 2009; Simon et al., 2012). These capsules are laid on the bottom and each yields a single fully-developed juvenile skate after one or two years. Adult skates are preyed upon by seals (Benoît and Swain, 2011, while fish and gastropods may eat the egg capsules (Cox et al., 1999).

There are four populations of smooth skate occurring in eastern Canadian waters. Smooth skate populations potentially occurring in the study area, which are considered to be of conservation concern are discussed in Section 3.9.

4.2.16 Hooded Seal (*Cystophora cristata*)

The hooded seal is a species of true seal, which can reach 2.6 m in length. Adult males can reach 300 to 460 kg, while females are about 145 to 300 kg (DFO, 2019b). They whelp on pack ice in mid to late march (DFO, 2019b), and pups grow rapidly, doubling their birth weight in just four days (DFO, 2019b). Populations of hooded seal in the northwest Atlantic are divided based on where they whelp, with the three main areas being the southern Gulf of St. Lawrence, the Davis Strait between Greenland and northern Canada, or off the coast of northern Newfoundland and Labrador. GPS tracking indicates that the majority of all three populations travel to the coast of Greenland to molt in June-July (Frederiksen et al., 2012). Diet also varies by region, with the population in the study area (southern Gulf of St. Lawrence population) feeding on invertebrates, squid and fish, with Greenland halibut and redfish being preferred species (Ross, 1992).

A commercial harvest is currently active for this species in Newfoundland Sealing Areas 4-23, 25-27 (Riggs-Power, *pers. comm*., 2020). Table 3.7 in Section 3.7 provides the timing of the commercial sealing fishery in the study area.

4.2.17 Harp Seal (*Pagophilus groenlandicus*)

The harp seal is a species of true seal that grows to be between 1.7 to 2.0 m and to and average weight of 135 kg for males and 120 for females (Kovacs, 2015). The Northwest Atlantic population's diet consists of

invertebrates and fish, with preference given to capelin when available (Lawson et al., 1998). Harp seals spend the summer in the Canadian arctic and migrate to the Gulf of St. Lawrence in the fall (DFO, 2019c). Females give birth to one pup between late February and mid-March and require stable ice conditions (DFO, 2019c).

A commercial harvest is currently active for this species in Newfoundland areas 4-23, 25-27 (Riggs-Power, *pers. comm*., 2020). Table 3.7 in Section 3.7 provides the timing of the commercial sealing fishery in the study area.

4.2.18Grey Seal (*Halichoerus grypus*)

The grey seal is a species of true seal, which grows up to 2.3 m in length and weighs up to 350kg for males, with females reaching 230 kg (DFO, 2019d). The Northwest Atlantic Grey Seal forms three herds based off their breeding locations: Sable Island, coastal Nova Scotia and the Gulf of St. Lawrence. Their diet consists of invertebrates, octopus, and fish with sand lance being the preferred prey species for the Sable Island population (Bowen and Harrison, 1994), and the Gulf population preferring cod (Murie and Lavigne, 1992). Grey seals have been blamed for inhibiting the rebound of Atlantic cod and winter skate; however, the information is not conclusive (Benoît et al., 2011). Grey seals breed in winter on ice, if ice is not available they will use ice floes or rocky beaches (Haller et al., 1996). During the breeding seasons the seals do not eat and live off of their fat reserves (Anderson and Harwood, 1985).

A commercial harvest is currently active for this species in Newfoundland areas 4-23, 25-27 (Riggs-Power, *pers. comm*., 2020). Table 3.7 in Section 3.7 provides the timing of the commercial sealing fishery in the study area.

4.3 Aquatic Species at Risk and Species of Conservation Concern Occurring in the Study Area

Many species of fish, marine mammals, and marine reptiles may occur on a regular or seasonal basis within the study area are considered to be of conservation concern. Brief species descriptions and a general overview of the ecology of each species listed by SARA and/or COSEWIC which is considered to have potential to occur in the vicinity of the study area is provided in the following subsections. These species are summarized in Table 3.8.

Note that COSEWIC has not designated any species of invertebrates occurring in the study area as species of conservation concern. Also, profiles for species assessed by COSEWIC and determined to be 'Not at Risk' are not provided (unless they are still listed under SARA, such as the Humpback Whale), nor are profiles for species which have been declared extinct (such as Atlantic Walrus) or extirpated in Newfoundland (i.e. Gray Whale).

4.3.1 American Eel (*Anguilla rostrata*)

A general species description and ecological profile of this species was provided in Section 4.2.3. The American eel is listed as threatened under COSEWIC (COSEWIC, 2012a) and as vulnerable in Newfoundland and Labrador under NLESA. Globally, threats to the American eel include the loss,

degradation and fragmentation of their habitats, turbine mortality at hydroelectric facilities, unregulated fishing, chemical and biological contamination, parasites, eel stocking, illegal harvesting of *Sargassum* algae in spawning habitats and climate change. In Newfoundland, the immediate threat to this species is the destruction or exclusion of habitat through economic growth and development, although the province is still believed to contain a relative abundance of unexploited and pristine habitats (Wildlife Division, 2010).

4.3.2 Banded Killifish (*Fundulus diaphanus*)

The banded killifish is a small schooling species of fish belonging to the Fundulidae family, which usually inhabits freshwater streams and lakes, though they are tolerant of brackish water. The average banded killifish ranges from 10 to 13 cm in length and weighs a few grams, with females being larger. The banded killifish is olive on the dorsal surface and white underneath with yellowish throat and fins, and vertical blackish and silver-white stripes along the sides. They feed on aquatic invertebrates.

Banded killifish are often found in the clear shallow regions of lakes and ponds with muddy or sandy bottoms and high concentrations of detritus and submergent vegetation, which they rely on for spawning. The females lay eggs equipped with adhesive threads that adhere to aquatic vegetation. The species tend to spawn when temperatures reach 19 to 23 degrees.

Its natural geographic range extends from Newfoundland to South Carolina, and west to Minnesota, including the Great Lakes drainages. Although widely distributed in the Atlantic Provinces, there are only seven reported locations of banded killifish in Newfoundland, despite the fact that the habitat considered suitable for banded killifish is common within the Province. Most sites are located on the southwest portion of the Island and occur near the coast. However, they do occur inland in the Indian Bay watershed of northeastern Newfoundland. The preferred habitat of banded killifish in Newfoundland tends to be quiet areas of clear lakes and ponds that have a muddy or sandy bottom and abundant submerged aquatic vegetation and detritus (DFO, 2011c).

The Newfoundland population of Banded killifish was listed under Schedule 1 as Special Concern in 2005, and their status was reconfirmed in 2014 (COSEWIC, 2003a; and COSEWIC, 2014a). It was also listed as vulnerable in Newfoundland and Labrador under the provincial ESA in May 2003. Confined to widely scattered watershed across the island, banded killifish are limited by the availability of suitable habitats and an abundance of natural barriers to range expansion such as waterfalls, rapids and steep river gradients. Threats include anthropogenic activities such as, development and industrial activities (Osborne and Brazil, 2006). Their general inability to expand their range in Newfoundland and their consequent vulnerability to localized or broader-scale disruptions are the primary limiting factors and threats to banded killifish in Newfoundland (DFO, 2017a).

4.3.3 Atlantic Salmon (*Salmo salar*) – South Newfoundland West Population

A general species description and ecological profile of this species was provided in Section 4.2.9. There are two populations of Atlantic salmon that may occur in the study area due to the potential for overlap between the ranges of the South Newfoundland West population and the Southwest Newfoundland population. Cape Ray is generally accepted as the boundary between the two populations, and Port aux Basques harbour is only 12 km east of Cape Ray.

Originally, there was one single South Newfoundland population, that was designated as Threatened by COSEWIC in November 2010 (COSEWIC, 2010b). A new population structure was proposed and accepted by COSEWIC, and the original designated unit was split into two in 2025, the South Newfoundland East and the South Newfoundland West populations. The South Newfoundland West population was designated by COSEWIC as Endangered in December 2025.

The South Newfoundland West population breeds from the west of the Burin Peninsula to the southwestern tip of Newfoundland. In rivers monitored for this population, there has been a decrease of 66% of mature individuals over the last three years, and coincident declines of over 90% in spawners and eggs per spawner. This decline has occurred despite the fact that mortality from commercial fisheries in coastal areas has greatly declined since 1992. It is suspected that this decline may be due to lower survival rates at sea due to changes in marine ecosystems, however this is poorly understood. Poaching is also a threat in some rivers (COSEWIC, 2010b).

The Southwest Newfoundland population breeds from Cape Ray northward along the west coast of Newfoundland, and is not at risk, as of its latest reassessment in December 2025.

4.3.4 Atlantic Wolffish (*Anarhichas lupus*)

The Atlantic wolffish is a demersal, carnivorous eel-like marine fish, which is found primarily in deeper waters on the slope of continental shelves in the western Atlantic Ocean (COSEWIC, 2012d; Scott and Scott, 1988). When they are not spawning or guarding their eggs, adult Atlantic wolffish are often found at depths between 100 to 350m (McRuer et al., 2000). Water temperature is known as one of the main habitat selection features for Atlantic wolfish, which prefer temperatures between 1 and 9^{o}C (COSEWIC, 2012d). Adults can grow to a size of 152 cm (COSEWIC, 2012d). Their strong jaws and large head/mouth allow them to feed predominately on invertebrates including bivalve molluscs and gastropods, and they are important predators of green sea urchins and the invasive green crab (Bigelow et al., 1953). Atlantic wolffish are found exclusively on hard bottoms of rock or sand and are not present on mud, clay or silty bottoms (Keats et al., 1985).

Atlantic wolffish migrate to shallow waters in the spring and mate in September (Keats et al., 1985). Spawning occurs in shallow waters (e.g., 5 to 15 m (Templeman, 1986)) in areas of hard substrate such as boulders and rocks, which provide abundant shelter. The non-buoyant eggs are defended by the male until hatching in mid-December (Keats et al., 1985) after which the males disperse. The larvae stay on the bottom to consume their yolk sac before becoming free swimming and leaving the bottom, after which they may be dispersed by currents. However, most fry do not travel far from the area they were hatched. Only young of year wolfish are present in the upper water column while the adults are only present on the bottom (Scott and Scott, 1988). They are known to take shelter in rocks around where they hatched (Larocque et al., 2008). The fry grow rapidly for the first year then growth becomes very slow (Beese and Kandler, 1969). Females reach maturity at varying sizes (50 to 70 cm) (COSEWIC, 2012d). Juvenile Atlantic wolfish do not migrate inshore (Keats et al., 1985).

This species is federally protected under the *Species at Risk Act* and was listed as Schedule 1 Special Concern in June 2003, and is also listed by COSEWIC as Special Concern as of 2012 (COSEWIC, 2012d). Steep declines in abundance and area of occupancy occurred throughout their range from the 1980s

until the mid-1990s. Small increases have since occurred in their abundance and area of occupancy; however, their current abundance remains low compared to the early 1980s. The mandatory release policy for all wolffish likely contributes to their limited recovery, although continued bottom fishing in deeper water likely slows the recovery of this species. Other poorly understood factors are also thought to threaten the recovery of the Atlantic wolffish, including those associated with climate change and changing ocean temperatures (COSEWIC, 2012d).

4.3.5 Northern Wolffish (*Anarhichas denticulatus*)

The Northern wolffish is a demersal, carnivorous eel-like marine fish, which can reach 180 cm in length. Like all wolffishes, it has prominent teeth in the front of the jaws and flattened grinding teeth behind. It has a relatively smaller head than other wolffish species, with a greyish to dark brown body covered by indistinct dark bars or spots. The Northern wolffish inhabits boreal and subarctic waters on both sides of the North Atlantic and in the Arctic. In Canadian waters, it extends from the Canadian portion of the Gulf of Maine north to the Bay of Fundy, the Scotian Shelf, the Grand Banks, Gulf of St. Lawrence, Northeastern Newfoundland Shelf, and Labrador Sea as far as the waters west of Greenland (COSEWIC, 2012e; Scott and Scott, 1988). This species occurs at greater depths than Atlantic or spotted wolffish and is mostly found between 500 and 1,000 m. Adults generally undertake only limited movements, and feed primarily on pelagic fish, as well as jellyfish, echinoderms, crustaceans and molluscs. Juvenile wolffish have been found in the stomachs of seals, Atlantic cod, Atlantic halibut, and haddock (COSEWIC, 2012e). Larvae likely feed on crustaceans and fish eggs and larvae. Northern wolffish have gelatinous flesh, and there is currently there is no commercial interest in this species.

Northern wolffish were listed as Threatened under Schedule 1 of SARA in June 2003, and this status was re-examined and confirmed by COSEWIC as Threatened in November 2012. Strong declines in abundance and the size of their range occurred during the 1980s and continued into early 2000s after which small increases occurred in their abundance and area of occupancy. The mandatory release policy currently in place for all wolffish is thought to have contributed to their limited recovery, however continued bottom fishing in deeper water than those occupied by the Spotted wolffish contribute to the slow recovery of this species. Environmental factors associated with changing ocean temperatures are also thought to threaten northern wolffish (COSEWIC, 2012e).

4.3.6 Spotted Wolffish (*Anarchichas minor*)

The spotted wolffish is an elongated fish with a relatively large head, rounded snout, and large pectoral fins. Like other wolffish, it has large prominent canine-like teeth in the front of its jaws and flattened, grinding (vomerine) teeth. These teeth allow this species to feed largely on echinoderms, such as urchins, sand dollars and brittle stars, as well as shrimp and fish (Templeman, 1986; Simpson et al., 2011).

Spotted wolffish is distinguished from other wolffish by the distinctive spotted pattern on its body. This species is thought to spawn directly on the substrate, based on observations of the closely related Atlantic wolffish (O'Dea and Haedrich, 2001).

Adults are considered sedentary, though wolffish larvae are found in the upper water column, which allows for limited dispersal. Little is currently known about the population structure of this species

(Kulka et al., 2004). It is known to prefer cold water in the 1.5 to 5°C range (Kulka et al., 2004). No spawning, nursery or foraging grounds have been identified (Department of Fisheries and Oceans, 2011). They are most abundant at depths of 200 to 750 m, and there is some evidence that they occupy shallower depths during periods of high abundance (Kulka et al., 2004).

Spotted wolffish were listed under Schedule 1 of SARA as Threatened in June 2003, and their status was re-examined and confirmed by COSEWIC as Threatened in November 2012. Significant population declines occurred between the late 1970s and the mid 1990s as a result of high incidental bycatch rates associated with commercial groundfish fisheries, and the simultaneous destruction of benthic habitats due to trawling and dragging. The implementation of a mandatory release policy for all wolffish species in 2003, and a coincidental reduction in bottom fishing efforts, has seen the population and area of occupancy of Spotted wolffish slowly increase since 2003. However, poorly understood environmental variables associated with climate change represent a continued threat to the recovery of this species (COSEWIC, 2012f).

4.3.7 Deepwater Redfish (*Sebastes mentella*)

A general species description and ecological profile of this species was provided in Section 4.2.10. There are two populations of deepwater redfish occurring in the northwestern Atlantic. The population overlapping the study area, the Gulf of St. Lawrence - Laurentian Channel population has been designated as Endangered by COSEWIC but is not listed as a SARA Schedule 1 species. The current main threats to this species are directed fishing and bycatch in other fisheries (COSEWIC, 2010c).

4.3.8 Acadian Redfish (*Sebastes fasciatus*) - Atlantic Population

A general species description and ecological profile of this species was provided in Section 4.2.11. There are two populations of Acadian redfish occurring in the northwestern Atlantic. The population overlapping the study area, the Atlantic population has been designated as Threatened by COSEWIC but is not listed as a SARA Schedule 1 Species. This species' slow growth rate, in addition to a recent population crash due to overfishing in the 1970s, have contributed to this designation. Though still caught as bycatch, other areas that saw a population crash have recovered so recovery may be possible (COSEWIC, 2010c). Like the Deepwater redfish, the current main threats to this species are directed fishing and bycatch in other fisheries (COSEWIC, 2010c).

4.3.9 Atlantic Bluefin Tuna (*Thunnus thynnus*)

Atlantic bluefin tuna are a large, pelagic marine fish, which occurs in temperate through tropical waters (COSEWIC, 2011a). In the western Atlantic Ocean, Atlantic bluefin range from Newfoundland and the Gulf of St. Lawrence to Venezuela and Brazil (COSEWIC, 2011a). Atlantic Canadian waters provide summer foraging opportunities for Atlantic bluefin tuna. Fisheries data suggest they occur in the southern Gulf of St. Lawrence, including the Northumberland Strait, as well as the Scotian Shelf, Bay of Fundy and Grand Banks off Newfoundland (COSEWIC, 2011a). This species tolerates a wide range of temperature (3 to 30°C) and can dive to depths up to 1000 m (COSEWIC, 2011a). Spawning grounds in the western Atlantic Ocean are located in the Gulf of Mexico. Foraging adults feed on a wide variety of species in Canadian waters, including capelin, saury, herring, mackerel, barracudinas, lanternfishes, silver and white hake, squid and euphausiids. This species is in turn preyed upon by killer whales and mako sharks (COSEWIC, 2011a).

The Atlantic Bluefin tuna was ranked by COSEWIC as Endangered but is not listed as a SARA Schedule 1 species (COSEWIC, 2011a). While a small tuna fishery occurs in some areas of eastern Canada, there is currently no active directed Bluefin tuna fishery within the study area (Barter, *pers. comms.*, 2020; Riggs-Power, *pers. comms*., 2020). Historic and current overfishing of the species remains the largest threat to the western Atlantic population of Atlantic bluefin tuna (COSEWIC, 2011a).

4.3.10 American Plaice (*Hippoglossoides platessoides*)

American plaice is a marine flatfish species occurring in depths of 50 to 200 m (DFO, 2016e). Adults spend long periods burrowed in bottom sediment (DFO, 2016e). Spawning occurs throughout the year, but peaks early April and May. Broadcasted eggs drift in the upper water column with surface currents as far as 49 km from their spawning site (Johnson et al., 1999). Growth occurs most readily in temperatures between 1.7 and 7.7°C (Johnson et al., 1999). Adults are opportunistic feeders consuming sand dollars, sea urchins, brittle stars, herring and molluscs (Johnson et al. ,1999). Larvae predominately eat diatoms and copepods while juveniles consume a mixture of larval and adult prey items. Salinity preference is 31 to 34 ppt (Johnson et al., 1999).

There are two populations of American plaice potentially occurring in the study area, both of which have been designated by COSEWIC as Threatened, although neither are listed under Schedule 1 of SARA (COSEWIC, 2009a). The Maritimes population occurs in the Gulf of St. Lawrence, the Scotian Shelf, the Bay of Fundy and Georges Bank, while the Newfoundland and Labrador population occurs from Hudson Strait to the southern limit of the Grand Bank, and westward north of the Laurentian Channel to the southwestern corner of Newfoundland.

Overfishing is considered to be a major cause of the decline of both populations, although apparent increases in natural mortality in the 1990s, when the largest part of the decline occurred, may also have contributed (COSEWIC, 2009a).

4.3.11 Atlantic Cod (*Gadus morhua*)

A general species description and ecological profile of this species was provided in Section 4.1.2. There are two populations of Atlantic cod potentially occurring in the study area, both of which have been designated by COSEWIC as Endangered but are not SARA Schedule 1 species (COSEWIC, 2010a). The Laurentian North population occurs north of the Laurentian Channel, along the south and west coast of Newfoundland and the south coast of Quebec. The Laurentian South population extends from the southern Gulf of St. Lawrence to the eastern Scotian Shelf and the Cabot Strait, often overwintering along the southern slope of the Laurentian Channel.

Historic overfishing has drastically impacted both of these populations. A directed fishery still exists for the Laurentian North Population. The southern Laurentian population appeared to stabilize after the cessation of commercial fisheries in the early 1990s; however, continued small catches and increased natural mortality cause the population to decrease again.

4.3.12 Atlantic Sturgeon (*Acipenser oxyrinchus*)

Atlantic sturgeon is a large anadromous fish species, which occurs in most coastal waters of Canada between the Canada-US border and Ungava Bay, Labrador. This species spawns in relatively shallow

freshwater (1 to 3 m deep) characterized by strong current and rocky substrate. The Maritime population spawns in the Saint John River in New Brunswick. Juveniles overwinter in either freshwater or estuaries, while mature Atlantic sturgeon prefer estuaries and small bays, presumably to aid in transitioning between freshwater and saltwater environments. Adults spend most of the non-breeding season at sea, feeding on worms, crustaceans, molluscs, small fish and aquatic insects while migrating along the coast (DFO, 2018b).

