REGIONAL ASSESSMENT OF OFFSHORE WIND DEVELOPMENT IN NOVA SCOTIA

DRAFT REPORT

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Acronyms and Abbreviations

AAROM	Aboriginal Aquatic Resource and Oceans Management
AC	Alternating Current
Accord Acts	The Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act and the Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation (Nova Scotia) Act
ADLS	Aircraft Detection Lighting System
AIS	Automated Identification System
ANS Index	African Nova Scotian Prosperity and Well-being Index
AOI	Area of Interest
BOEM	Bureau of Ocean Management (US)
BNOW	Business Network for Offshore Wind
CAC	Criteria air contaminants
CAPEX	Capital Expenditure
CCTH	Department of Communities, Culture, Tourism and Heritage (Nova Scotia)
CEA	Cumulative Effects Assessment
CER	Canada Energy Regulator
CFWG	Commercial Fisheries Working Group (Scotland)
CI	Construction and installation phase
CMM	Confederacy of Mainland Mi'kmaq
CNSOER	Canada-Nova Scotia Offshore Energy Regulator
CNSOPB	Canada-Nova Scotia Offshore Petroleum Board
CO2	Carbon dioxide
COP	Community of Practice
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
COVE	Centre for Ocean Ventures and Entrepreneurship
CRIAW	Canadian Research Institute for the Advancement of Women
CSAS	Canadian Science Advisory Secretariat
CV	Collision vulnerability
CWS	Canadian Wildlife Service
DC	Direct current
DEVEX	Development Expenditure
DEPEX	Decommissioning Expenditure
DFO	Department of Fisheries and Oceans Canada
DND	Department of National Defence
DV	Displacement vulnerability
EBSA	Ecologically and Biologically Significant Area
ECC	Department of Environment and Climate Change (Nova Scotia)
ECCC	Environment and Climate Change Canada

ECSAS	Eastern Canada Seabirds at Sea
eDNA	Environmental DNA
EEZ	Exclusive Economic Zone
EEM	Environmental Effects Monitoring
EIB	European Investment Bank
EIS	Environmental Impact Statement
EMF	Electromagnetic Field
EMSP	Enhanced Maritime Situational Program (Transport Canada)
EPP	Environmental Protection Plan
EPU	Ecosystem Protection Unit
ESRF	Environmental Studies Research Fund (Canada)
EU	European Union
FSC	Food, Social and Ceremonial (fisheries)
FTE	Full-time Equivalent
GCIFA	Guysborough County Inshore Fishermen's Association
GBA+	Gender Based Analysis Plus
GBS	Gravity Bases Structures
GDP	Gross domestic product
GHG	Greenhouse gas(es)
GIS	Geographic Information Systems
GSC	Geological Survey of Canada
GW	Gigawatt
GWEC	Global Wind Energy Council
H_2	Hydrogen
ha	Hectare
HRM	Halifax Regional Municipality
HVDC	High voltage direct current
hz	Hertz
IAA	Impact Assessment Act
IAAC	Impact Assessment Agency of Canada
IBA	Important Bird Area
IR	Information Request
IPCC	Intergovernmental Panel on Climate Change
IPF	Impact Producing Factor
IRENA	International Renewable Energy Agency
ISC	Indigenous Services Canada
KBA	Key Biodiversity Area
KDE	Kernel Density Area
km	Kilometers
km/hr	Kilometers per hour