There are two populations of Atlantic sturgeon, which could potentially occur in the study area, both of which have been designated by COSEWIC as Endangered, but neither are listed under Schedule 1 of SARA (COSEWIC, 2010b). These are the St Lawrence population and the Maritimes population. Neither of these are known or suspected to breed in the study area, but both populations may venture into coastal marine waters and, in particular, travel through the Laurentian Channel area between southwest Newfoundland and Nova Scotia (COSEWIC, 2010b).

4.3.13 White Hake (*Urophycis tenuis*)

White hake is a demersal gadiform (cod-like) finfish occupying the northwest Atlantic Ocean ranging from the Gulf of St. Lawrence and Newfoundland to North Carolina. This species is not federally listed as a species at risk; however, COSEWIC has designated the Southern Gulf of St. Lawrence population endangered in Atlantic Canadian waters. Adult White hake inhabit the benthos at varying depths and temperatures along the continental slope and shelf, whereas juveniles prefer estuaries and waters near shore. White hake of all ages prefer muddy and fine-grained sandy bottoms, and eelgrass is particularly important habitat for juveniles (Chang et al., 1999). Adult hake feed primarily on fish, shrimp and other crustaceans (COSEWIC, 2013a). Juveniles tend to feed on annelid worms and crustaceans. On the Scotian shelf, white hake spawn offshore in late summer, from August to September. Adults and juveniles migrate near shore during the warmer months and return to deeper waters during the colder months.

There are two populations of white hake potentially occurring in the study area. These are the Atlantic and Northern Gulf of St. Lawrence population, which has been designated at Threatened, and the Southern Gulf of St. Lawrence population which is Endangered (COSEWIC, 2013a). Both populations have declined in recent decades due to fishing pressure. Mortality due to predation are thought to be the main threat to the White hake population in the southern Gulf (COSEWIC, 2013a).

4.3.14 Basking Shark (*Cetorhinus maxima*)

The basking shark is the second largest fish in the world, second only to the whale shark. It is named after its habit of basking (actually feeding) at the water's surface, where it is usually observed. A planktivorous species, the basking shark tends to summer in areas where oceanographic conditions serve to concentrate their zooplankton prey. This included fronts where water masses meet, headlands, and around islands and bays with strong tidal flow (COSEWIC, 2009b).

Very little is known about the life history of this species, and small (young) individuals have only rarely been observed. They are long-lived and are thought to have the lowest estimated reproduction rate of any shark known (COSEWIC, 2009b). Adults have no known predators, but other sharks may possibly

prey on juveniles. Recent tagging studies have shown that Basking Sharks can dive to great depths and can spend considerable time at these depths (Gore et al., 2008; Skomal et al., 2009).

Basking sharks are found around the world in temperate coastal shelf waters, often in localized concentrations where food supplies are abundant. Individuals in Canada are considered to be part of an Atlantic population shared with the USA, Europe, the Caribbean, and northeastern South America (COSEWIC, 2009b).

Bycatch records from observer programs, visual surveys, and recent satellite tagging studies suggest that Basking Sharks in Atlantic Canada are most abundant south of the Newfoundland-Labrador shelf but may extend north to 51° latitude or beyond (COSEWIC, 2009b). An examination of 371 incidences of incidental bycatch of basking sharks in nearshore waters of Newfoundland in the early 1980s, when coastal fishing effort was considerably higher than at present, show that the catches were concentrated between Port aux Basques and Hermitage, with most captures occurring near headlands (Lien and Fawcett, 1986).

The basking shark was designated as Special Concern by COSEWIC in November 2009, but is not listed as a SARA Schedule 1 species. (COSEWIC, 2009b). Threats to this species include bycatch in in trawl, longline, and gillnet fisheries in Atlantic Canada, and collisions with ships. Characteristics making it vulnerable include late age of maturity, low fecundity and long gestation period (apparently the longest of any vertebrate), sex-segregated populations, overlapping habitats with commercial fisheries, surface behaviour, and naturally small populations. There is no evidence of recovery following declines associated with fisheries in other parts of their range (COSEWIC, 2009b).

4.3.15 Winter Skate (*Leucoraja ocellata*)

A general species description and ecological profile of this species was provided in Section 4.2.13. There are three populations of winter skate occurring in eastern Canadian waters (COSEWIC, 2015a). These are the Gulf of St. Lawrence, Eastern Scotian Shelf – Newfoundland, and Western Scotian Shelf - Georges Bank populations. Two of these populations, the Gulf of St. Lawrence, Eastern Scotian Shelf – Newfoundland likely have some overlap with the study area. Both of these populations have been designated by COSEWIC as Endangered, but are not listed as Schedule 1 species under SARA (COSEWIC 2015a). Both populations are currently at historically low levels, possibly due to high levels of bycatch in ground fish fisheries. There are no targeted fisheries for this species. There is currently an unsustainable rate of non-fishing mortality in both populations, which may be due to predation by grey seal, as well as continued bycatch pressure on the Eastern Scotian Shelf-Newfoundland population (COSEWIC, 2015a).

4.3.16 Thorny Skate (*Amblyraja radiata)*

A general species description and ecological profile of this species was provided in Section 4.2.14. As summarized in COSEWIC (2012b), thorny skates are known to feed on decapod crustaceans, euphausiids, fish, cephalopods, and polychaetes. There is little information regarding predation on thorny skate, although a few fish and shark species have been reported to prey on them (COSEWIC, 2012b).

This species was designated as Special Concern by COSEWIC in 2012 but is not listed under SARA as a Schedule 1 species (COSEWIC, 2012b). While it has few natural predators, it is subject to both targeted and bycatch fishing mortality. Fishing pressure and predation, combined with this species' low fecundity and late maturity are causes for concern for this species.

4.3.17 Smooth Skate (*Malacoraja senta*)

A general species description and ecological profile of this species was provided in Section 4.2.15. Of the four populations of smooth skate recognized in eastern Canada, one occurs within the study area. The Laurentian-Scotian population, which occurs in the Gulf of St Lawrence and over the Scotian Shelf, is ranked as Special Concern by COSEWIC, but not listed under Schedule 1 of SARA (COSEWIC, 2012c). The abundance and area of occupancy of smooth skate in this population have declined steeply since the 1970s, and numbers remain low, despite the lack of a directed fishery.

4.3.18 Lumpfish (*Cyclopterus lumpus*)

The lumpfish is a small thick, almost ball-shaped fish with variable colouration, which often matches their surroundings. This species is broadly distributed across the Northwest Atlantic, with highest estimates of abundance in waters surrounding the island of Newfoundland, particularly off the south and west coasts in Zones 3P and 4R, where most fishing occurs (COSEWIC, 2017). They occur in both pelagic and demersal habitats. Females lay eggs in inshore nests established by males around rocky areas and in crevices, and the males guard the eggs. Young of the year inhabit near-surface waters often attached to or under floating seaweed. Lumpfish at all life stages are often observed adhering to stones, lobster pots, seaweed or other objects by means of the pelvic adhesive disk, thereby making use of complex benthic structure to prevent drift in the currents (COSEWIC, 2017). Small juveniles (young of the year) occupy surface waters, where they feed on plankton, primarily copepods, amphipods, isopods, and smaller juvenile Lumpfish. Adults are also known to exhibit diel vertical movements in the water column, and it has been observed that a significant part of diet of adult Lumpfish consists of the pelagic northern comb jelly (*Bolinopsus infundibulum*), indicating that adults spend time in pelagic waters (Rusyaev and Orlov, 2014).

In the 1970s, a sizeable fishery for lumpfish was developed off Newfoundland as a replacement for sturgeon caviar. Lumpfish was designated as Threatened by COSEWIC, but is not listed under SARA as a Schedule 1 species (COSEWIC, 2017). Fishery landings have declined sharply since 2005, in spite of high market demand, and there has been a decline in abundance of about 58% indicated in bottom trawl surveys over 19 to 20 years off southern Newfoundland, although abundance appears to have remained stable across other parts of the Canadian range.

4.3.19 White Shark (*Carcharodon carcharias*)

The white shark is a globally distributed species occurring in both inshore and offshore waters in sub-polar through tropical waters (COSEWIC, 2006a). This species is listed as Endangered under SARA, and was reassessed by COSEWIC in 2021 as Endangered. White sharks occur in a wide range of habitats and depths, including the intertidal zone through to the continental slope and mesopelagic zone. They regularly occur off sandy and rocky shorelines and readily transit shallow bays, lagoons, harbours and estuaries; the species does not tolerate brackish or freshwater habitats (COSEWIC, 2006a). The white shark is rarely observed in Atlantic Canadian waters, as these waters form their most northerly range;

however, recorded sightings have occurred, primarily through the summer months when water temperatures are higher (COSEWIC, 2006a). White sharks tolerate a wide range of temperatures; evidence suggests a preferred temperature of 14 to 15°C although they are regularly observed in warmer waters (COSEWIC, 2006a). Pupping grounds in the western Atlantic Ocean are thought to be located in the Mid-Atlantic Bight off of the eastern United States. Foraging adults feed on a wide range of prey species, including finfish, elasmobranchs, marine mammals, cephalopods, decapods, marine birds and marine reptiles. In Atlantic Canada, confirmed reports indicate white sharks forage on Harbour porpoise and Harbour seals, and are also thought to feed on Grey seals (COSEWIC, 2006a).

The Atlantic population of white shark was listed Endangered under Schedule 1 of SARA in June 2011. The White shark is a relatively rare occupant of Atlantic Canadian waters, which represent the most northerly portion of their range. In Canada, threats to the white shark population are primarily associated with commercial fishing, including entanglement in fishing gear and as bycatch. Commercial and recreational fishing outside of Canadian waters represent the largest threat to the global populations of white shark, as they are targeted for consumption, traditional medicine, jewelry and collectibles. Other threats include pollution, underwater noise, offshore and coastal development and climate change (COSEWIC, 2006a).

4.3.20 Porbeagle (*Lamna nasus*)

The porbeagle is a large pelagic shark species belonging to the Lamnidae, or mackerel shark family. This species occurs temperate waters in the North Atlantic, South Atlantic, South Pacific, South Indian and Antarctic Oceans. A deep-diving cold-water species, it occurs from coastal areas to the open sea, most often on continental shelves (COSEWIC, 2014b). In the Northwest Atlantic, it ranges from northern Newfoundland and Labrador to New Jersey and possibly South Carolina, with mature females ranging farther south to the Sargasso Sea. The North Atlantic population undertakes long-distance, seasonal migrations along the east coast of Canada and United States each year. In Canadian waters, it is encountered primarily in the deeper basins and along the shelf edge in depths less than 200 m and temperatures between 5 and 10°C (COSEWIC, 2014b). A warm-blooded shark species, porbeagles can reach a maximum length of approximately 350 cm. They feed on a wide variety fish and cephalopod prey. They are known to use mating grounds in the summer and early fall, off the Grand Banks off southern Newfoundland and Labrador and Georges Bank. Females give birth to two to six pups in the late winter or early spring on their pupping grounds in the Sargasso Sea (COSEWIC, 2014b).

Overfishing in the 1960s and 1990s has led to two porbeagle population collapses in the Northwest Atlantic (Campana et al., 2015; COSEWIC 2014b). Porbeagle has been designated as Endangered by COSEWIC but is not listed under SARA as a Schedule 1 species (COSEWIC, 2014b). This species is slow growing and late to mature and is still subject to bycatch in many fisheries (Campana et al., 2015).

4.3.21 Shortfin Mako (*Isurus oxyrinchus*)

The shortfin mako is a large and highly migratory pelagic shark, which occurs throughout all tropical and temperate oceans. They are rarely found in waters below 16°C, and in Canada, are typically associated with warm waters such as in and around the Gulf Stream. This species is fast swimming and distinguishing features include the presence of a pointed snout, a caudal keel, and a U-shaped mouth with teeth extending outside of the mouth. Individuals reach maturity in seven to eight years, after

which the females can produce to up to 25 well-developed live young roughly every three years (COSEWIC, 2006b). Adults have few natural predators due to their large size and rapid swimming ability.

Shortfin makos are edible and are considered a prized game fish. There is no directed commercial fishery for this species in Canadian waters, all specimens are caught as bycatch. Examination of available catch rates data form the entire northwest Atlantic suggests that shortfin mako populations may have decreased by up to 50% in the past 15 to 30 years. There is also some evidence that the average size of shortfin makos in Atlantic waters may have decreased (COSEWIC, 2006b).

The Shortfin mako was designated as Threatened by COSEWIC in 2006 and reassessed in 2019 (COSEWIC, 2006b). However, it is not listed under SARA as a Schedule 1 species. The main threat to adult shortfin mako sharks is mortality as a result of by-catch from commercial fisheries.

4.3.22 Spiny Dogfish (*Squalus acanthias*)

The spiny dogfish is a small shark species, which has spines in front of both dorsal fins. Said to be the most abundant shark in the world, this species occurs globally in both in both temperate and boreal waters. The Atlantic population is found from Labrador to Cape Hatteras, and is most abundant in Canada in southwestern Nova Scotia. A habitat generalist, this species occurs on continental shelves, form the intertidal zone to the shelf slope, where they feed on a wide variety of fish and invertebrate species. In Atlantic Canada and eastern U.S. waters there are several more or less well defined “groups” of spiny dogfish, which remain largely separate, and engage in seasonal onshore-offshore migrations. They are usually found swimming in large schools just above the seabed with no strong preference for any particular type of substrate (Campana et al., 2007).

A slow-growing species, adult females have about six pups every two years. Mature females and large males aggregate during winter/spring in deep warm waters off the edge of the continental shelf (Campana et al., 2007), where mating and pupping is suspected to occur. In summer and fall, they prefer warmer, shallower shelf waters (Campana et al., 2007). Spiny dogfish are at the northern limit of their range dogfish in Newfoundland waters (NAFO 3LNOP), where they are mainly found along the western edges of the St. Pierre and Grand Banks where the water is sufficiently warm (Kulka, 2006).

The spiny dogfish has been utilized for more varied purposes than any other fish in Canada. This includes harvesting for oil for industrial lubrication, lighting, and vitamin products, flesh for use as fertilizer, food, and fishmeal, for fins as part of the international shark fin trade; and they finally they have subject to eradication programs due to their nuisance factor in commercial fisheries (COSEWIC, 2010d). The fishery in Canada is managed by a quota system. Fishing mortality is the largest known cause of mortality for adult spiny dogfish, although they are also preyed upon by other shark and large fish species, as well as seals (Scott and Scott, 1988).

This species was designated as Special Concern by COSEWIC in 2010 but is not listed under SARA as a Schedule 1 species (COSEWIC, 2010d). While it has few natural predators, it is subject to both targeted and bycatch fishing mortality. Fishing pressure, combined with low fecundity and long generation time (23 years) are causes for concern regarding the recovery potential of this species.

4.3.23 North Atlantic Right Whale (*Eubalaena glacialis*)

North Atlantic right whales are a large stocky baleen cetacean with paddle-like flippers and a large head. They occur from Florida to the Gulf of St. Lawrence and Newfoundland where their habitats include shallow and deep coastal and offshore waters (COSEWIC, 2013b). North Atlantic right whales forage primarily on zooplankton, particularly copepods (COSEWIC, 2013b). Calves are generally born in coastal waters off the southeastern United States between November and April (i.e. during winter), and nurse for about a year. In spring, mature females and their calves, along with small numbers of juveniles, migrate north from their winter calving grounds off the coast of Florida and Georgia to summer foraging grounds located along the northeastern United States to the Bay of Fundy and the Scotian Shelf (COSEWIC, 2013b). Right whales also travel though the Cabot Strait to reach the Gulf of St Lawrence, and therefore, may be present in the study area during the spring and fall migration periods. They are known to occur off southern Newfoundland (Brown et al., 2009).

North Atlantic right whales were nearly driven to extinction by commercial whaling prior to 1900 and have been protected from whaling since 1935. In Canada, the species was designated Endangered and listed under Schedule 1 of SARA in 2005, and assessed again as Endangered in 2013 by COSEWIC. Critical habitat areas within Canada have been identified in the Roseway Basin off the south-eastern coast of Nova Scotia and in the Grand Manan Basin in the Bay of Fundy (Brown et al., 2009), areas known to have high densities of copepods (COSEWIC 2013b). In recent years, however, increased numbers have been documented in the Gulf of St. Lawrence (NOAA, 2018a), where significant mortality has occurred (Daoust et al., 2018), leading to temporary closures in some snow crab fishing areas. Vessel strikes and entanglement in fishing gear, in addition to habitat degradation due to anthropogenic influences (pollution), small population size and nutritional stress, are potential limiting factors influencing this species (COSEWIC, 2013b).

4.3.24 Blue Whale (*Balaenoptera musculus*)

The blue whale is the largest animal known to have lived on Earth, capable of reaching 33.6 m and weigh up to 136,000 kg. Occurring globally in both coastal and offshore waters, blue whales feed on plankton, mostly euphausiids (krill), which they capture by gulping large quantities of water and prey, which is strained as it is forced out through the baleen plates by the muscular throat and tongue (Sears and Calambokidis, 2002). In Canada, there are thought to be fewer than 250 mature individuals, with strong indications of a low calving rate and a low rate of recruitment to the studied (Sears and Calambokidis, 2002). Blue whales mate and calve from late fall to mid-winter in the Northern Hemisphere and give birth to a single calf every two to three years (Sears and Calambokidis, 2002). The blue whale is sighted regularly in the Gulf and estuary of the St. Lawrence from April to December, as well as off the south coast of Newfoundland (Lien et al., 1987; Lien and Jones, 1990; Sergeant, 1982). The blue whale is also known to overwinter along the relatively ice-free southern coast of Newfoundland, including the study area, although specific overwintering locations are not known (Beauchamp et al., 2009).

The Atlantic population of blue whale was listed under Schedule 1 of SARA as Endangered in January 2005, and assessed by COSEWIC as Endangered in 2012. Historic whaling efforts persist as the primary threat to the recovery of this species due to the commercial harvest of an estimated 70% of all blue whale in the Northwestern Atlantic Ocean before a moratorium on whaling was enacted in 1966 (Beauchamp et al., 2009). Blue whales continue to face further challenges to their recovery, such as low

calving rates, collisions with shipping traffic and disturbances caused by whale-watching, underwater noise, entanglement in fishing gear, pollution (especially oil pollution), climate change, ice entrapment, and predation (DFO, 2018c). They may also be vulnerable to long-term changes in climate, which could affect the abundance of their prey (zooplankton). The available information is insufficient for identifying critical habitat of blue whales in Canadian Atlantic waters (Beauchamp et al., 2009).

4.3.25 Harbour Porpoise (*Phocoena phocoena*)

The harbour porpoise is the smallest member of the porpoise family, rarely achieving a length greater than 1.7 m in Canadian waters. Widely distributed over the continental shelves of the temperate Northern Hemisphere, the have stocky bodies with rounded heads, dark backs and paler undersides. Specimens in eastern Canada belong to the *phoceana* subspecies. Generally shy animals, harbour porpoises are sometimes found in bays and harbours, particularly during the summer, where they feed on fish and squid. Very little is known of the winter distribution of porpoises in Newfoundland (COSEWIC, 2006c). They generally travel in small pods of a few individuals. Females appear to reach maturity at about three years, after which they produce a single calf per year (Read, 1999).

The harbour porpoise was assessed by COSEWIC as Special Concern in April 2006 and again in 2022, and was designated Threatened under Schedule 2 of SARA. Although Schedule 2 does not offer formal protection under SARA, this species is considered at risk and may be added to Schedule 1 following future reassessment by COSEWIC. Incidental catch (bycatch) in fishing gear, especially gillnets, is a major source of mortality for harbour porpoises in Atlantic Canadian waters (COSEWIC, 2006c).

4.3.26 Fin Whale (*Balaenoptera physalus*)

The fin whale is a large, streamlined whale known for its fast swimming speeds. They reach an adult length of 25 m, second only to the blue whale. They have asymmetrically-coloured jaws, dark on the left and light on the right. Fin whale are thought to migrate between foraging grounds in high latitudes and calving/breeding grounds in lower latitudes. They feed on small invertebrates, schooling fishes and squids, especially capelin off Newfoundland. Fin whales have been observed within the study area off the coast of Newfoundland (COSEWIC, 2005). Summer concentrations tend to be located where there is abundant prey (Kawamura, 1980; Gaskin, 1982), but they are known to search over long distance for suitable habitat and feeding areas (COSEWIC, 2005). Fin whales are known to occur in the Gulf of St. Lawrence during the summer months (Edds and MacFarlane, 1987; Kingsley and Reeves, 1998). In winter, the Newfoundland stock is thought to migrate into the Nova Scotia summer concentration areas and the Nova Scotia stock is thought to migrate south to coastal waters along the US eastern seaboard (Kellogg, 1929; Allen, 1971; Mitchell, 1974).

Intensive commercial whaling efforts in the late 1800s greatly reduced the Atlantic Fin whale population. The species was listed under Schedule 1 of SARA as Special Concern in August 2006, and this was reconfirmed in 2019 (COSEWIC, 2005; COSEWIC, 2019). Current estimates within Canadian waters are less than 1000 mature individuals. Though most nationalities, have ceased commercial whaling efforts, Norway and Greenland continue to harvest a regulated quota of Fin whale each year. In Canadian waters, the primary threats to the recovery of this species include ship strikes, entanglement in fishing gear, underwater noise, pollution, parasites and disease, and climate change (DFO, 2016f).

4.3.27 Sowerby's Beaked Whale (*Mesoplodon bidens*)

Sowerby's beaked whale is a deep-diving species of beaked whale which is found only in cold North Atlantic waters, from Massachusetts to Labrador (Taylor et al., 2008). Preying on fish and squid, they have streamlined bodies with small heads, and are thought to reach a length of 5.5 m. They are rarely seen, but have been reported from continental edges and slopes, at depths of 550 to 1500 m or more. They are difficult to distinguish from two closely-related species of beaked whale which overlap its range (COSEWIC, 2019a). Their seasonal movements, if any, are unknown and little is known of their life history.

Sowerby's beaked whale was listed under Schedule 1 of SARA as Special Concern in 2011 and this rank was revaluated and confirmed by COSEWIC in 2019 (COSEWIC, 2019a). Underwater noise pollution has been theorized to cause mass stranding, serious injury, and death in beaked whales, including Sowerby's beaked whale. Military sonar and acoustic surveys have been associated with serious injury and mortality in beaked whales. Other anthropogenic stressors including incidental by-catch in commercial fisheries, ship strikes, entanglement in fishing gear, pollution, and climate change further threaten the recovery of this species (DFO, 2017b).

4.3.28 Humpback Whale (*Megaptera novaeangliae)*

The humpback whale is a large distinctive whale, which has long jagged fins and can measure up to a third of the whale's body length. Adults measure between 14 and 19 m, and weigh between 34,000 and 45,000 kg. They have a black back and white belly, with a small dorsal fin located near the center of the back. Large expansive grooves in the Humpback's throat permit it to open its mouth wide to swallow large amounts of prey at one time (NOAA, 2018b). In the Atlantic, Humpback Whales occur from the West Indies to Greenland, where the population is estimated to be about 4,000 individuals. They are typically found along the coastline, and their summer movements are associated with the availability of prey. Within eastern Canada, humpbacks are common during the summer months off the eastern and southern coasts of Newfoundland, off southeastern Labrador, on the edges of the Grand Banks, and in the Gulf of St Lawrence. In the fall, humpback whales start their migration south to tropical waters to mate and overwinter. Females reach maturity at about nine years of age, after which time they can produce a calf every two years (COSEWIC, 2003b; Johnson and Wolman, 1984).

Historical overharvesting of humpback greatly reduced their numbers, although they have rebounded significantly in the past 30 years (SARA, 2018). Other threats include overexploitation of prey species such as capelin, entanglement in fishing gear, and oil pollution (COSEWIC, 2003b). The Western North Atlantic population of humpback was initially listed on Schedule 3 of SAR as Special Concern, however in 2003, it was reassessed as Not at Risk by COSEWIC. Despite the existing threats, the North Atlantic population is not considered to be at risk from current activity levels. As this species is still technically listed under SARA (and not extinct or extirpated) it is included in this document.

4.3.29 Killer Whale (*Orcinus orca*)

The Killer Whale or Orca *(Orcinus orca*) is a large distinctive whale species with striking black and white colouration. The largest member of the dolphin family, the largest males can reach up to nine m in length with weights recorded up to 6,800 kg. Males and females are similar in appearance, though males are larger with taller dorsal fins and longer flippers and tail flukes. Killer whales are long-lived, with wild

specimens known to reach 80 years. Females reach maturity between 12-17 years of age and may produce a single calf every five years. They appear to be tolerant of wide ranges of salinity, temperature and turbidity, and their distribution is largely linked to the presence of prey, the preferred type of which varies across populations.

There are five discrete populations of Killer Whale in Canadian waters, only one of which occurs in the Atlantic Ocean. This population, the Northwest Atlantic / Eastern Arctic population, has been designated as Special Concern by COSEWIC and again in 2023, but is not listed as a SARA Schedule 1 species (COSEWIC, 2008). The distribution of this population is poorly documented, but they are known to be widespread and sightings are reported most commonly in the coastal waters of Newfoundland, likely due in part to the relatively concentrated sighting effort there (COSEWIC, 2008). There is very little information available on this population, but it is considered likely to consist of less than 250 mature individuals. This population is known to feed on seals and fish (COSEWIC, 2008). Killer whales from the Northwestern Atlantic / Eastern Arctic population continue to be hunted in western Greenland. Other threats to this species include acoustical and physical disturbance, which will become greater as shipping traffic increases in the Arctic, and contaminants (COSEWIC, 2008).

4.3.30 Sei Whale (*Balaenoptera borealis*)

The Sei whale is a large slim baleen whale species found in all the oceans of the world, and like many large whales, make seasonal migrations from low-latitude wintering areas to high-latitude summer feeding grounds. They reach sexual maturity at between five and 15 years of age (COSEWIC, 2019b). Adults may live to 60 years and reach an average size of 15 m and 19 tonnes. In the northwest Atlantic, they are mainly associated with the continental shelf edge. While the locations of their wintering grounds are unknown, Sei Whales are found in the summers in the Labrador Sea, off Newfoundland, and on the Scotian Shelf and Slope; and at least some individuals are present in these waters in the fall, winter and spring (COSEWIC, 2019b).

The Sei Whale was recently assessed by COSEWIC as Endangered in 2019, but is not listed under SARA as a Schedule 1 species (COSEWIC, 2019b). Current threats to Sei Whales include noise from seismic surveys, shipping and military exercises, vessel strikes, and entanglement in fishing gear, and perhaps insufficient access to prey (COSEWIC, 2019b).

4.3.31 Leatherback Sea Turtle (*Dermochelys coriacea*)

Leatherback sea turtle is a large highly migratory species, which is widely distributed worldwide. They occur in the tropical and temperate waters of the Atlantic, Pacific and Indian oceans. Reaching up to 2 m in length, leatherbacks have a carapace with conspicuous longitudinal ridges, covered by a leathery, fibrous tissue embedded with tiny bones. They nest on sandy beaches in the tropics, but are present on both shelf and offshore waters in Atlantic Canada between April and December, where they forage primarily on jellyfish (COSEWIC, 2012h).

The Atlantic population of the Leatherback sea turtle was designated Endangered in May 2012 and subsequently listed under Schedule 1 of SARA. In 2022, they were assessed again as Endangered by COSEWIC. Leatherback sea turtles are also protected under the *Fisheries Act* and the *Oceans Act*. Threats to the recovery of this species include entanglement in fishing gear and ship strikes, noise

pollution, poaching, plastic debris, oil and chemical pollution, construction and development of nesting beaches, natural predation, and climate change. In Canadian waters, the primary threat to leatherbacks is entanglement in fishing gear (COSEWIC, 2012h).

4.3.32 Loggerhead Sea Turtle (*Caretta caretta*)

The Loggerhead sea turtle is a large highly migratory species, which is widely distributed worldwide. They are the only hard-shelled sea turtle occurring in Canadian waters. Loggerhead sea turtles, mostly juveniles, routinely forage in Atlantic Canadian waters, where they are typically associated with the Gulf Stream and encountered on the Scotia Shelf, Scotian Slope, Georges Bank and the Grand Banks (COSEWIC, 2010e). They are present in spring, summer, and fall, feeding on crustaceans, salps, fish, squid, and jellyfish. A long-lived species, loggerheads do not nest in Canada, but instead bury their eggs on sandy beaches in southern USA, Bahamas, Gulf of Mexico and Cuba, and parts of South America (COSEWIC, 2010e). Little is known about population size or trends within Canada.

The Loggerhead was designated as Endangered by COSEWIC in 2010, and subsequently listed under Schedule 1 of SARA as Endangered in April 2017. The primary known threat to this species is capture and entanglement in gear associated with pelagic longlining activities. Other threats include poaching, beachfront development on nesting habitats, plastics, oil and chemical pollution, natural predation, and climate change (COSEWIC, 2010e).

Chapter 5 Closure

The fish and fish habitat literature review used a variety of open data sources available online and in published literature sources, including peer-reviewed literature concerning fish and fish habitat in the study area, DFO science advisory report, DFO fisheries resources reports and statistics, federal and provincial species at risk and species of conservation concern databases, management areas, geographic spatial information on species observations and distributions, and general literature pertaining to coastal environments in southwestern Newfoundland.

The services performed as described in this report were conducted in a manner consistent with the level of care and skill normally exercised by other members of the engineering and science professions currently practicing under similar conditions, subject to the time limits and financial and physical constraints applicable to the services.

This report provides a professional opinion and therefore no warranty is expressed, implied, or made as to the conclusions, advice, and recommendations offered in this report. This report does not provide a legal opinion regarding compliance with applicable laws. With respect to regulatory compliance issues, it should be noted that regulatory statutes and interpretation of regulatory statues are subject to change.

Chapter 6 References

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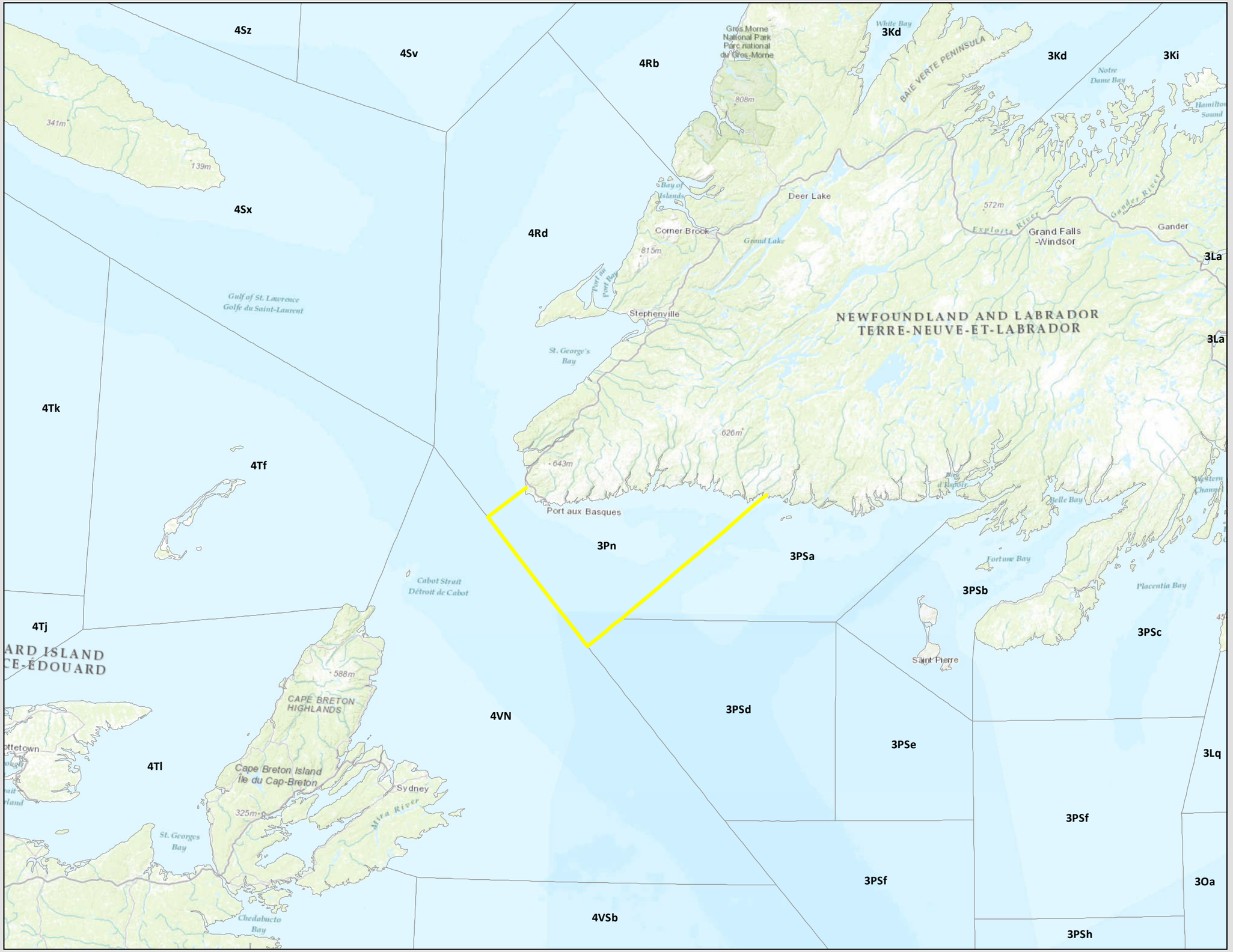
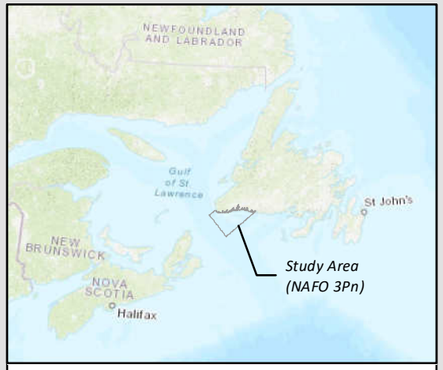
APPENDIX A

Figures





NAFO 3Pn - Study Area

NAFO Management Divisions

CBCL LIMITED
Consulting Engineers

MARINE ATLANTIC INC.

Fish and Fish Habitat Assessment

Port aux Basques, Newfoundland and Labrador

Figure 1: Study Area

Drawn by: MD	**Date: 2020-03-13**
Checked:	**CBCL Project #: 192479.45**
Approved:	**Scale @ 11" x 17" :** 1:2,000,000

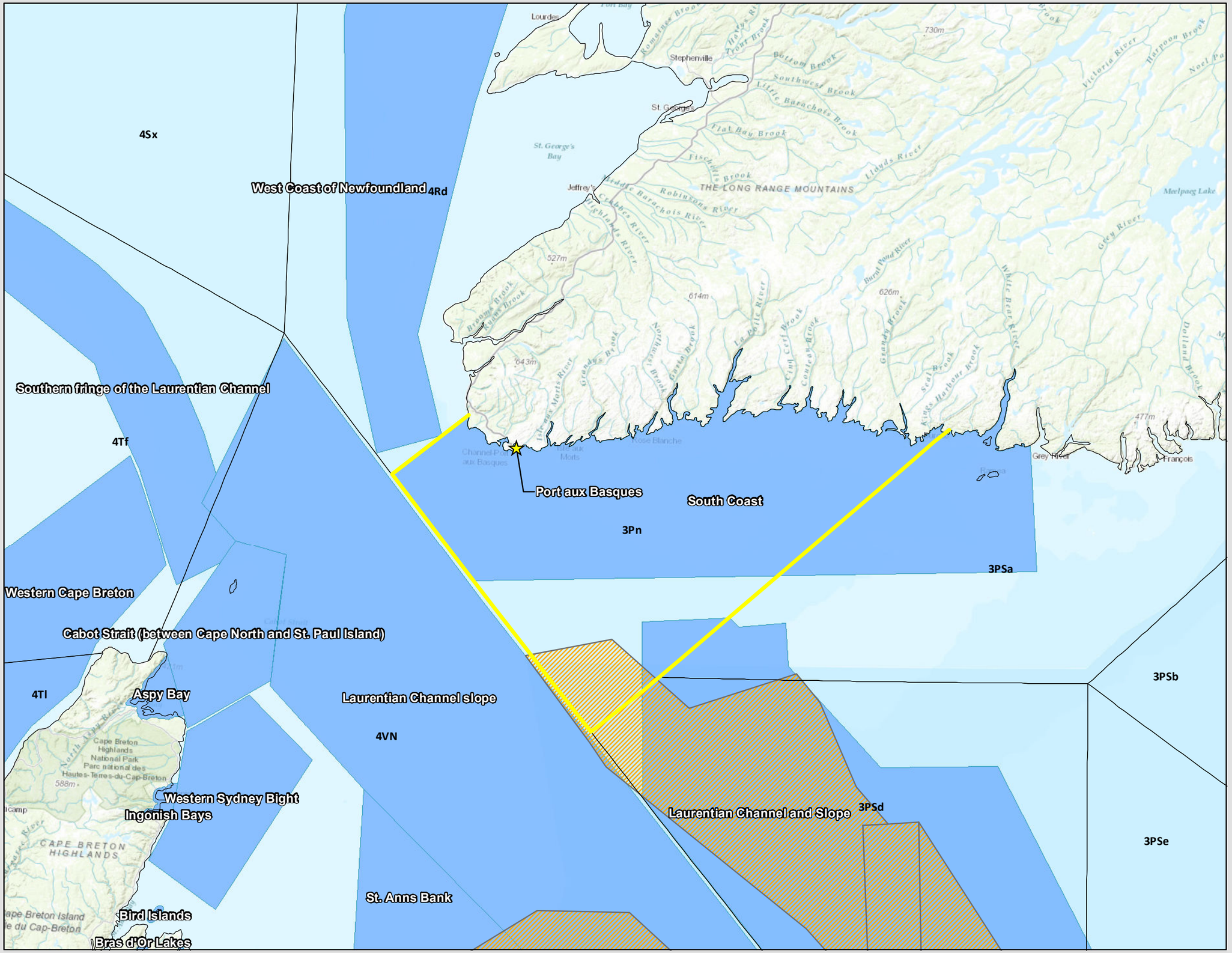
Notes:

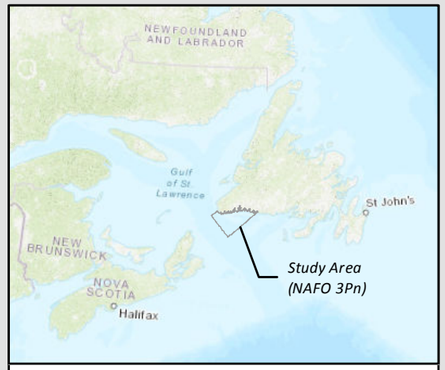
Data Sources:
Northwest Atlantic Fisheries Organization, 2020

Coordinate System: NAD 1983 UTM Zone 21N
Units: Meter

0 30 60 90 120 km

Z:\192479.45 VARDYS ISLAND ENVIRONMENTAL\192479.45 MAI FISH AND FISH HABITAT - FIG 1 - STUDY AREA.mxd





NAFO 3Pn - Study Area

NAFO Management Divisions

DFO Marine Protected Areas (MPAs)

DFO Ecologically and Biologically Sensitive Areas (EBSAs)

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Fish and Fish Habitat Assessment

Port aux Basques, Newfoundland and Labrador

Figure 2: Important Natural Areas

Drawn by:	**Date: 12/03/2020**
Checked:	**CBCL Project #: 192479.45**
Approved:	**Scale @ 11" x 17" :** 1:1,000,000

Notes:

Coordinate System: NAD 1983 UTM Zone 21N
Units: Meter
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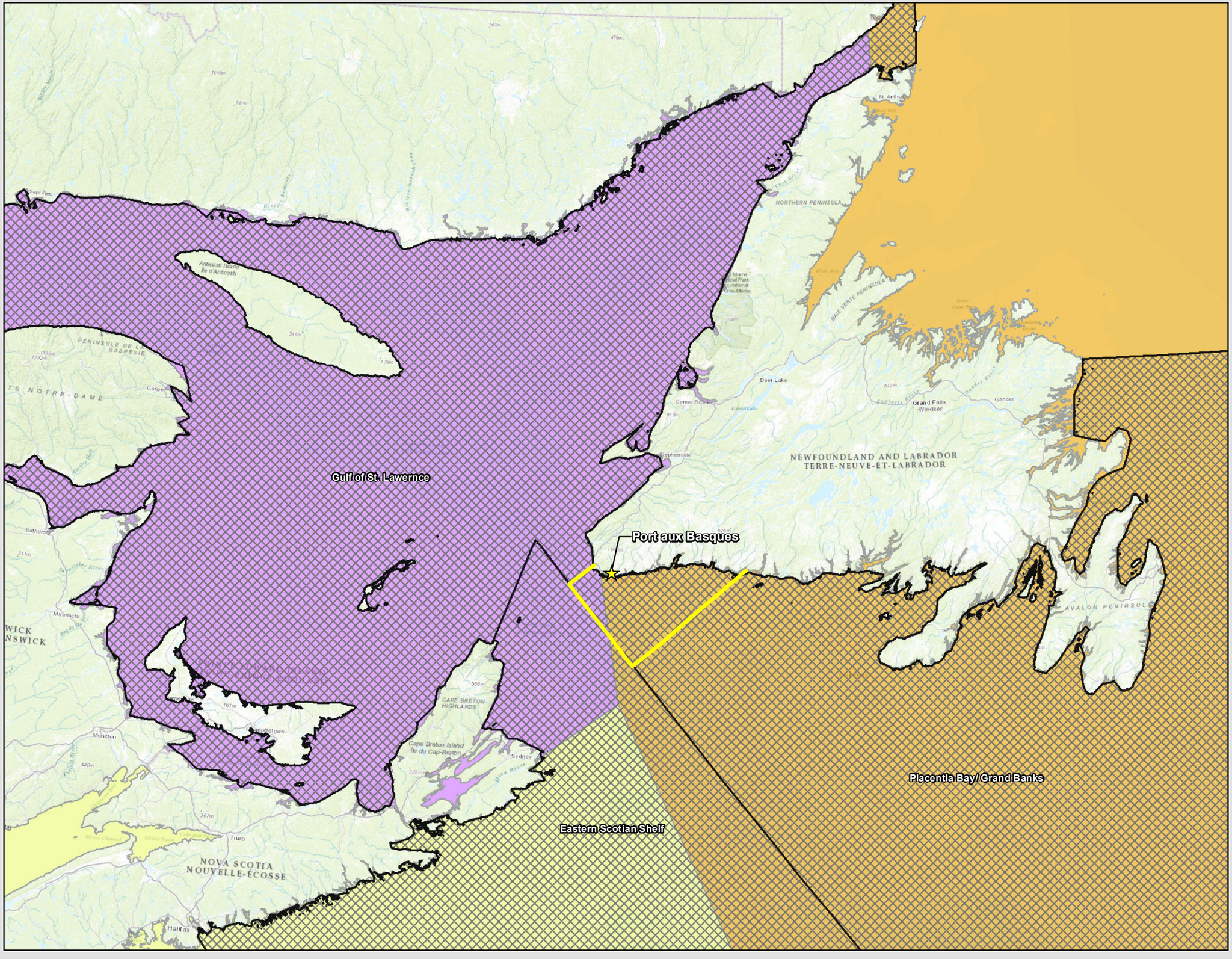