KMKNO	Kwilmu'kw Maw-klusuaqn Negotiation Office
KW	Kilowatt
LBST	Leatherback Sea Turtle
LCoE	Levelized Cost of Energy
LFA	Lobster Fishing Area
LNG	Liquified Natural Gas
m	Meters
MARS	Marine Animal Response Society
MAARS	Maritime Aboriginal Aquatic Resources Secretariate
MBC	Marine Bird Colony
MARLOA	Maritime Local Operating Area
Max	Maximum
MEKS	Mi'kmaw Ecological Knowledge Study
MBS	Migratory Bird Sanctuary
MMO	Marine Management Organization (England)
MPA	Marine Protected Area
MRC	Marine Renewables Canada
m/s	Meters per second
MSP	Marine Spatial Planning
MW	Megawatt
NAFO	Northwest Atlantic Fisheries Organization
NAO	North Atlantic Oscillation
NB	New Brunswick
NZA	Net Zero Atlantic
NL	Newfoundland and Labrador
NGO	Non-governmental organization
NM	Nautical mile
NMCA	National Marine Conservation Areas
NOAA	National Oceanic and Atmospheric Administration
NRCan	Natural Resources Canada
NREL	US Department of Energy's National Renewable Energy Laboratory
NRR	Nova Scotia Provincial Department of Natural Resources and Renewables
NS	Nova Scotia
NSCC	Nova Scotia Community College
NSFAEE	Nova Scotia Fisheries Alliance for Energy Engagement
NSOLA	Nova Scotia Provincial Office of L'Nu Affairs
NSP	Nova Scotia Power
NRC	National Research Council
NWA	National Wildlife Area
NYSERDA	New York State Energy Research and Development Authority

NZA	Net Zero Atlantic
OCAP	First Nations' principles of ownership, control, access, and possession
OECM	Other Effective Area-Based Conservation Measure
OER	Offshore Energy Regulator
O&G	Oil and gas
O&M	Operations and maintenance
OPEX	Operating Expenditures
ORE	Offshore Renewable Energy
ORERs	Offshore Renewable Energy Regulations
OSW	Offshore Wind
OTN	Ocean Tracking Network
PAM	Passive acoustic monitoring
PC	Pre-construction phase
PCB	Polychlorinated biphenyls
PDA	Potential Development Area
PEI	Prince Edward Island
PFDA	Potential Future Development Area
RA	Regional Assessment (of Offshore Wind Development in Nova Scotia)
RCN	Royal Canadian Navy
RD	Repowering and decommissioning phase
RFP	Request for Proposals
ROSA	Responsible Offshore Science Alliance
ROV	Remote operated vehicle
SAR	Species at risk
SARA	Species at Risk Act
SBA	Significant Benthic Area
ScotMER	Scottish government's Marine Renewable Energy Program
SEER	US Offshore Wind Synthesis of Environmental Effects Research
SOCG	Statement of Common Ground
SPANS	Seafood Producers Association of Nova Scotia
SSCRI	Scotian Shelf Collaborative Research Initiative
t	Tonnes
TAC	Total Allowable Catch
TLP	Tension Leg Platform
TC	Transport Canada
TEKS	Traditional Ecological Knowledge Study
TF	Traditional food
The Agreement	The Agreement to conduct a Regional Assessment of Offshore Wind Development in Nova Scotia
The Assembly	The Assembly of Nova Scotia Mi'kmaq Chiefs

The Atlas	DFO's Marine Spatial Planning Atlas
The Committee	The Committee for the Regional Assessment of Offshore Wind Development in Nova Scotia
The Initiative	Nova Scotia Offshore Wind Collaborative Research Initiative
The Minister	The federal Minister of Environment and Climate Change
The Shelf	The Scotian Shelf
TOR	Terms of Reference
UAV	Unmanned aerial vehicle (drone)
UBHS	Underwater benthic habitat surveys
UINR	Unama'ki Institute of Natural Resources
UK	United Kingdom
UKRI	UK Research and Innovation
UNCLOS	United Nations Convention on the Law of the Sea
UNDRIP	United Nations Declaration on the Rights of Indigenous Peoples
US	United States of America
US DoE	US Department of Energy
US EPA	US Environmental Protection Agency
UXO	Unexploded Explosive Ordnance
VC	Valued Component
VMS	Vessel Monitoring System
WEA	Wind Energy Area
WEBMR	Western Emerald Bank Marine Refuge
WEI	Wind Energy Ireland
WETO	US Department of Energy's Wind Energy Technologies Office
WWF Canada	World Wildlife Fund Canada