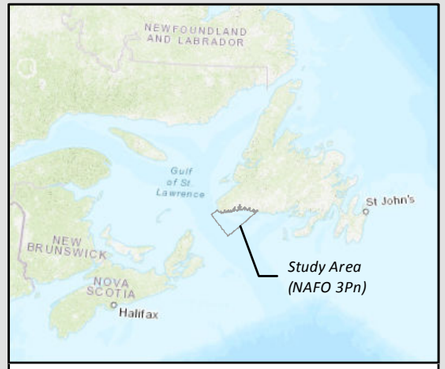

NAFO 3Pn - Study Area

Large OCean Management Areas (LOMAs)

DFO Bioregions

- Gulf of St.Lawrence
- Newfoundland and Labrador Shelf
- Scotian Shelf

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Fish and Fish Habitat Assessment

Port aux Basques, Newfoundland and Labrador

Figure 3: Management Areas

Drawn by:	**Date: 13/03/2020**
Checked:	**CBCL Project #: 192479.45**
Approved:	**Scale @ 11" x 17" :** 1:3,151,422

Notes:

Coordinate System: NAD 1983 UTM Zone 21N
Units: Meter
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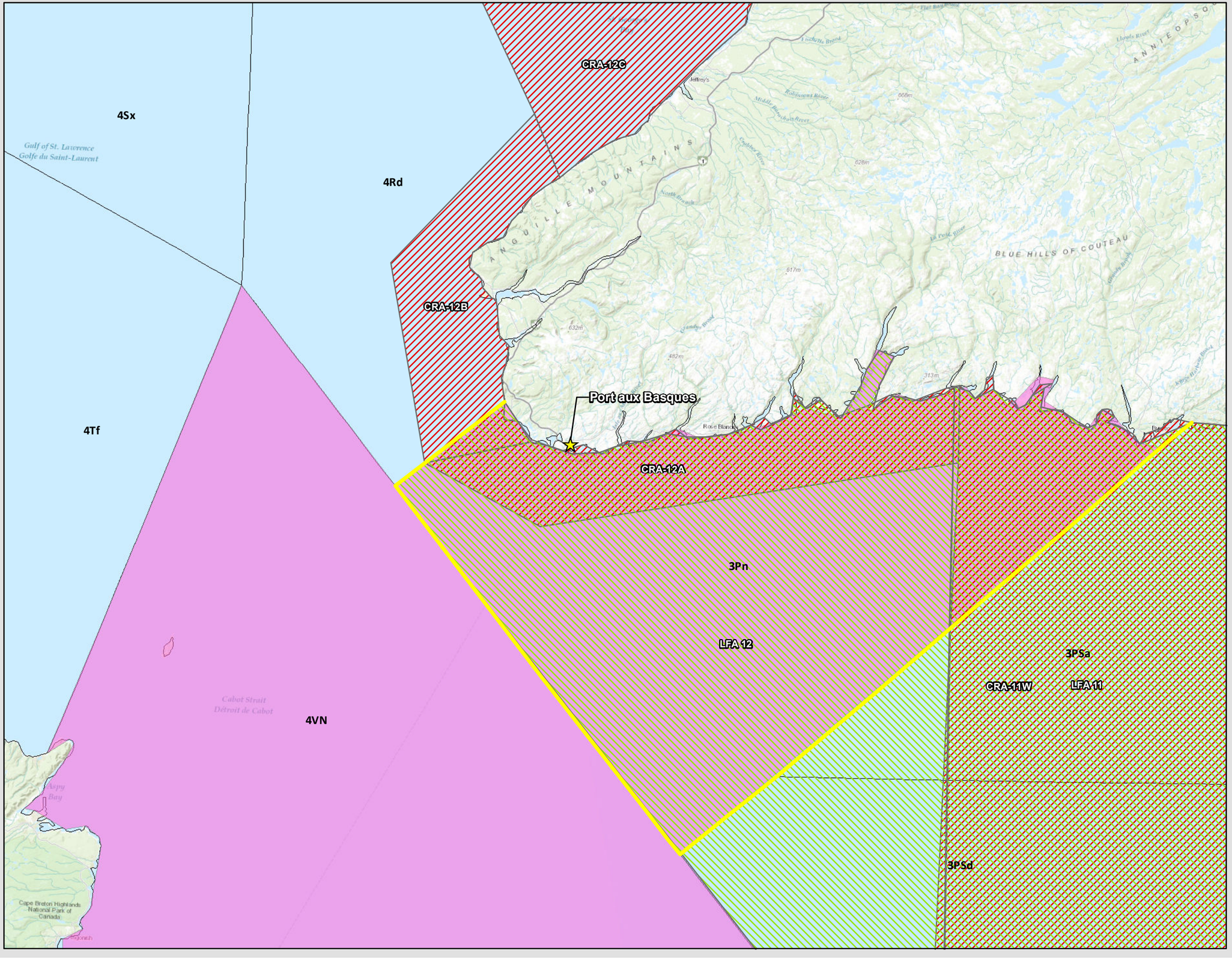

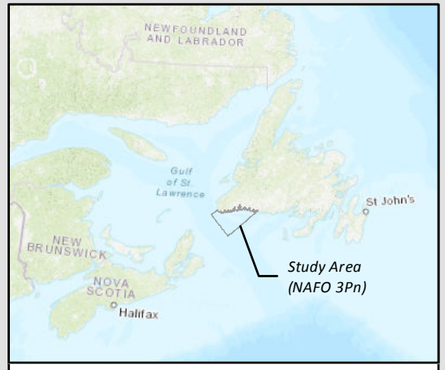

NAFO 3Pn - Study Area
DFO Lobster Fishing Areas (LFAs)
DFO Crab Fish Areas (CRAs)
DFO Redfish Seasonal Common Area
NAFO Management Divisions

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Fish and Fish Habitat Assessment

Port aux Basques, Newfoundland and Labrador

Figure 4: Fishing Zones

Drawn by:	**Date: 17/03/2020**
Checked:	**CBCL Project #: 192479.45**
Approved:	**Scale @ 11" x 17" :** 1:700,000

Notes:

Data Sources:
Department of Fisheries and Oceans, 2020
AMEC Environment and Infrastructure, 2014

Coordinate System: NAD 1983 CSRS UTM Zone 21N
Units: Meter
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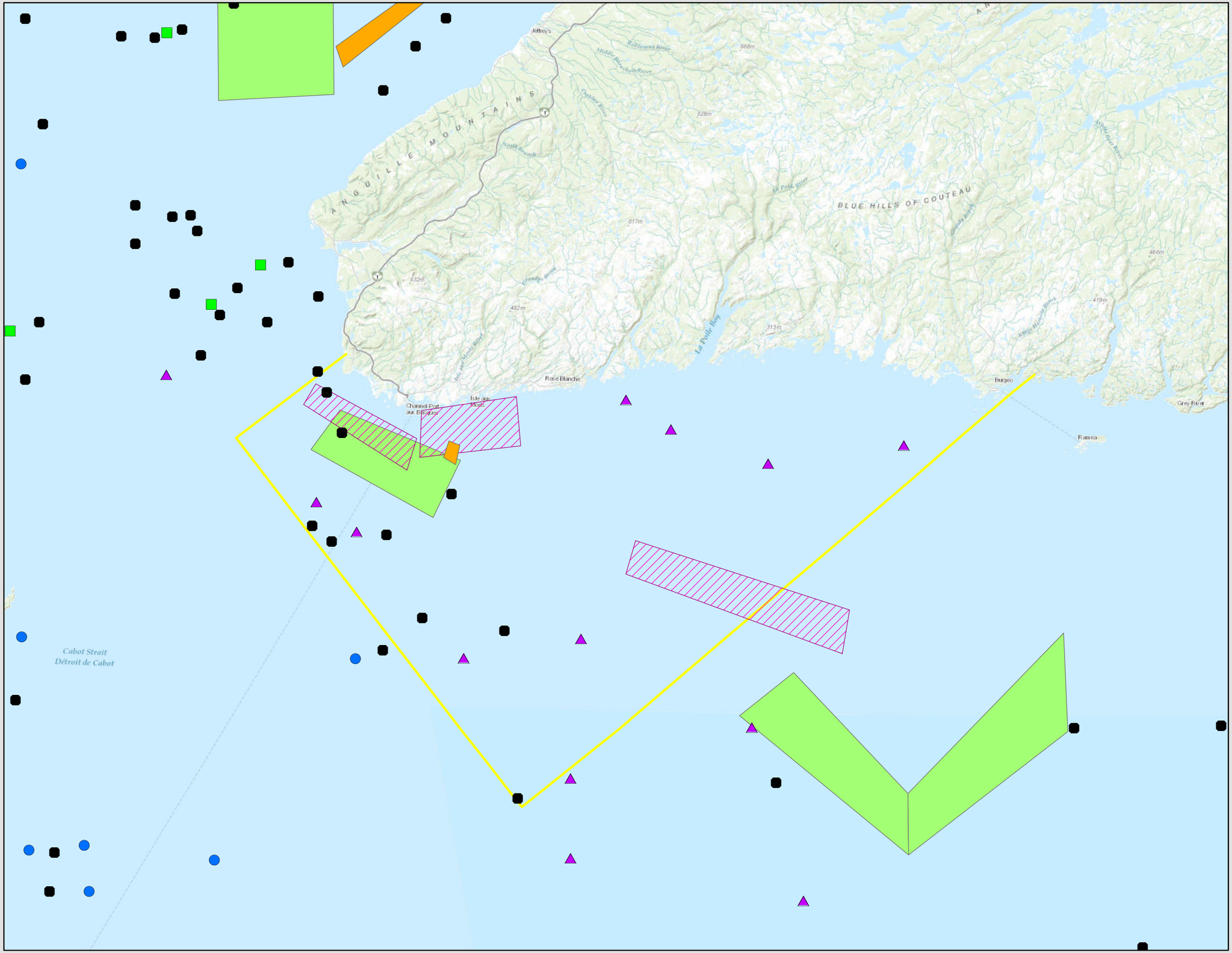
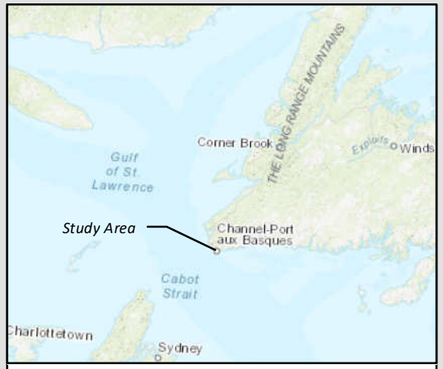
Z:\192479.45 VARDOYS ISLAND ENVIRONMENTAL\192479.45 MAP FISH AND FISH HABITAT - FIG 4 - FISHING ZONES.mxd





Soft Coral Occurances

- Alcyoniidae F.
- Duva spp. (Duva florida)
- Gersemia rubiformis
- Nephtheidae (Drifa glomerata, Drifa spp.)
- Cup Corals - Scleractinia spp.
- Acanthogorgia armata
- Keratoisis ornate
- NAFO 3Pn - Study Area

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Fish and Fish Habitat Assessment
Port aux Basques, Newfoundland and Labrador

Figure 5: Reported Coral Locations within NAFO 3Pn

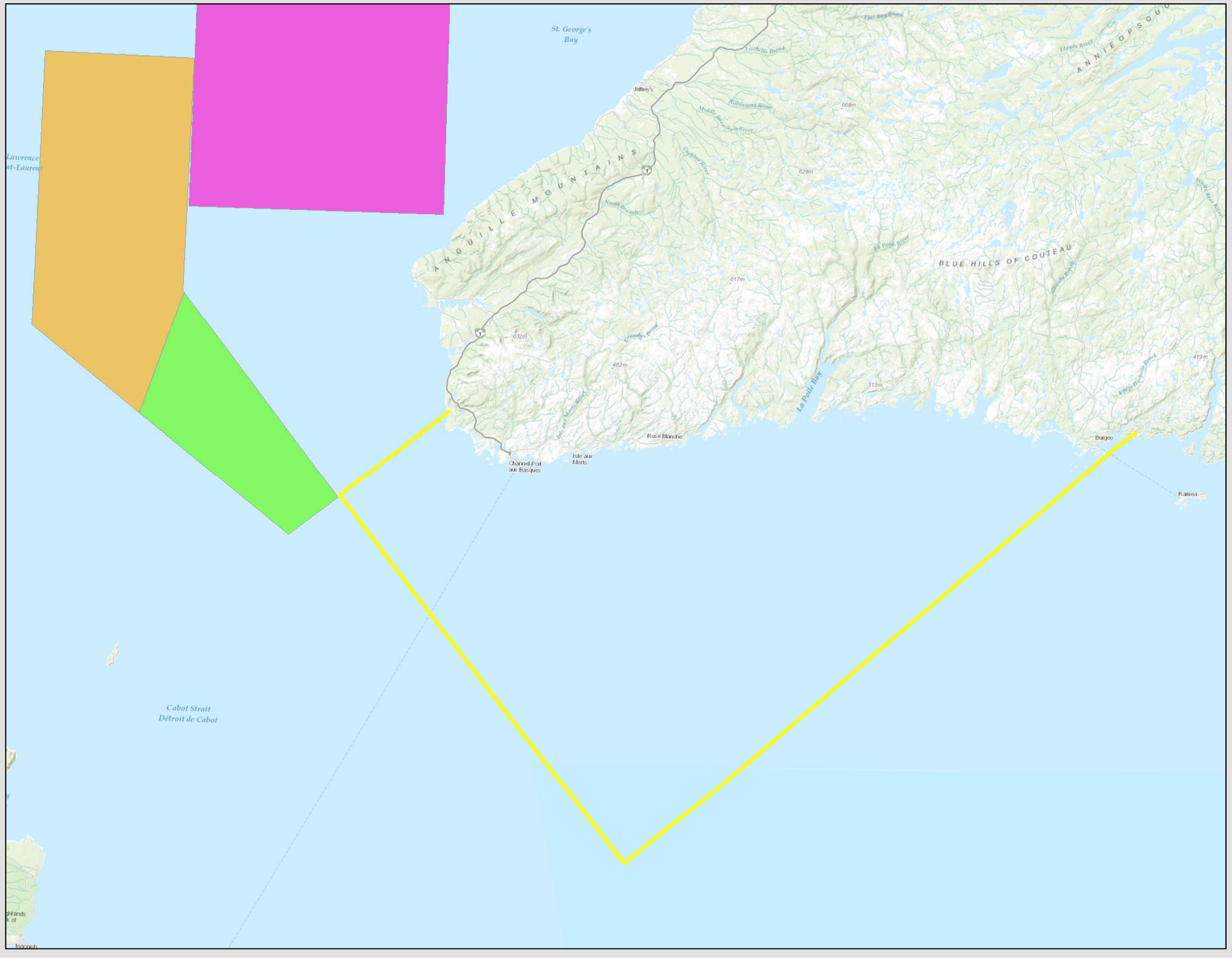
Drawn by: MD	**Date: 2020-03-13**
Checked:	**CBCL Project #: 192479.45**
Approved:	**Scale @ 11" x 17" :** 1:700,000

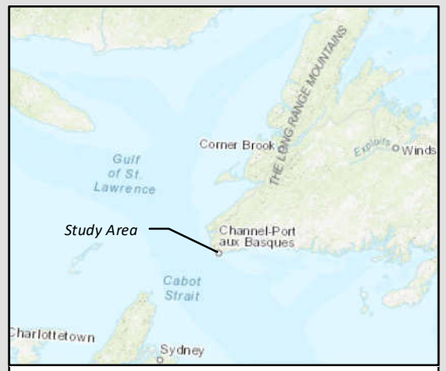
Notes:

Data Sources:
Northwest Atlantic Fisheries Organization, 2020
Gilkinson & Edinger, 2009
Colpron et. al, 2010

Coordinate System: NAD 1983 UTM Zone 21N
Units: Meter
0 10 20 30 40 km

Z:\192479.45 VARDYS ISLAND ENVIRONMENTAL\192479.45 MAI FISH HABITAT - FIG 5 - SPONGE AND CORAL LOCATIONS.mxd





NAFO 3Pn - Study Area

Cod (Gadus morhua) Spawning Locations

Important Redfish (Sebastes sp.) Areas

Larvae Extrusion Area

Mating Area

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MARINE ATLANTIC INC.