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Summary

On March 23, 2023, the Minister of Environment and Climate Change announced the appointment of a five-person independent Committee to conduct a Regional Assessment of Offshore Wind Development in Nova Scotia (the Regional Assessment). The Committee was mandated by its Terms of Reference to provide two deliverables to the Minister of Environment and Climate Change Canada, Minister of Energy and Natural Resources Canada, and Nova Scotia's Minister of Natural Resources and Renewables. The first deliverable, the Interim Report, was submitted on March 23, 2024, and included a summary of the research conducted to date, a description of the engagement undertaken, maps showing proposed future development areas, the process used to identify and select these areas and preliminary non-spatial recommendations for governments to consider in advance of the completion of the Final Report. This report is a draft of the Committee's Final Report and represents the results of an analysis of numerous studies and initiatives and research, extensive engagement, information sharing and expert input. The Draft Report for the Regional Assessment includes:

- an overview of the Regional Assessment;
- a description of the approach and methodology including a summary of engagement;
- a description of offshore wind development;
- a description of existing conditions in the Regional Assessment Study Area;
- the potential effects of offshore wind on environment, health, communities and economy;
- recommended potential areas for offshore wind development and the process for identifying these areas;
- cumulative effects;
- data gaps;
- an examination of the socio-economic considerations; and
- recommendations.

Introduction

Offshore wind energy has emerged as a vital component of the global renewable energy portfolio, critical to meeting rising energy demands and to mitigate the global issue of climate change. Nova Scotia has committed to having 80% of electricity generated from renewables and phasing out coal by 2030, with a target to achieve net zero greenhouse gas emissions by 2050. The regulatory framework is evolving to support these commitments. Canada's Bill C-49 amends the current oil and gas legislation (the Accord Acts) and is mirrored in the revised provincial Bill 471. The new Canada-Nova Scotia Offshore Energy Regulator will administer the requirements of the amended Accord Acts and the Offshore Renewable Energy Regulations.

Interest in developing offshore wind in Nova Scotia is also evolving. The first call for bids in the offshore area is expected in 2025 which could potentially result in an issue of a submerged land license later in 2025 or early 2026, after which detailed site assessment work would begin. Following an impact

assessment process, acquisition of development approvals and a two-to-three-year installation and construction phase, the first turbines may be installed sometime after 2030, but likely closer to 2035.

While legislation and development interests are moving towards a possible future of offshore wind, it was recognized that a Regional Assessment process would be beneficial at this stage before development was initiated. Regional assessments do not evaluate a specific project and are not a legislated decision-making process. They consider potential impacts from a broad perspective, the results of which are considered in and used to inform future project specific impact assessments. The goal of this Regional Assessment is to provide information, knowledge and analysis regarding future offshore wind development activities in the Regional Assessment Study Area and their potential effects, to inform and improve future planning, licencing and impact assessment processes to help protect the environment and health, social and economic conditions while also creating opportunities for sustainable economic development.

Approach, Activities and Outcomes

Over the last 18 months, the Committee has hosted over 120 engagement sessions which have included one-on-one and group meetings, Indigenous community information sessions, and open house events in Nova Scotia, New Brunswick and Prince Edward Island attended by over 800 participants. Engagement was used to inform participants about offshore wind and to gather feedback and information on key aspects of the Regional Assessment, concerns, other ocean uses and input on possible locations for future offshore wind development areas.

Information was also obtained through meetings with Advisory Groups, and on specific subject matter through briefings from government agencies, experts and contracts. The Committee also reviewed work commissioned by several federal and provincial government departments, fisheries organizations and industry representatives to assist with the identification of suitable locations for offshore wind development. To supplement their analyses, the Committee also met with representatives from other jurisdictions with established offshore wind industries for lessons learned in design engineering, potential environmental and social impacts and appropriate mitigation strategies, necessary monitoring and research programs and effects resulting from large scale offshore wind investment. Finally, to guide their work, the Committee has drawn on the concepts of the precautionary principle and adaptive management, and the Two-Eyed Seeing (*Etuaptmumk*) approach.

Offshore Wind Development

Offshore wind farms are more efficient than onshore wind farms due to stronger and more consistent wind speeds and lack of physical interference that landforms or human-made objects can present. Stronger winds and greater consistency mean more electricity is produced per equivalent unit of generating capacity. In Nova Scotia, the provincial government has announced plans to have 5 gigawatts of offshore leases issued by 2030. It is difficult to predict the number of turbines that this will require as turbine size and therefore output is increasing.

The main components of offshore wind farms are the turbines, their foundations, cables and substations. Turbines are mounted on either a fixed foundation attached directly to the seafloor or use a floating foundation, which is secured to the seafloor via various anchor and chain assemblies. Project development involves planning and development (including site assessment), construction and installation, operations and maintenance and repowering and decommissioning phases. In each phase, there are activities that may create potential negative or positive effects over the lifetime (approximately 30 years) of an offshore wind project.

The supply chain that underpins and facilitates offshore wind development at the multi-gigawatt scale is complex and extensive. To better understand the potential implications of the offshore wind supply chain, the Committee provides a summary of the roles that ports and vessels play in manufacturing, transporting and installing major offshore wind components.

Existing Conditions

This Regional Assessment Study Area is an offshore area adjacent to Nova Scotia that includes the Scotian Shelf, including Sydney Bight and a portion of the southern Gulf of St. Lawrence between Nova Scotia and Prince Edward Island and the Northumberland Strait. The Scotian Shelf experiences some of the strongest and most persistent winds in the world for offshore wind power generation. The Committee provides summaries of the known baseline conditions for various physical characteristics including fishing activities, wind conditions, water depth, marine geology, water circulation patterns, temperature, salinity, surface water mixing and wave conditions, as well as climatic changes. Ecological characteristics include plankton, benthos, pelagic organisms, fish, species at risk and introduced species, marine mammals and sea turtles, birds and bats, as well as conservation initiatives such as key biodiversity areas and designated protected and special areas. Although the focus is principally concerned with the ecological consequences of potential offshore wind development, the Terms of Reference also requires that the Committee consider other components including Indigenous communities, activities, interests and rights; visual aesthetics; physical and cultural heritage; health; communities and the economy. Summaries on the demographic profiles, the provincial economy including distribution of employment between sectors, other marine users, existing infrastructure, as well as other social costs of carbon on air quality and public health, are described to provide information to enable the consideration of these factors.

Impact Producing Factors and Mitigation

Impact producing factors identify the cause-and-effect relationships between actions and define the way(s) in which an action or activity affects a given valued component. Each impact producing factor has the potential to impact different valued components throughout the different development stages of an offshore wind project. The valued components, from the Terms of Reference are environmental, social, cultural and economic conditions that are important to the community at large.

There are many potential pathways that connect offshore wind development activities to the broader environmental and socio-economic environment. All phases of offshore wind development will provide

varying levels of short and long-term reductions in greenhouse gas emissions, impacts to fish and fish habitats, marine mammals, sea turtles and birds and bats, as well as employment and business opportunities, which will bring both potential positive and adverse impacts.

For the purposes of this assessment, the potential broad socioeconomic impacts from offshore wind development are changes to employment and economy, community services and infrastructure, and to quality of life/health, as well as inequities and barriers to disadvantaged groups. The potential environmental impacts are changes in air pollutants and greenhouse gas emissions, changes in habitat quality/quantity and biological diversity, injury/mortality and behavioural changes in local species.

In their analyses of impacts, the Committee considered *Netukulimk*; an essential Mi'kmaq concept that embraces the sustainable use of natural resources while maintaining balance with the physical, emotional, cognitive, social and spiritual relationships a person has with the world around them. The Committee also conducted jurisdictional scans on applicable legislation, including standards adopted through international conventions and best practices, and received information and support from various agencies and departments to identify potential effects and appropriate mitigation and monitoring. As a result of the analysis, the following potential impact producing factors were identified:

- atmospheric emissions;
- artificial lighting;
- vessel activity;
- noise and vibrations;
- exclusion zones;
- seabed disturbance;
- electrification of subsea power cables;
- presence of infrastructure;
- movement of turbine blades;
- waste handling and management; and
- accidents and malfunctions.