Fish and Fish Habitat Assessment

Port aux Basques, Newfoundland and Labrador

Figure 6: Known Spawning Locations

Drawn by: MD	**Date: 2020-03-13**
Checked:	**CBCL Project #: 192479.45**
Approved:	**Scale @ 11" x 17" :** 1:700,000

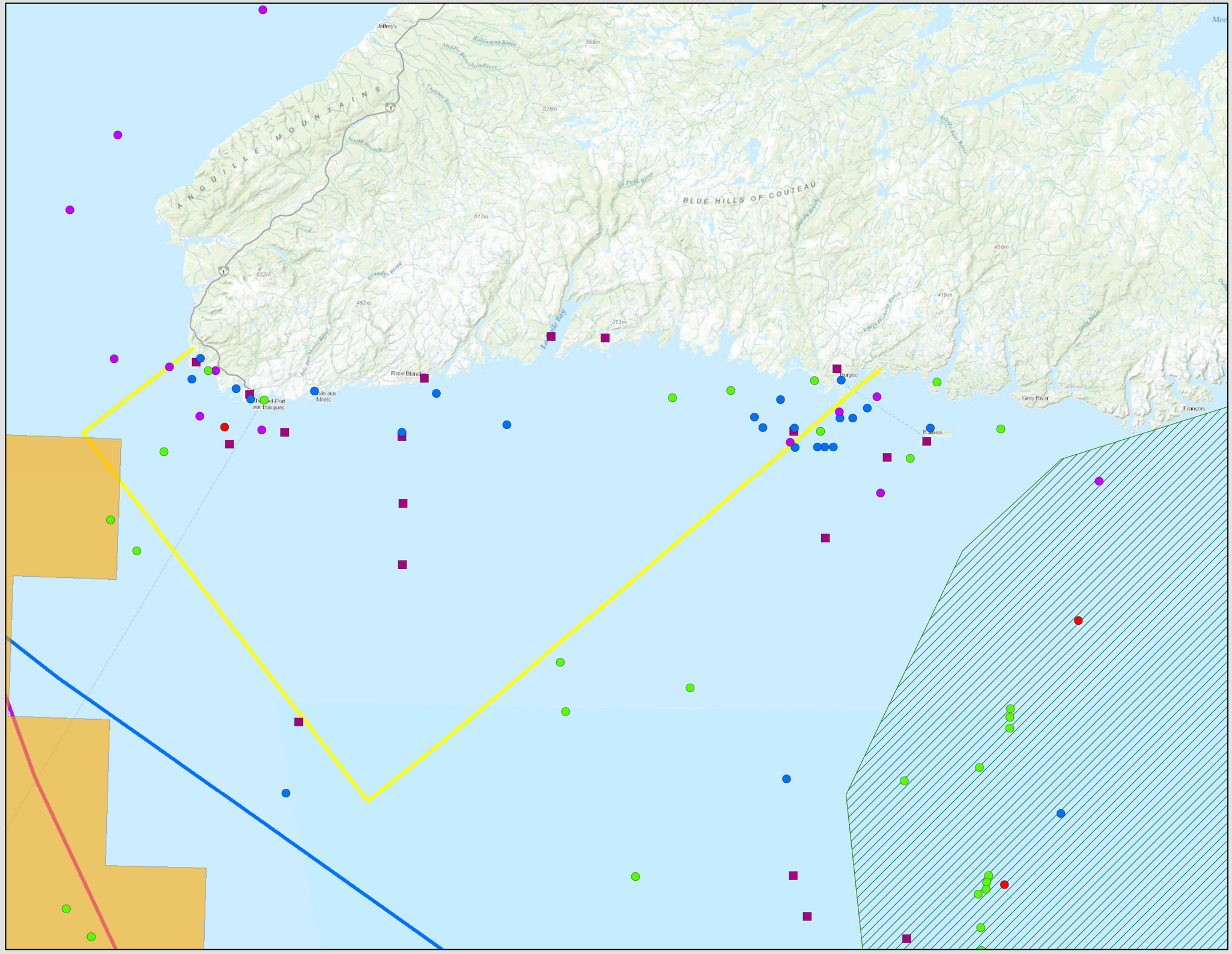
Notes:

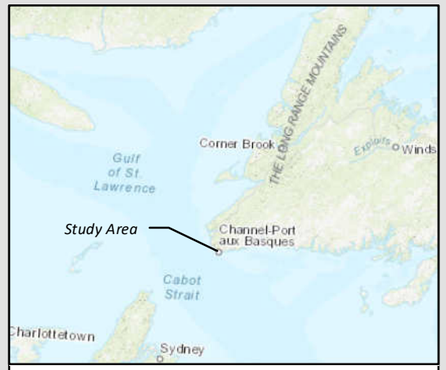
Data Sources:
Northwest Atlantic Fisheries Organization, 2020
AMEC Environment and Infrastructure, 2014

Coordinate System: NAD 1983 UTM Zone 21N
Units: Meter

0 10 20 30 40 km

Z:\192479.45 VARDYS ISLAND ENVIRONMENTAL\192479.45 MAI FISH AND FISH HABITAT - FIG 6 - SPAWNING AREAS.mxd





Marine Mammal Observations

- Blue Whale (Balaenoptera musculus)
- Fin Whale (Balaenoptera physalus)
- Beluga Whale (Delphinapterus leucas)
- North Atlantic Right Whale (Eubalaena glacialis)
- Killer Whale (Orcinus orca)
- Leatherback Sea Turtle Observations (Dermochelys coriacea)
- Humpback Whale Feeding Grounds (Megaptera novaeangliae)
- Leatherback Sea Turtle Critical Habitat (Draft)
- NAFO 3Pn - Study Area

Whale Migration Routes

- Killer Whale
- Whales / Dolphins

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Fish and Fish Habitat Assessment

Port aux Basques, Newfoundland and Labrador

Figure 7: Marine Mammals and Turtles Observations

Drawn by: MD	**Date: 2020-03-13**
Checked:	**CBCL Project #: 192479.45**
Approved:	**Scale @ 11" x 17" :** 1:700,000

Notes:

Data Sources:
Northwest Atlantic Fisheries Organization, 2020
DFO Database: J .Lawton, Husky Energy Environmental Assessment, 2010
COSEWIC, 2005; DFO – Brown, M.W., 2009
DFO – Lawson, J., 2007; DFO, 2011
University of Nebraska: Stevick, P., 2003
Home Oil Company, 1980

Coordinate System: NAD 1983 UTM Zone 21N
Units: Meter

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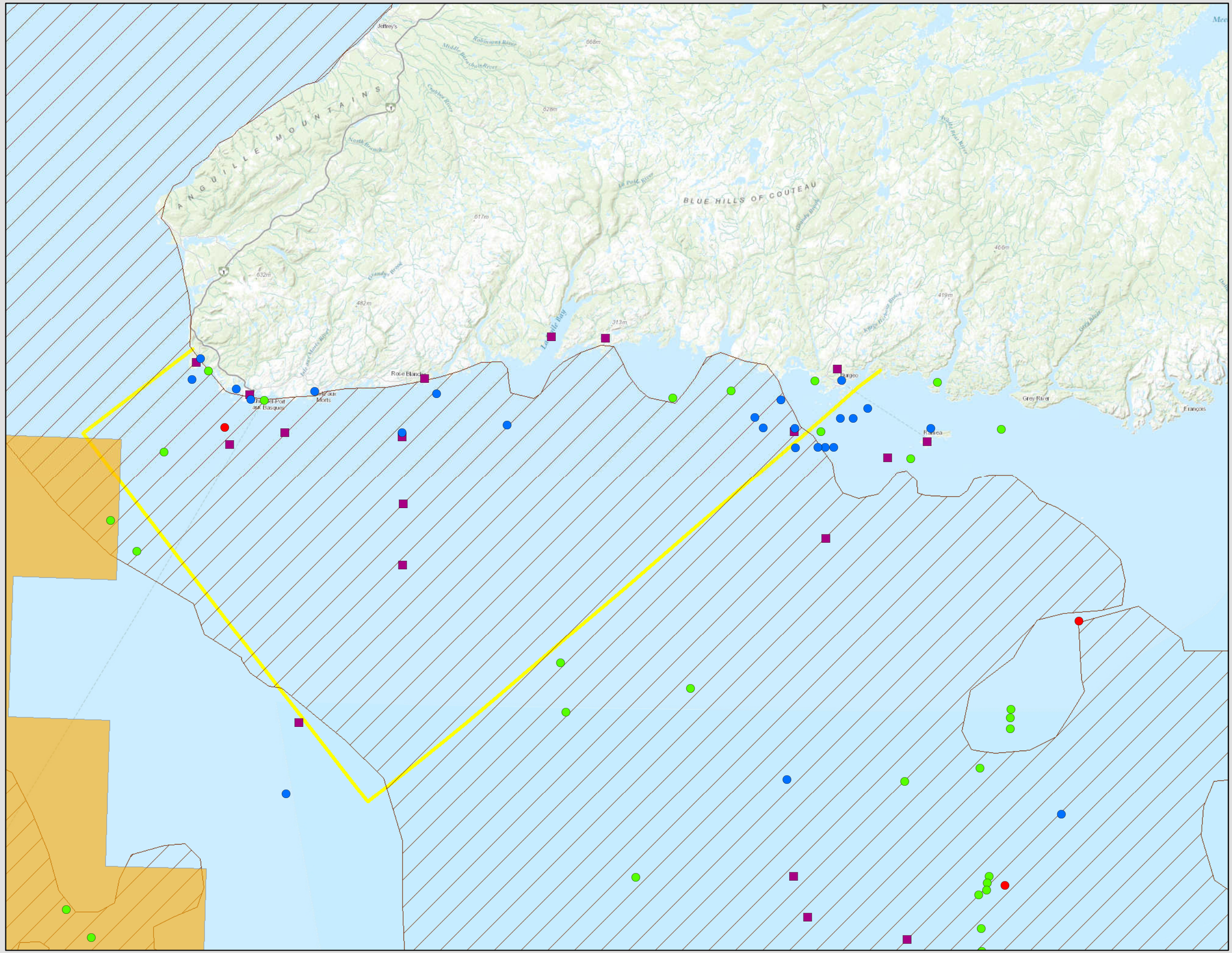
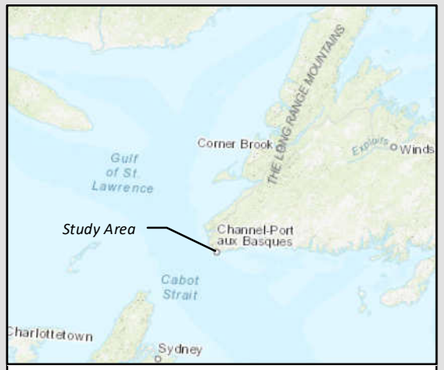
Z:\192479.45 VARDYS ISLAND ENVIRONMENTAL\192479.45 MAI FISH AND FISH HABITAT - FIG 7 - MARINE MAMMALS and TURTLES.mxd





- Atlantic Wolffish (Anarhichas lupus)
- Northern Wolffish (Anarhichas denticulatus)
- Spotted Wolffish (Anarhichas minor)
- Blue Whale (Balaenoptera musculus)
- Fin Whale (Balaenoptera physalus)
- North Atlantic Right Whale (Eubalaena glacialis)
- Leatherback Sea Turtle Observations (Dermochelys coriacea)
- Leatherback Sea Turtle Critical Habitat (Draft)
- Wolffish Distribution
- NAFO 3Pn - Study Area

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Fish and Fish Habitat Assessment

Port aux Basques, Newfoundland and Labrador

Figure 8: Species at Risk

Drawn by: MD	**Date: 2020-03-13**
Checked:	**CBCL Project #: 192479.45**
Approved:	**Scale @ 11" x 17" :** 1:700,000

Notes:

Data Sources:
Northwest Atlantic Fisheries Organization, 2020
DFO Database: J.Lawton, Husky Energy Environmental Assessment, 2010
COSEWIC, 2005; DFO – Brown, M.W., 2009
DFO – Lawson, J., 2007; DFO, 2011
DFO - Dutil, J., 2010
COSEWIC - O'Dea, N.R., 2001

Coordinate System: NAD 1983 UTM Zone 21N
Units: Meter

0 10 20 30 40 km

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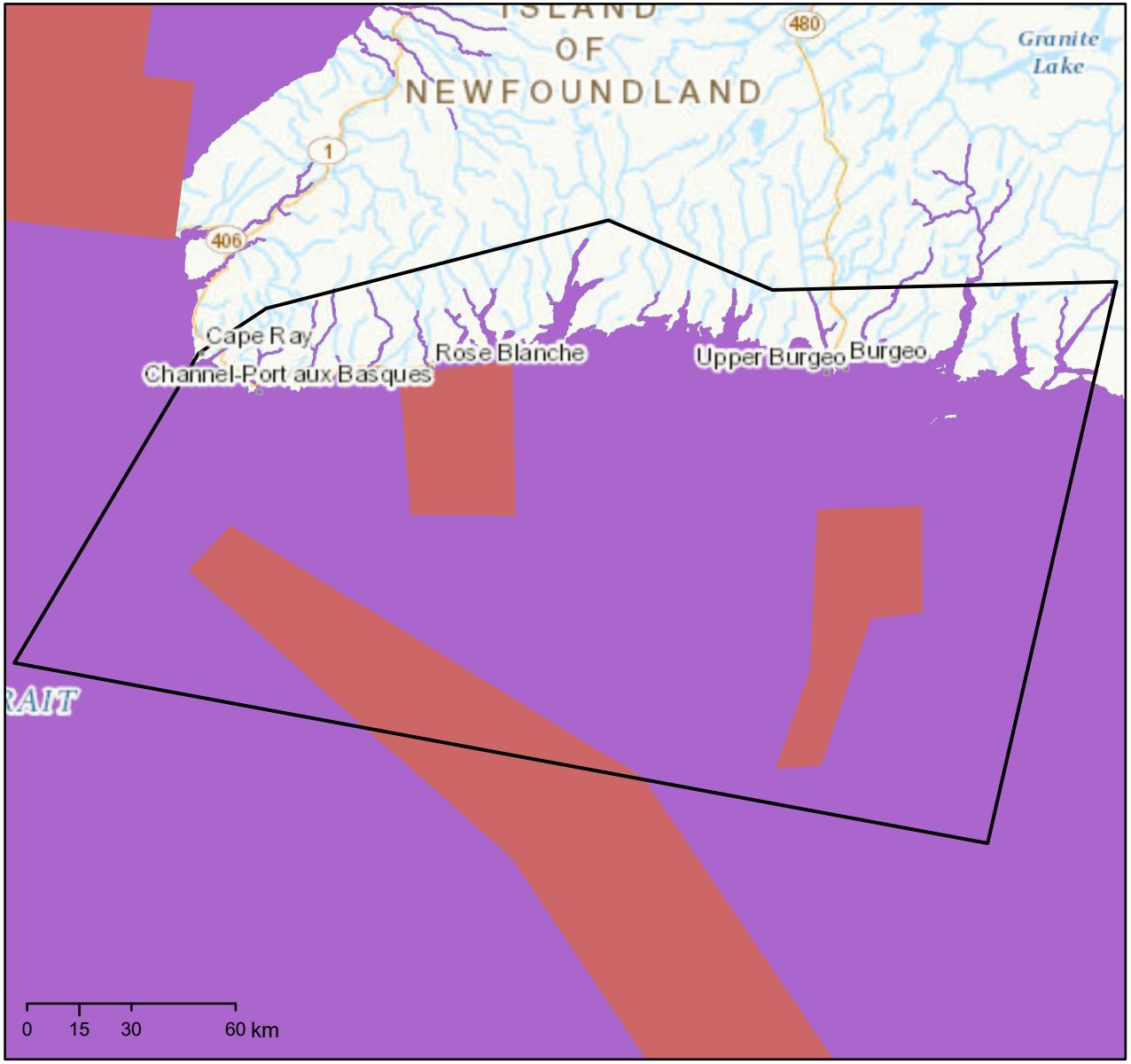
APPENDIX B

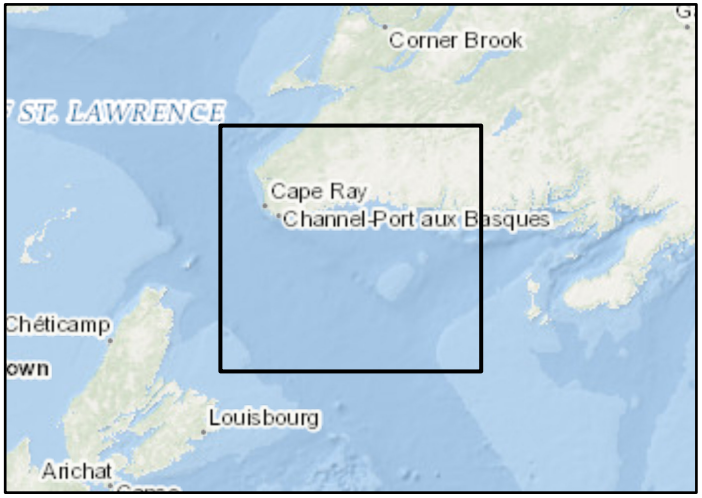
Aquatic SAR Report

Fisheries and Oceans Canada | Pêches et Océans Canada

Aquatic Species at Risk Report

Canada





One or more aquatic species listed under the Species at Risk Act are found (or potentially found) within the coloured areas.

- Critical Habitat
- Extirpated, Endangered, or Threatened
- Special Concern

How to use this information:

1. The map and species list are intended to provide a general overview of aquatic species at risk and their critical habitat that may occur within the mapped area.

2. To assess your project go to: www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html

If you encounter an aquatic species at risk in an area that is not currently mapped, please notify your regional Fisheries Protection Program office to ensure that you are compliant with the Species at Risk Act. The official source of information for species at risk is the Species at Risk Public Registry https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html

To protect fish and fish habitat, including aquatic species at risk, their residences, and their critical habitat, efforts should be made to avoid, mitigate and/or offset harm. Following the measures to avoid harm will help you comply with the Fisheries Act and the Species at Risk Act.

Critical habitat for these species is found within the outlined area

Critical habitat is identified in recovery strategies or action plans for species listed under Schedule 1 of the Species at Risk Act as extirpated, endangered or threatened.

Name	Where Found	Species Status
Northern Wolffish	Atlantic Ocean/Océan Atlantique	Threatened
Spotted Wolffish	Atlantic Ocean/Océan Atlantique	Threatened

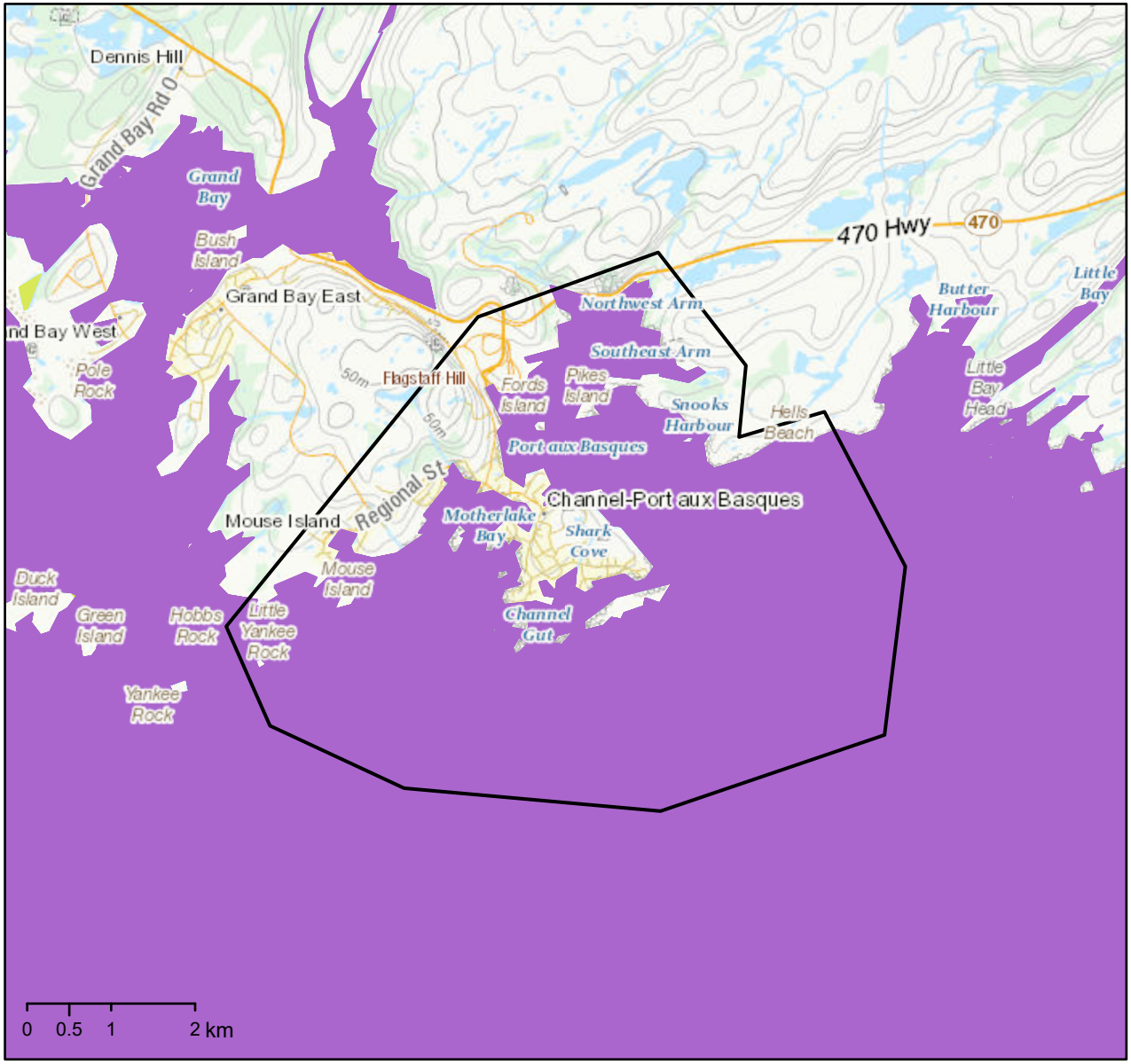
Species found (or potentially found) within the outlined area

Name	Where Found	Species Status
Atlantic Wolffish	Atlantic Ocean/Océan Atlantique	Special Concern
Banded Killifish - Newfoundland	First Pond (Lac)	Special Concern
Banded Killifish - Newfoundland	Ramea Island (Lac)	Special Concern
Blue Whale - Atlantic	Atlantic Ocean/Océan Atlantique	Endangered
Fin Whale - Atlantic	Atlantic Ocean/Océan Atlantique	Special Concern
Leatherback Sea Turtle - Atlantic	Atlantic Ocean/Océan Atlantique	Endangered
North Atlantic Right Whale	Atlantic Ocean/Océan Atlantique	Endangered
Northern Wolffish	Atlantic Ocean/Océan Atlantique	Threatened
Spotted Wolffish	Atlantic Ocean/Océan Atlantique	Threatened
White Shark - Atlantic	Atlantic Ocean/Océan Atlantique	Endangered

Fisheries and Oceans Canada | Pêches et Océans Canada

Aquatic Species at Risk Report

Canada



One or more aquatic species listed under the Species at Risk Act are found (or potentially found) within the coloured areas.

- Critical Habitat
- Extirpated, Endangered, or Threatened
- Special Concern

How to use this information:

1. The map and species list are intended to provide a general overview of aquatic species at risk and their critical habitat that may occur within the mapped area.

2. To assess your project go to: www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html

If you encounter an aquatic species at risk in an area that is not currently mapped, please notify your regional Fisheries Protection Program office to ensure that you are compliant with the Species at Risk Act. The official source of information for species at risk is the Species at Risk Public Registry https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html

To protect fish and fish habitat, including aquatic species at risk, their residences, and their critical habitat, efforts should be made to avoid, mitigate and/or offset harm. Following the measures to avoid harm will help you comply with the Fisheries Act and the Species at Risk Act.

Critical habitat for these species is found within the outlined area

Critical habitat is identified in recovery strategies or action plans for species listed under Schedule 1 of the Species at Risk Act as extirpated, endangered or threatened.

Name	Where Found	Species Status
	No critical habitat	

Species found (or potentially found) within the outlined area

Name	Where Found	Species Status
Atlantic Wolffish	Atlantic Ocean/Océan Atlantique	Special Concern
Blue Whale - Atlantic	Atlantic Ocean/Océan Atlantique	Endangered
Fin Whale - Atlantic	Atlantic Ocean/Océan Atlantique	Special Concern
Leatherback Sea Turtle - Atlantic	Atlantic Ocean/Océan Atlantique	Endangered
North Atlantic Right Whale	Atlantic Ocean/Océan Atlantique	Endangered
Northern Wolffish	Atlantic Ocean/Océan Atlantique	Threatened
Spotted Wolffish	Atlantic Ocean/Océan Atlantique	Threatened
White Shark - Atlantic	Atlantic Ocean/Océan Atlantique	Endangered

APPENDIX C

AC CDC Report

Atlantic Canada Conservation Data Centre
Centre de données sur la conservation du Canada atlantique

NL Data Request RQ1338: Pikes Island

Prepared Friday, May 15, 2026
by Adam Durocher, Data Manager

CONTENTS OF REPORT

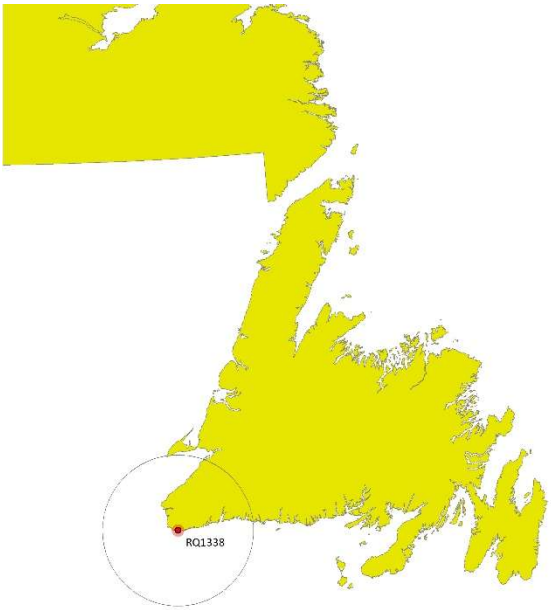


Figure 1: A 100km buffer around the point of interest.

1.0 Introduction

The Atlantic Canada Conservation Data Centre (AC CDC; www.accdc.com) is part of the network of NatureServe data centres and heritage programs serving all 50 states, 10 provinces and 3 Canadian territories, plus several Central and South American countries. The NatureServe network is more than 30 years old and shares a common conservation data methodology. The AC CDC was founded in 1997, and maintains data for the Maritimes, as well as Newfoundland and Labrador. Although a non-governmental agency, the AC CDC is supported by six federal agencies and four provincial governments, as well as through outside grants and data processing fees.

Upon request and for a fee, the AC CDC queries its database and produces customized reports of the rare and endangered flora and fauna known to occur in or near a specified study area. As a supplement to that data, the AC CDC includes locations of managed areas with some level of protection, and known sites of ecological interest or sensitivity.

1.1 SUPPLEMENTAL FILES

Included datasets:

Filename	Contents
RareFlora.xlsx	a list of the rare flora records, including their SRANK, NRANK, GRANK and habitats.
RareFauna.xlsx	a list of rare fauna records, including their SRANK, NRANK, GRANK and habitats.
DataDictionary.doc	Definitions of the various columns in RareFlora.xlsx and RareFauna.xlsx.

1.2 RESTRICTIONS

The AC CDC makes a strong effort to verify the accuracy of all the data that it manages, but it shall not be held responsible for any inaccuracies in data that it provides. By accepting AC CDC data, recipients assent to the following limits of use:

a) Data is restricted to use by trained personnel who are sensitive to landowner interests and to potential threats to rare and/or endangered flora and fauna posed by the information provided.
b) Data is restricted to use by the specified Data User; any third party requiring data must make its own data request.
c) The AC CDC requires Data Users to cease using and delete data 12 months after receipt, and to make a new request for updated data if necessary at that time.
d) AC CDC data responses are restricted to the data in our Data System at the time of the data request.
e) Each record has an estimate of locational uncertainty, which must be referenced in order to understand the record's relevance to a particular location. Please see attached Data Dictionary for details.
f) AC CDC data responses are not to be construed as exhaustive inventories of taxa in an area.
g) The absence of a taxon cannot be inferred by its absence in an AC CDC data response.
h) Woodland Caribou observations and occurrences aren't retained in the ACCDC-NL database and will not appear in data request results. Questions about Woodland Caribou should be directed to the Wildlife Division.

1.3 ADDITIONAL INFORMATION

The accompanying Data Dictionary provides explanations of the fields in RareFauna.xls and RareFlora.xls.

2.0 SPECIES AT RISK (SAR) AND SPECIES OF CONSERVATION CONCERN

2.1 FLORA

The 5-kilometer search area around your point of interest contains 25 rare flora records. Of these 25 rare flora records, only Sharpleaf Aster (*Oclemena acuminata*) is listed provincially under the Endangered Species Act (ESA) as *Threatened*. The remaining rare flora records are for species not found on the provincial Endangered Species Act (ESA) or COSEWIC lists, but these species are considered rare for the Island of Newfoundland.

2.2 FAUNA

The study area contains 44 rare fauna records. Of these 44 rare fauna records, there is 1 Banded Killifish record (listed as *Special Concern* under COSEWIC and *Vulnerable* under our ESA), 4 Lesser Yellowlegs records (listed as *Threatened* under COSEWIC and our ESA), and 14 Piping Plover records (listed as *Endangered* under both COSEWIC and our ESA). The remaining rare fauna records are for species which are not provincially or nationally listed, but are considered rare on the Island of Newfoundland.

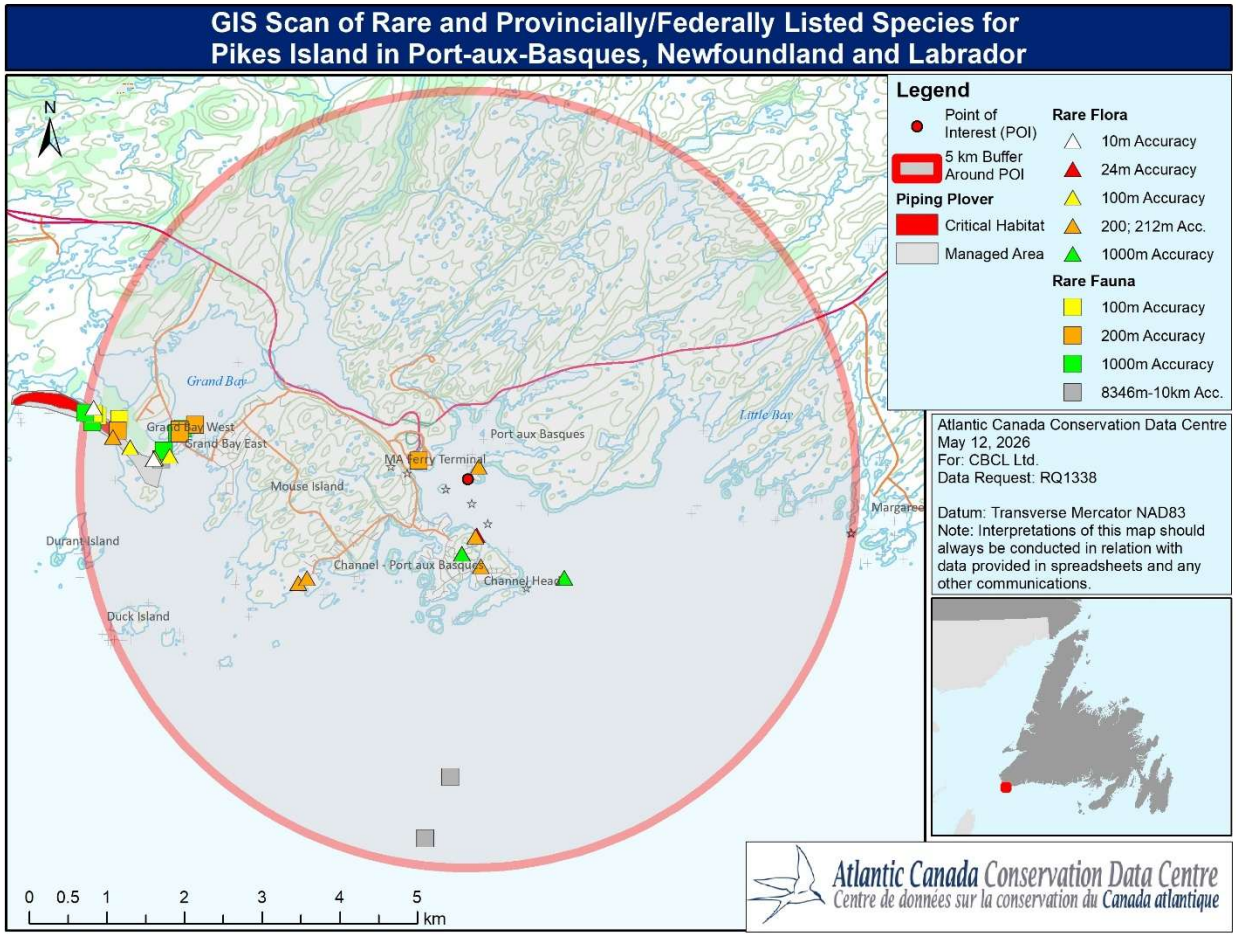


Figure 2: Known observations of rare and/or protected flora and fauna within the search area

3.0 SPECIAL AREAS

3.1 MANAGED AREAS

The GIS scan identified one managed area or sensitive wildlife area (Rocky Barachois Bight Piping Plover beach) in the vicinity of the five-km search area.

3.2 SIGNIFICANT AREAS

Significant Areas are sites with a conservation designation and management that qualifies them for listing in the Canadian Protected and Conserved Areas Database (CPCAD; https://www.canada.ca/en/environment-climate-change/services/national-wildlife-areas/protected-conserved-areas-database.html). The absence of a “Significant Area” within a site or region does not indicate an absence of ecologically significant properties. The GIS scan identified zero biologically significant sites in the vicinity of the study area (Map 3).

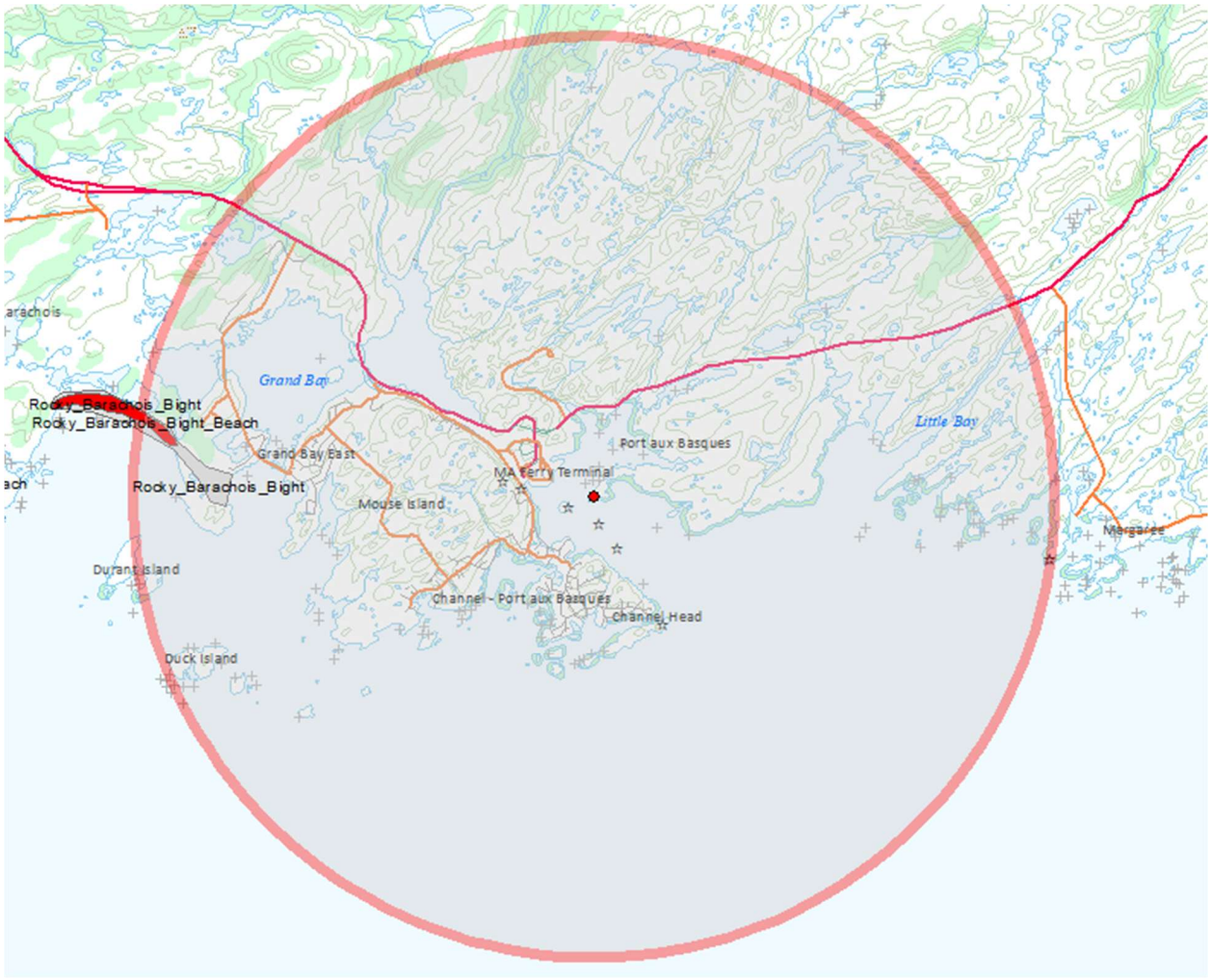


Figure 3: Boundaries and/or locations of known Managed and Significant Areas within the study area

4.0 RARE SPECIES LISTS

Rare and/or endangered taxa within the five-km search area are listed below.

4.1 Rare Fauna

GNAME	GCOMNAME	OBSERVERS	Month	Day	Year	RARITY RANK	COSEWIC_ST	PROVINCIAL
Fundulus diaphanus	Banded Killifish		0	0	2002	S3	Special Concern	Vulnerable
Pluvialis squatarola	Black-bellied Plover	inaturalist user: kblaney	7	30	2019	S3M		
Pluvialis squatarola	Black-bellied Plover	inaturalist user: fblb2003	9	23	2023	S3M		
Pluvialis squatarola	Black-bellied Plover	Terri Donovan	7	22	2024	S3M		
Tringa semipalmata	Eastern Willet	inaturalist user: paulreevesphotography	5	24	2016	S1B,SUM		
Tringa melanoleuca	Greater Yellowlegs	inaturalist user: fblb2003	9	23	2023	S3B,S4M		
Tringa melanoleuca	Greater Yellowlegs	Terri Donovan	7	22	2024	S3B,S4M		
Tringa melanoleuca	Greater Yellowlegs	Terri Donovan	7	24	2024	S3B,S4M		
Tringa melanoleuca	Greater Yellowlegs	Terri Donovan	7	26	2024	S3B,S4M		
Calidris minutilla	Least Sandpiper	inaturalist user: kblaney	7	30	2019	S3B,S4M		
Calidris minutilla	Least Sandpiper	Terri Donovan	7	24	2024	S3B,S4M		
Tringa flavipes	Lesser Yellowlegs	inaturalist user: kblaney	7	30	2019	S2S3M	Threatened	Threatened
Tringa flavipes	Lesser Yellowlegs	Terri Donovan	7	22	2024	S2S3M	Threatened	Threatened
Tringa flavipes	Lesser Yellowlegs	Terri Donovan	7	24	2024	S2S3M	Threatened	Threatened

Tringa flavipes	Lesser Yellowlegs	Terri Donovan	7	26	2024	S2S3M	Threatened	Threatened
Morus bassanus	Northern Gannet	inaturalist user: agmcmll	8	11	2018	S2B		
Morus bassanus	Northern Gannet	inaturalist user: salmonskyview	6	21	2018	S2B		
Morus bassanus	Northern Gannet	inaturalist user: salmonskyview	6	21	2018	S2B		
Circus hudsonius	Northern Harrier	inaturalist user: kblaney	7	30	2019	S3B,SUM		
Charadrius melodus	Piping Plover	Douglas K. Gibbons	5	26	1998	S1B,SUM	Endangered	Endangered
Charadrius melodus	Piping Plover	Todd Marshall	4	30	2004	S1B,SUM	Endangered	Endangered
Charadrius melodus	Piping Plover	Todd Marshall	5	9	2004	S1B,SUM	Endangered	Endangered
Charadrius melodus	Piping Plover	Jason Foster	8	9	2007	S1B,SUM	Endangered	Endangered
Charadrius melodus	Piping Plover	Leah Soper, Mike Bennet, Paul Grenier	7	21	1999	S1B,SUM	Endangered	Endangered
Charadrius melodus	Piping Plover	Joe Brazil	6	6	1992	S1B,SUM	Endangered	Endangered
Charadrius melodus	Piping Plover	Eric Menchenton and Ed Anderson	7	18	1995	S1B,SUM	Endangered	Endangered
Charadrius melodus	Piping Plover	Cathy Ryan	6	8	1994	S1B,SUM	Endangered	Endangered
Charadrius melodus	Piping Plover	Cathy Ryan	7	2	1994	S1B,SUM	Endangered	Endangered
Charadrius melodus	Piping Plover	Cathy Ryan	8	20	1994	S1B,SUM	Endangered	Endangered
Charadrius melodus	Piping Plover	Cathy Ryan	6	8	1994	S1B,SUM	Endangered	Endangered
Charadrius melodus	Piping Plover	Cathy Ryan	0		1994	S1B,SUM	Endangered	Endangered
Charadrius melodus	Piping Plover	LaFrense	6	12	1999	S1B,SUM	Endangered	Endangered
Charadrius melodus	Piping Plover	Blanchard, Kathleen, Billard, David, Wall, Russell and Bennett, Eric	7	29	2024	S1B,SUM	Endangered	Endangered
Charadrius semipalmatus	Semipalmated Plover	inaturalist user: kblaney	7	30	2019	S1B,S4M		

Charadrius semipalmatus	Semipalmated Plover	Terri Donovan	7	22	2024	S1B,S4M		
Charadrius semipalmatus	Semipalmated Plover	Terri Donovan	7	24	2024	S1B,S4M		
Charadrius semipalmatus	Semipalmated Plover	Terri Donovan	7	26	2024	S1B,S4M		
Calidris pusilla	Semipalmated Sandpiper	inaturalist user: kblaney	7	30	2019	S3M		
Calidris pusilla	Semipalmated Sandpiper	Terri Donovan	7	24	2024	S3M		
Limnodromus griseus	Short-billed Dowitcher	inaturalist user: kblaney	7	30	2019	S3M		
Limnodromus griseus	Short-billed Dowitcher	Terri Donovan	7	22	2024	S3M		
Limnodromus griseus	Short-billed Dowitcher	Terri Donovan	7	24	2024	S3M		
Limnodromus griseus	Short-billed Dowitcher	Terri Donovan	7	26	2024	S3M		
Calidris fuscicollis	White-rumped Sandpiper	Terri Donovan	7	26	2024	S3M		

4.2 Rare Flora

GNAME	GCOMNAME	OBSERVERS	Day	Month	Year	RARITY RANK	PROV END ACT	COSEWIC
Diapensia lapponica	Lapland Diapensia	iNaturalist user: icbryson	22	10	2019	S3S4		
Xanthoria parietina	Maritime Sunburst Lichen	iNaturalist user: icbryson	22	10	2019	S1S3		
Rusavskia elegans	Elegant Sunburst Lichen	iNaturalist user: breton	23	7	2020	S3S5		
Juncus gerardii	Black Grass	iNaturalist user: breton	24	7	2020	S2S3		
Rhinanthus minor	Little Yellow-Rattle	iNaturalist user: breton	23	7	2020	S3		

Utricularia geminiscapa	Twin-Stemmed Bladderwort	Fernald, M.L., B. Long, B. Dunbar	20	7	1924	S3		
Lycopodiella appressa	Southern Bog Club-Moss	Fernald, M.L., B. Long, B. Dunbar	21	7	1924	S2		
Catabrosa aquatica	Brook Grass	Fernald; Long; Dunbar	20	7	1924	S2S3		
Mitchella repens	Partridge-Berry	Fernald, M.L., B. Long, B. Dunbar	20	7	1924	S2S3		
Oclemena acuminata	Sharpleaf Aster	Fernald, M.L., B. Long, B. Dunbar	31	8	1924	S1	Threatened	
Huperzia selago	Fir Clubmoss	Djan-ChÃ©kar, N., Hanel, C. Lafosse, L. and Mann, H.	8	9	2000	S3S4		
Dryopteris cristata	Crested Wood Fern	Djan-ChÃ©kar, N., Hanel, C. Lafosse, L. and Mann, H.	8	9	2000	S3S4		
Calamagrostis breviligulata	American Beachgrass	Hanel, C. and Powell, S.	5	7	2000	S3S4		
Sagina nodosa ssp. nodosa	knotty pearlwort	Hanel, C. and Powell, S.	5	7	2000	S3S4		
Packera aurea	Golden Groundsel	Hanel, C. and Powell, S.	5	7	2000	S3S4		
Stellaria longipes ssp. longipes	longstalk starwort	Hanel, C. and Powell, S.	5	7	2000	S3		
Rhinanthus minor	Little Yellow-Rattle	Hanel, C. and Powell, S.	5	7	2000	S3		
Stuckenia pectinata	sago pondweed	Djan-ChÃ©kar, N., Hanel, C., Lafosse, L. and Mann, H.	8	9	2000	S2S3		
Lycopodium lagopus	One-Cone Gound-Pine	Maunder, John E.	23	7	1997	S2		
Pedicularis palustris ssp. palustris	Purple Lousewort	Maunder, John E.	23	7	1997	S3S4		
Andreaea rupestris	Black Rock Moss	Tuomikoski, R.	30	6	1949	S3S5		
Calamagrostis breviligulata	American Beachgrass	C. Hanel, J. E. Maunder and Wildflower Society members.	12	7	2007	S3S4		

Carex aurea	Golden-Fruited Sedge	C. Hanel, J. E. Maunder and Wildflower Society members.	12	7	2007	S3S4		
Rhinanthus minor	Little Yellow-Rattle	C. Hanel, J. E. Maunder and Wildflower Society members.	12	7	2007	S3		
Stellaria longipes	Long-Stalked Stitchwort	iNaturalist user: newfiehabsfan	18	7	2019	S3		

5.0 RARE SPECIES WITHIN 100 KM

A 100 km buffer around the point of interest contains 1118 rare fauna records and 1230 rare flora records.

These are taxa within 100 km of the study site that are rare and/or endangered in the subnation (Island of Newfoundland or Labrador) in which the study site occurs. All ranks correspond to the subnation in which the study site falls. The ACCDC-NL databases and the Maritimes database are two separate entities and searches from Southwestern Newfoundland will not include Nova Scotia's St. Paul Island.

GNAME	GCOMNAME	Most Recent Year	Rarity Rank	COSEWIC STATUS	PROVINCIAL	# RECS:
Acanthis flammea	Common Redpoll	1987	S2S3B,S4N,SUM			2
Accipiter atricapillus	American Goshawk	2010	S3			2
Accipiter atricapillus	Northern Goshawk	2023	S3			3
Aegolius acadicus	Northern Saw-Whet Owl	2023	S3B			3
Agelaius phoeniceus	Red-winged Blackbird	2022	S1B,SUM			22
Alca torda	Razorbill	2023	S3B			4
Anas acuta	Northern Pintail	2022	S3B,SUM			13
Anas platyrhynchos	Mallard	2022	S3B,SUM			10
Anthus rubescens	American Pipit	2019	S3B,S4M			2
Archilochus colubris	Ruby-throated Hummingbird	2021	S1B,SUM			2
Ardea herodias	Great Blue Heron	2023	S2B,SUM			63
Arenaria interpres	Ruddy Turnstone	2019	S2S3M			5

Asio flammeus	Short-eared Owl	2016	S2S3B	Threatened	Threatened	15
Besma quercivoraria	Oak Besma Moth	2023	S3S5			1
Biston betularia	Peppered Moth	2010	S3S4			1
Bombus terricola	Yellow-banded Bumble Bee	2019	S3S4	Special Concern	Vulnerable	1
Bubo scandiacus	Snowy Owl	2002	S3N,SUM	Threatened		1
Bucephala albeola	Bufflehead	1987	S1S2B,S1S2N,SUM			1
Buteo lagopus	Rough-legged Hawk	2012	S2S3			2
Calidris alba	Sanderling	2020	S2N,S3M			5
Calidris canutus	Red Knot	2018	S2M	Endangered	Endangered	1
Calidris fuscicollis	White-rumped Sandpiper	2024	S3M			1
Calidris maritima	Purple Sandpiper	2022	S3N			1
Calidris minutilla	Least Sandpiper	2024	S3B,S4M			2
Calidris pusilla	Semipalmated Sandpiper	2024	S3M			5
Callophrys augustinus	Brown Elfin		S3			2
Calopteryx aequabilis	River Jewelwing	2022	S3			1
Cardellina canadensis	Canada Warbler	2008	SNA	Special Concern		2
Catharus fuscescens	Veery	2018	S2B,SUM			1
Catharus minimus	Gray-Cheeked Thrush	2016	S2B,SUM	Candidate (Mid Priority)	Threatened	7
Charadrius melodus	Piping Plover	2023	S1B,SUM	Endangered	Endangered	41
Charadrius melodus	Piping Plover melodus ssp	2013	S1B,SUM	Endangered	Endangered	2
Charadrius semipalmatus	Semipalmated Plover	2024	S1B,S4M			12
Charadrius vociferus	Killdeer	2018	S3B,SUM	Candidate (Low Priority)		3
Chordeiles minor	Common Nighthawk	2019	SNA	Special Concern	Vulnerable	3
Chroicocephalus ridibundus	Black-headed Gull	2010	S1B,S3N,SUM			1
Circus hudsonius	Northern Harrier	2021	S3B,SUM			19

Coccothraustes vespertinus	Evening Grosbeak	2019	S3S4	Special Concern	Vulnerable	3
Contopus cooperi	Olive-sided Flycatcher	2020	S3B,SUM	Special Concern	Vulnerable	52
Dolichonyx oryzivorus	Bobolink	2020	S1B,SUM	Threatened	Vulnerable	91
Empidonax minimus	Least Flycatcher	2022	S2S3B,SUM	Candidate (Group 3, Low Priority)		24
Eremophila alpestris	Horned Lark	1987	S3B,SUM			1
Euphagus carolinus	Rusty Blackbird	2024	S2S3B,SUM	Special Concern	Vulnerable	9
Fulmarus glacialis	Northern Fulmar	2022	S1B			7
Fundulus diaphanus	Banded Killifish	2007	S3	Special Concern	Vulnerable	5
Fundulus heteroclitus	Mummichog	2006	S3		Vulnerable	7
Hirundo rustica	Barn Swallow	2021	S2B,SUM	Special Concern	Vulnerable	16
Histrionicus histrionicus	Harlequin Duck	2023	S2B,S2N	Special Concern	Vulnerable	8
Hydrobates leucorhous	Leach's Storm-Petrel	2018	S4B	Threatened	Threatened	3
Hydroprogne caspia	Caspian Tern	2011	S2B,SUM			1
Lagopus muta	Rock ptarmigan	2019	S3			2
Larus fuscus	Lesser Black-backed Gull	2021	S3N,SUM			2
Lepus arcticus	Arctic Hare	2010	S2S3			3
Leucorrhinia glacialis	Crimson-ringed Whiteface/ Common Skimmer		S3S4			1
Limnodromus griseus	Short-billed Dowitcher	2024	S3M			6
Loxia curvirostra	Red Crossbill	2005	S1S2	Threatened	Threatened	9
Lynx canadensis	Canada Lynx	2023	S3S4			1
Mareca americana	American Wigeon	2022	S3B,SUM			75

Megaceryle alcyon	Belted Kingfisher	2019	S4B,S3N,SUM	Candidate (Group 3, Low Priority)		22
Melanitta americana	Black Scoter	2017	S2B,S2N,SUM			1
Morus bassanus	Northern Gannet	2023	S2B			33
Myotis lucifugus	Little Brown Bat		S1S3	Endangered	Endangered	2
Myotis septentrionalis	Northern Long-eared Bat		S1S3	Endangered	Endangered	1
Numenius phaeopus	Whimbrel	2019	S2S3M			1
Phalacrocorax carbo	Great Cormorant	2023	S3B,S3N			13
Phalaropus lobatus	Red-necked Phalarope	2008		Special Concern	Vulnerable	1
Picoides dorsalis	American Three-toed Woodpecker	2012	S3S4			1
Plectrophenax nivalis	Snow Bunting	1987	S2N,S5M			1
Pluvialis squatarola	Black-bellied Plover	2024	S3M			13
Podilymbus podiceps	Pied-billed Grebe	2021	S1B,SUM			12
Polites peckius	Peck's Skipper		S3			2
Polygonia progne	Gray Comma		S3			2
Polygonia satyrus	Satyr Comma		S3			1
Porzana carolina	Sora	2020	S2B,SUM			1
Puffinus puffinus	Manx Shearwater	2023	S1B			1
Pungitius pungitius	Ninespine Stickleback	1966	S3			1
Quiscalus quiscula	Common Grackle	2019	S4B,S3?N,SUM			77
Rangifer tarandus	Caribou	2011	S3S4	Special Concern (NF Population)	Threatened (Labrador Population)	1
Riparia riparia	Bank Swallow	2024	S1S2B,SUM	Threatened	Threatened	61
Scolopax minor	American Woodcock	2023	S1B,SUM			1
Seiurus aurocapilla	Ovenbird	2022	S3B,SUM			63
Setophaga americana	Northern Parula	2022	S1B?,SUM			9
Setophaga castanea	Bay-breasted Warbler	2022	S2B,SUM			5

Setophaga fusca	Blackburnian Warbler	2022	S2B,SUM			5
Setophaga tigrina	Cape May Warbler	2022	S2B,SUM			10
Somatochlora septentrionalis	Muskeg Emerald/ Green Eyed Skimmer	1949	S3S4			1
Somatochlora walshii	Brush-tipped Emerald	2009	S3S4			2
Sphyrapicus varius	Yellow-bellied Sapsucker	2020	S2B,SUM			1
Spizella passerina	Chipping Sparrow	2019	S2S3B,SUM			18
Spizelloides arborea	American Tree Sparrow	1987	S3B,SUM			2
Surnia ulula	Northern Hawk-Owl	2002	S3			1
Tringa flavipes	Lesser Yellowlegs	2024	S2S3M	Threatened	Threatened	8
Tringa melanoleuca	Greater Yellowlegs	2024	S3B,S4M			23
Tringa semipalmata	Eastern Willet	2016	S1B,SUM			1
Tringa semipalmata	Willet	2022	S1B,SUM			1
Troglodytes hiemalis	Winter Wren	2018	S3B,SUM			22
Vanessa virginiensis	American Lady		S3B,SUM			1
Vireo olivaceus	Red-eyed Vireo	2022	S3S4B,SUM			35
Vireo philadelphicus	Philadelphia Vireo	2020	S3B,SUM			9
Vireo solitarius	Blue-headed Vireo	2023	S3S4B, SUM			33
Zenaida macroura	Mourning Dove	2022	S3			31

GNAME	GCOMNAME	Most Recent Occurrence	RARITY RANK	COSEWIC	PROV_END_A	# RECS
Acorus americanus	Sweet Flag	1961	S1			1
Agrimonia striata	Woodland Agrimony	2024	S3			21
Agrostis perennans	Perennial Bentgrass	2000	S2			2
Alchemilla filicaulis ssp. filicaulis	thinstem lady's mantle	2000	S3			1
Allium schoenoprasum	Chives	2021	S2S3			1
Andreaea rothii	Dusky Rock Moss	1978	S3S4			1
Andreaea rupestris	Black Rock Moss	1981	S3S5			5
Antennaria howellii	Small Pussy-Toes	2000	S3S4			3
Antennaria pulcherrima	Handsome Pussy-Toes	2000	S3			6

Antennaria rosea ssp. pulvinata	pulvinate pussytoes	1922	S3S4			1
Apocynum androsaemifolium	Spreading Dogbane	2020	S3			1
Apocynum cannabinum	Clasping-Leaf Dogbane	2023	S3			35
Arceuthobium pusillum	Dwarf Mistletoe	1986	S3			2
Arnica angustifolia	Alpine Arnica	1922	S3			1
Arnica lonchophylla	Northern Arnica	2000	S3S4			1
Aronia melanocarpa	black chokeberry	2001	S2S4			1
Astragalus alpinus var. brunetianus	Alpine Milk-Vetch	1867	S2S3			1
Bartonia paniculata	Twining Bartonia	2002	S3S4			4
Bartonia virginica	Yellow Screwstem	2007	S1			3
Betula alleghaniensis	Yellow Birch	2022	S3			18
Blysmopsis rufa	red clubrush	2000	S3			3
Bolboschoenus maritimus ssp. paludosus	saltmarsh bulrush	2000	S2			3
Botrychium matricariifolium	Chamomile Grape-Fern	2020	S2S3			2
Botrychium simplex	Little Grapefern	1997	S2			2
Brachyelytrum aristosum	Northern Shorthusk	2013	S3S4			7
Bryoria fuscescens	Pale-footed Horsehair Lichen	2021	S3S5			1
Calamagrostis breviligulata	American Beachgrass	2023	S3S4			11
Calamagrostis canadensis var. canadensis	Blue-Joint Reedgrass	2011	S3S5			4
Calypso bulbosa var. americana	Fairy Slipper	1997	S1			1
Carex atratiformis	Black Sedge	2000	S3S4			1
Carex aurea	Golden-Fruited Sedge	2021	S3S4			6
Carex concinna	Beautiful Sedge	1922	S2			1
Carex diandra	Lesser Panicled Sedge	2000	S3S4			1
Carex eburnea	Ebony Sedge	2000	S3			2
Carex glacialis	Alpine Sedge	1922	S3			1
Carex glareosa	Gravel Sedge	2000	S3			1
Carex gracillima	Graceful Sedge	2013	S3S4			11
Carex gynocrates	Northern Bog Sedge	2012	S3S4			1
Carex hormathodes	Marsh Straw Sedge	2000	S3			9

Carex hostiana	Host's Sedge	1939	S2			1
Carex interior	Inland Sedge	2011	S3S4			2
Carex novae-angliae	New England Sedge	2000	S2S3			10
Carex pallescens	Pale Sedge	2017	S3			6
Carex pedunculata	Longstalk Sedge	2010	S3			10
Carex petricosa var. misandroides	Rock Dwelling Sedge	1922	S1		Endangered	1
Carex projecta	Necklace Sedge	2013	S3			29
Carex pseudocyperus	Cyperus-Like Sedge	2021	S2			35
Carex radiata	Stellate Sedge	1867	S1			1
Carex rariflora	Loose-Flowered Sedge	2000	S3			1
Carex retrorsa	Retrorse Sedge	2013	S1			1
Carex rupestris	Rock Sedge	2000	S3			1
Carex salina	Salt-Marsh Sedge	2000	S3			1
Carex silicea	Sea-Beach Sedge	2000	S2			1
Carex sterilis	Dioecious Sedge	2000	S2S3			1
Carex vaginata	Sheathed Sedge	2000	S3S4			1
Carex viridula ssp. brachyrrhyncha var. elatior	long-stalked yellow sedge	1999	S3S4			1
Carex wiegandii	Wiegand's Sedge	2007	S3			2
Catabrosa aquatica	Brook Grass	1924	S2S3			1
Cerastium beeringianum	Bering Sea Chickweed	1922	S3			1
Cetraria muricata	Spiny Heath Lichen	2009	S3S5			2
Cicuta bulbifera	Bulb-Bearing Water-Hemlock	2000	S3			2
Cladonia amaurocraea	Quill Lichen	2018	S3S5			4
Cladonia caespiticia	Stubby Stalked Lichen	2021	S3			1
Claytonia caroliniana	Carolina Spring-Beauty	2016	S2			1
Clinopodium vulgare	Field Basil	2016	S3			3
Coeloglossum viride	Long-Bract Green Orchid	2000	S3S4			2
Collema subflaccidum	Tree Tarpaper Lichen	2008	S3S4			5
Cornus alternifolia	Alternate-Leaf Dogwood	2024	S3S4			18
Crataegus chrysocarpa	Fineberry Hawthorn	2012	S2			1

Crataegus chrysocarpa var. chrysocarpa	Fineberry Hawthorne	2001	S2			8
Crataegus macrosperma	Big-Fruit Hawthorn	1959	S1			1
Cypripedium reginae	Showy Lady's-Slipper	2014	S3			2
Cystopteris bulbifera	Bulblet Bladder Fern	1922	S2S3			1
Cystopteris laurentiana	Laurentian Bladder Fern	1949	S2			2
Deschampsia cespitosa	Tufted Hairgrass	2016	S3S5			5
Diapensia lapponica	Lapland Diapensia	2019	S3S4			4
Dicranum leioneuron	Variableleaf Broom Moss	2000	S3S4			1
Diervilla lonicera	Northern Bush-honeysuckle	2012	S3S4			3
Diphasiastrum complanatum	northern running-pine, groundcedar	2000	S3S4			1
Diphasiastrum sitchense	Sitka clubmoss, tufted groundceder	2020	S3S4			3
Drosera anglica	English Sundew	1997	S3			1
Dryopteris cristata	Crested Wood Fern	2009	S3S4			3
Dulichium arundinaceum	Three-Way Sedge	2010	S3S4			2
Eleocharis acicularis	Least Spike-Rush	2000	S3S4			6
Eleocharis elliptica	Slender Spike-Rush	2000	S3S4			5
Eleocharis parvula	Small Spikerush	2000	S3S4			4
Eleocharis quinqueflora	Few-Flower Spikerush	2000	S3S4			7
Elymus virginicus var. virginicus	Virginia Wild Rye	2000	S3S4			4
Empetrum atropurpureum	Purple Crowberry	1997	S3S4			1
Epigaea repens	Trailing Arbutus	2021	S3S4			7
Epilobium lactiflorum	White-Flower Willow-Herb	2012	S3			2
Epilobium leptophyllum	Linear-Leaved Willow-Herb	2012	S3			4
Equisetum hyemale	Rough Horsetail	2013	S1			4
Equisetum hyemale ssp. affine	tall scouring rush	2010	S1			4
Equisetum palustre	Marsh Horsetail	2013	S3S4			13
Equisetum pratense	Meadow Horsetail	2020	S3			4
Equisetum variegatum	Variegated Horsetail	2012	S3			1
Equisetum variegatum ssp. variegatum	variegated scouring rush	2000	S3			1

Eriophorum tenellum	Rough Cotton-Grass	2000	S3S4			1
Evernia mesomorpha	Boreal Oakmoss Lichen	2021	S3S4			2
Festuca altaica	Northern Rough Fescue	1939	S2			1
Festuca rubra	Red Fescue	2001	S2S3			20
Galium kamtschaticum	Boreal Bedstraw	1949	S3S4			3
Galium tinctorium	Stiff Marsh Bedstraw	2000	S3S4			3
Gaylussacia baccata	Black Huckleberry	2000	S3			1
Gaylussacia bigeloviana	Dwarf Huckleberry	2007	S3S4			3
Gentianopsis detonsa	Sheared Gentian	2022	S3			1
Glyceria grandis	American Mannagrass	2013	S2S3			1
Hedysarum americanum	Alpine Sweet-Vetch	2016	S3			5
Hedysarum boreale	Boreal Sweet-vetch	2021	S1			2
Hedysarum boreale ssp. mackenziei	Mackenzieâ€™s Sweetvetch	2021	S1		Threatened	35
Hordeum jubatum ssp. jubatum	foxtail barley, squirreltail grass	2000	S2S3			3
Hudsonia ericoides	Golden-Heather	2007	S2S3	Candidate (Priority 3)		7
Humulus lupulus var. lupuloides	American Hop	2021	S1			3
Huperzia selago	Fir Clubmoss	2000	S3S4			1
Hydrocotyle americana	American Water-Pennywort	2020	S1			4
Hypericum ellipticum	Pale St. John's-Wort	19721974	S3			29
Impatiens pallida	Pale Jewel-Weed	1949	S1			3
Juncus alpinoarticulatus	Northern Green Rush	2000	S3S4			4
Juncus dudleyi	Dudley's Rush	2000	S2			5
Juncus gerardii	Black Grass	2020	S2S3			1
Juncus longistylis	Long-styled Rush	2013	S1			28
Juncus nodosus	Knotted Rush	2010	S2			13
Juncus subcaudatus	Woods-Rush	2000	S1			4
Leptogium cyanescens	Blue Jellyskin	2021	S3S4			1
Limonium carolinianum	Sea-Lavender	2000	S2S3			4
Littorella americana	American Shore-grass	2000	S3S4			1
Lobelia kalmii	Kalm's Lobelia	2014	S3S4			3

Luzula acuminata	Pointed Woodrush	2023	S1			3
Luzula acuminata ssp. acuminata	hairy woodrush	2008	S1			4
Lycopodiella appressa	Southern Bog Club-Moss	1989	S2			3
Lycopodium lagopus	One-Cone Gound-Pine	1997	S2			1
Lycopus americanus	American Bugleweed	2010	S3			2
Maianthemum racemosum	Feathery False Solomon's Seal	2024	S1		Endangered	96
Maianthemum racemosum ssp. racemosum	Feathery False Solomon's Seal	2002	S1		Endangered	9
Malaxis monophyllos var. brachypoda	white addersmouth, Northenr white addersmouth	2000	S3			2
Malaxis unifolia	Green Adder's-Mouth	2013	S3			11
Matteuccia struthiopteris	Ostrich Fern	2021	S3S4			1
Matteuccia struthiopteris var. pensylvanica	Ostrich Fern	2023	S3S4			8
Melampyrum lineare	American Cow-Wheat	2011	S3S4			3
Milium effusum var. cisatlanticum	Tall Millet-Grass	1964	S2S3			2
Mitchella repens	Partridge-Berry	2019	S2S3			20
Mononeuria groenlandica	Mountain Sandwort	1989	S2			2
Morella pensylvanica	Northern Bayberry	2018	S2			3
Muhlenbergia uniflora	Fall Dropseed Muhly	2002	S3S4			2
Myriophyllum farwellii	Farwell's Water-Milfoil	2000	S1S2			1
Myriophyllum verticillatum	Whorled Water-Milfoil	2000	S2S3			1
Najas flexilis	Bushy Naiad	1930	S2			1
Neottia auriculata	Auricled Twayblade	1939	S2			2
Neottia convallarioides	Broad-lip Twayblade	2024	S3S4			2
Nephroma laevigatum	Mustard Kidney Lichen	2021	S3S4			3
Nymphaea odorata ssp. odorata	fragrant waterlily, water nymph	2000	S3			1
Oclemena acuminata	Sharpleaf Aster	2021	S1		Threatened	23
Omalotheca sylvatica	Woodland Cudweed	2000	S3S4			1
Osmorhiza depauperata	Blunt-Fruited Sweet-Cicely	1939	S3			1
Oxalis montana	White Wood-Sorrel	1989	S1S2			3

Oxyria digyna	Mountain Sorrel	2012	S2S3			5
Oxytropis campestris	Northern Yellow Point-Vetch	2016	S3			4
Oxytropis campestris var. johannensis	St. John's Oxytrope	2021	S1S3			2
Oxytropis campestris var. minor	St John's Oxytrope	2000	S3			3
Packera aurea	Golden Groundsel	2016	S3S4			2
Pannaria lurida	Wrinkled Shingle Lichen	2016	S1	Threatened	Threatened	3
Pannaria rubiginosa	Brown-eyed Shingle Lichen	2021	S3			1
Parmeliella triptophylla	Black-bordered Shingles Lichen	2024	S3S4			15
Parmeliopsis ambigua	Green Starburst Lichen	2021	S3S5			1
Parnassia palustris	Marsh Grass-Of-Parnassus	2000	S2S3			4
Pedicularis palustris ssp. palustris	Purple Lousewort	2013	S3S4			2
Petasites frigidus var. palmatus	Sweet Coltsfoot	2000	S3S4			1
Physaria arctica	Arctic Bladderpod	2000	S3			5
Pinus resinosa	Red Pine	2019	S2		Threatened	1
Piptatheropsis canadensis	Canada Mountain-ricegrass	1939	S2			1
Platanthera grandiflora	Large Purple-Fringed Orchid	2018	S3			36
Platanthera lacera	Ragged-Fringed Orchid	2011	S3S4			4
Platanthera orbiculata	Large Roundleaf Orchid	2007	S3S4			1
Platismatia norvegica	Oldgrowth Rag Lichen	2021	S3S5			3
Poa pratensis	Kentucky Bluegrass	2016	S3			8
Poa saltuensis	Drooping Bluegrass	2000	S3S4			2
Polygonum fowleri ssp. hudsonianum	Hudson's knotweed	1976	S2S3			1
Polygonum oxyspermum ssp. raii	Ray's knotweed	1978	S2			1
Polystichum braunii	Braun's Holly-Fern	2016	S3S4			6
Potamogeton alpinus	Northern Pondweed	2000	S3S4			1
Potamogeton confervoides	Algae-Like Pondweed	2011	S3S4			1
Potamogeton pusillus ssp. tenuissimus	Berchtold's pondweed, slender pondweed	2000	S3S4			1

Potentilla crantzii	Crantz's Cinquefoil	1922	S2S3			2
Primula egaliksensis	Greenland Primrose	2022	S3			1
Prunella vulgaris	Self-Heal	2024	S3S5			20
Pseudocyphellaria holarctica	Holarctic Lung Lichen	2021	S2S3			1
Pycnothelia papillaria	Nipple Lichen	2018	S2S3			1
Pyrola elliptica	Shinleaf	2013	S2S3			1
Ramalina dilacerata	Punctured Ramalina Lichen	2021	S1S3			4
Ramalina farinacea	Dotted Line Lichen	2007	S3			1
Ramalina thrausta	Angelhair Ramalina Lichen	2021	S2S3			1
Ranunculus gmelinii	Gmelin's Watercrowfoot	2024	S1		Endangered	30
Ranunculus macounii	Macoun Buttercup	1922	S2S3			1
Ranunculus recurvatus	Hooked Crowfoot	1949	S1S2			1
Rhinanthus minor	Little Yellow-Rattle	2021	S3			13
Rhynchospora fusca	Brown Beakrush	2011	S3S4			2
Ricasolia quercizans	Smooth Lungwort	2024	S3S4			9
Rusavskia elegans	Elegant Sunburst Lichen	2020	S3S5			1
Sabulina dawsonensis	Rock Stitchwort	2014	S2S3			2
Sagina nodosa ssp. borealis	northern knotty pearlwort	2012	S3S4			2
Sagina nodosa ssp. nodosa	knotty pearlwort	2000	S3S4			2
Sagittaria graminea	Grassleaf Arrowhead	2000	S3S4			3
Salix argyrocarpa	Northern Willow	2011	S1S2			1
Salix calcicola	Lanate Willow	2000	S3S4			1
Salix eriocephala	Heart-Leaved Willow	2012	S3			13
Salix myricoides	Blue-Leaved Willow	2000	S3S4			7
Sanicula marilandica	Black Snake-Root	2013	S3S4			8
Saxifraga oppositifolia	Purple Mountain Saxifrage	2022	S3S4			2
Saxifraga oppositifolia ssp. oppositifolia	purple mountain saxifrage	2000	S3S4			1
Sceptridium multifidum	Leathery Grapefern	2000	S3			4
Scheuchzeria palustris	Pod Grass	2011	S3S4			1
Schizachne purpurascens	Purple Oat	1997	S3			1
Schizaea pusilla	Curly-Grass Fern	2013	S3S4			7

Schoenoplectus acutus var. acutus	Hard-Stemmed Bulrush	2012	S3			5
Schoenoplectus pungens	Three-Square Bulrush	2016	S3			8
Schoenoplectus tabernaemontani	Soft-Stem Bulrush	2024	S2			10
Scirpus cyperinus	Cottongrass Bulrush	2013	S3S4			7
Scirpus hattorianus	Bulrush	2000	S3S4			1
Scutellaria lateriflora	Mad Dog Skullcap	2024	S3			10
Senecio pseudoarnica	Seabeach Groundsel	2021	S3S4			2
Sium suave	Hemlock Water-parsnip	2000	S3S4			1
Solidago brendae	Brenda's Goldenrod	2017	S3			1
Solidago multiradiata	Alpine Goldenrod	2012	S3S4			1
Sparganium fluctuans	Floating Bur-Reed	2012	S2S3			6
Sparganium natans	Small Bur-Reed	2000	S3S4			4
Sphaerophorus fragilis	Fragile Coral Lichen	2011	S3S5			3
Sphaerophorus globosus	Northern Coral Lichen	2011	S3S5			2
Sporobolus alterniflorus	Saltwater Cordgrass	2000	S2			2
Stellaria alsine	Trailing Stitchwort	2000	S3S4			1
Stellaria longipes	Long-Stalked Stitchwort	2019	S3			1
Stellaria longipes ssp. longipes	longstalk starwort	2000	S3			1
Stuckenia pectinata	sago pondweed	2000	S2S3			2
Suaeda calceoliformis	American Sea-Blite	2000	S1S2			2
Symphyotrichum ciliolatum	Lindley's Aster	1930	S2		Endangered	2
Symphyotrichum lanceolatum	White Panicled American-Aster	2016	S2			1
Symphyotrichum lanceolatum var. lanceolatum	Panicled Aster	2000	S2			8
Symphyotrichum tradescantii	Tradescant Aster	2013	S1		Threatened	2
Tanacetum bipinnatum	dwarf tansy, Lake huron tansy	2021	S3			1
Tanacetum bipinnatum ssp. huronense	Newfoundland dwarf tansy, Lake Huron tansy, dune tansy	2021	S3			4
Taraxacum latilobum	Large-lobed Dandelion	1990	S3			4
Taxus canadensis	Canadian Yew	2022	S3S4			5
Thamnolia vermicularis	Alpine Whiteworm Lichen	2011	S3S5			1

Triglochin gaspensis	GaspT Peninsula Arrow-Grass	2000	S3			1
Urtica dioica ssp. gracilis	slender stinging nettle	2012	S3S5			1
Usnea dasopoga	Fishbone Beard Lichen	2021	S3S4			4
Utricularia geminiscapa	Twin-Stemmed Bladderwort	2000	S3			5
Valeriana dioica ssp. sylvatica	northern vlaerian, march valerian	1922	S3			1
Veronica serpyllifolia	Thyme-Leaved Speedwell	2021	S3S4			4
Veronica serpyllifolia ssp. humifusa	northern speedwell	1986	S3S4			6
Viola nephrophylla	Northern Bog Violet	2010	S3			3
Viola selkirkii	Great-Spurred Violet	1922	S2			1
Viscaria alpina	Alpine Campion	2012	S3			1
Vulpicida pinastri	Powdered Sunshine Lichen	2021	S3S5			4
Woodsia glabella	Smooth Woodsia	1922	S3			1
Xanthoria parietina	Maritime Sunburst Lichen	2019	S1S3			1
Xyris montana	Northern Yellow-Eyed-Grass	2002	S3			2
Zannichellia palustris	Horned Pondweed	2000	S2S3			7
Zostera marina	Sea-Wrack	2000	S3S4			1

6.0 EXPERT OPINION

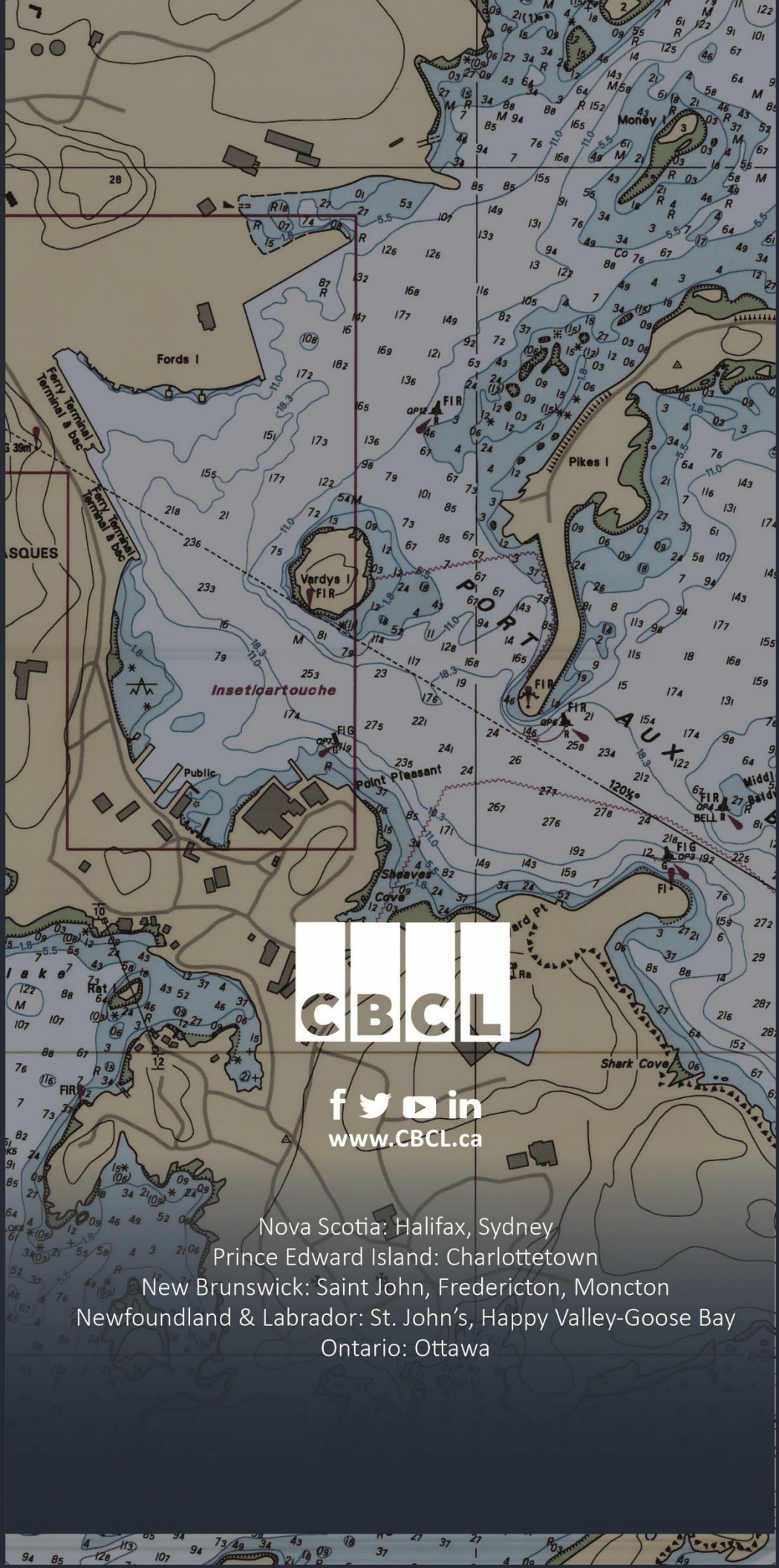
Our Expert Opinion Maps are the result of our work with species-specific experts to gather suggestions about locations where species at risk - either provincially or COSEWIC listed - may be found. While we don't have observations in our database for these species within 5 km of your site, our Expert Opinion Maps suggest Boreal Felt Lichen, Red Crossbills, and Rusty Blackbirds are *possible* within 5km of your point of interest, while Newfoundland Marten are considered *possible, but unlikely*. Also, the oceanic waters within 5km of your point of interest are within the Barrow's Goldeneye's range.

APPENDIX D

Seasonal Occurrences

Species	Status	Activity	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
FISH														
Acadian Redfish Atlantic	Harvested Species; COSEWIC - Threatened	Spawning, Overwintering concentration, nursery. Preferred depth of larvae is between 11 and 30 m												
American eel	Harvested Species; COSEWIC- Threatened; NLESA- Vulnerable	Migration, nursery, foraging, overwintering												
Atlantic Bluefin tuna	COSEWIC-Endangered	Foraging, migration												
Atlantic Cod- Laurentian North and South populations	Harvested species; SARA- Special Concern Schedule 3; COSEWIC- Endangered	All Life History Events												
Atlantic Halibut	Harvested species	All Life History Events												
Atlantic Herring	Harvested species	Overwintering												
Atlantic salmon - South Newfoundland	Harvested Species; COSEWIC - Threatened	Foraging in coastal areas throughout the year, rivers												
Atlantic sturgeon - Maritimes	COSEWIC-Endangered	Possible migration and foraging												
Atlantic sturgeon - St. Lawrence	COSEWIC-Endangered	Possible migration and foraging												
Atlantic Wolffish	SARA- Special Concern-Schedule 1, COSEWIC- Special Concern	All Life History Events												
Atlantic wolffish - Atlantic	SARA- Special Concern-Schedule 1, COSEWIC- Special Concern	Spawning, foraging, rearing, overwintering												
Banded killifish - Newfoundland	SARA- Special Concern-Schedule 1, COSEWIC- Special Concern, NLESA- Vulnerable	Spawning, foraging, rearing, overwintering												
Basking shark - Atlantic population	COSEWIC-Special Concern	Migration and foraging												
Capelin	Harvested Species	Migration and foraging												
Deepwater Redfish - Gulf of Saint Lawerence/ Laurentian Channel	Harvested Species; COSEWIC - Endangered	Spawning, foraging, overwintering, rearing.												
Lumpfish - Atlantic	Harvested Species; COSEWIC- Threatened	Spawning, foraging, rearing, overwintering												
Monkfish	Harvested Species	Spawning												
Northern Wolffish	SARA: Threatened Schedule 1; COSEWIC - Threatened	Spawning, foraging, rearing, overwintering												
Pollock	Harvested species?													
Porbeagle Shark	COSEWIC-Endangered	Migration, foraging, pupping in Laurentian Channel												
Shortfin mako - Atlantic	COSEWIC-Threatened	Migration, foraging												
Smooth Skate -Laurentian-Scotian Population	Harvested species; COSEWIC Special Concern	Spawning												
Spiny dogfish - Atlantic	COSEWIC-Special Concern	Migration, foraging												
Spotted Wolffish	SARA- Threatened - Schedule 1; COSEWIC -Threatened	Spawning, foraging, nursery, ovewintering												
Thorny skate - Atlantic	Harvested Species; COSEWIC-Special Concern	Spawning												
White hake - - Southern Gulf of St. Lawrence	Harvested species; COSEWIC- Threatened	Foraging, migration, overwintering												

Species	Status	Activity	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
White Hake - Northern Gulf of St Lawrence/Atlantic	Harvested species; COSEWIC-Endangered	Foraging, migration, spawning, overwintering												
White shark - Atlantic	SARA: Endangered, Sch 1; COSEWIC-Endangered	Feeding, Migration												
Winter skate - Eastern Scotian Shelf - Newfoundland and Gulf of St. Lawrence populations	COSEWIC-Endangered	Foraging, migration, spawning, overwintering												
Witch Flounder	Harvested Species	All Life History Events												
INVERTEBRATES														
American Lobster	Harvested Species	All Life History Events												
Coldwater Coral	Habitat-forming species protected under Fisheries Act..	All Life History Events												
Snow Crab	Harvested Species	All Life History Events												
Sponges	Habitat-forming species protected under Fisheries Act..	All Life History Events												
MARINE MAMMALS														
Blue whale	SARA- Endangered Schedule 1, COSEWIC Endangered	Migration, Feeding, Potential Breeding												
Fin whale- Atlantic	SARA Special Concern -Schedule 1; COSEWIC- Special Concern	Migration and Feeding												
Grey seal	Harvested Species	Whelping, Feeding and Migration												
Harp seal	Harvested Species	Whelping, Feeding and Migration												
Hooded seal	Harvested Species	Whelping, Feeding and Migration												
Harbour porpoise - Northwest Atlantic	SARA- Threatened - Schedule 2; COSEWIC- Special Concern	Feeding and Migration	unknown											
Humpback whale - Western North Atlantic	SARA- Special Concern Schedule 3; COSEWIC- Not at Risk	Migration and Feeding												
Killer whale - Northwest Atlantic / Eastern Arctic	COSWIC: Special Concern	Feeding and Migration especially off the coast of Cape Ray	unknown											
North Atlantic right whale	SARA- Endangered Schedule 1; COSEWIC Endangered	Migration and Feeding												
Sei whale	COSEWIC-Endangered	Possible migration and feeding												
Sowerby's beaked whale - Atlantic	SARA-Special Concern Schedule 1; COSEWIC- Special Concern	Possible migration and feeding	unknown											
MARINE REPTILES														
Leatherback Turtle - Atlantic	SARA- Endangered Schedule 1; COSEWIC - Endangered	Migration and Feeding												
Loggerhead Turtle	SARA- Endangered Schedule 1; COSEWIC - Endangered	Migration and Feeding												



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