The Committee recognizes the need for best practice guidelines in the Nova Scotia context and the value they could bring to inform project developers on specific mitigation and monitoring. The Committee hopes the information presented will be taken into consideration by the Offshore Energy Regulator to inform the development of best practice guidance for mitigating and monitoring potential impact producing factors associated with offshore wind development on the various valued components.

Potential Development Areas

The Committee presents eight potential development areas which include Tier 1 areas (recommended for immediate consideration as prospective Wind Energy Areas): Sydney Bight, French Bank, Middle Bank, Sable Island Bank and Western Emerald Bank; and Tier 2 areas (requiring additional investigation and/or engagement before being elevated to the Tier 1 or designated as Wind Energy Areas): Misaine Bank, LaHave Basin and Canso Bank. Actual locations and configuration of these areas may evolve as

governments identify Wind Energy Areas and advance Nova Scotia's offshore wind industry. Much work remains, and the Committee recommends that the principles of adaptive management be adopted to ensure an iterative approach that systematically analyzes changes in the understanding of the marine environment based on new data gathered over time.

The Committee also recommends that no development take place within a 25 km buffer zone from the coastline and 25 km around Sable Island, with an understanding that there will be circumstances where an incursion into the recommended coastal buffer may be either necessary or sought.

Cumulative Effects

Cumulative effects assessments seek to facilitate the identification of data gaps, monitoring and research necessary to reduce or effectively manage effects (positive and/or negative) related to a specific project or series of projects or activities within a region.

In the absence of multi-disciplinary modelling, or even a model project, the Committee identified activities that have occurred, are occurring, or may occur, in or in proximity to one or more potential development areas within the Regional Assessment Study Area. These activities, other offshore wind areas that reference the same use, the rationale for their identification and a brief description of their importance in the Regional Assessment Study Area, are presented.

The Committee believes that responsibility for the data and research necessary for effective cumulative effects assessments resides not with one party, e.g., the proponent, but with many groups, and requires a tiered process integrated across all levels of government.

Socio-economic Impacts

The Committee has struggled to adequately identify what the benefits and disadvantages of offshore wind development may be for Nova Scotia and what these might mean for all Nova Scotians. Challenges with identifying these benefits and disadvantages include assumptions, lack of certainty and predictability regarding the scale of offshore wind in Nova Scotia, feasibility and timeline of the industry and the potential economic benefits capture for Nova Scotia.

To examine this in greater detail the Committee considered experiences in other countries, study results of the Nova Scotia context, and an examination of three potential scenarios for Nova Scotia, concluding that existing ports do not have the capacity to completely service the requirements that may be generated by the offshore wind industry. Similar to the Ireland approach, funding should be considered to facilitate the process of cost estimates for upgrades; to determine which ports fit within the provincial development strategy; and determine the timeline based on the potential for complementary roles and synergies and how best to secure the necessary financing. This approach supports a regional or possibly a national strategy for offshore wind development. Regardless, the Committee notes that the potential opportunity for Nova Scotia is immense, regardless of whether the electricity is used to

produce hydrogen, or if generated power is used here or exported to other parts of Canada and/or the United States. However, implications for the potential development of an offshore wind industry will include the establishment of a robust supply chain, labour force, as well as upgrades to the domestic grid and consideration of potential impacts to communities and social infrastructure. The supply chain requirements may include the skills, services, supplies, technologies and infrastructure required to support the entire lifecycle of an offshore wind project through all project phases.

Data and Knowledge Gaps

Addressing data and knowledge gaps and becoming familiar with the needs of, and trends associated with the offshore wind energy sector, is essential for informed decision-making and sustainable development. The offshore wind industry faces many uncertainties with respect to environmental, social and economic effects, including cumulative effects.

Throughout the Regional Assessment process, the Committee identified a series of knowledge and data gaps related to the environment (physical and biological, species focused, and climate change); socio-economic concerns (commercial fisheries, health issues, skilled labour, supply chain issues, ports and related infrastructure); as well as housing and other services and potential effects of offshore wind technology on various valued components, within the Regional Assessment Study Area. It is essential that the shared knowledge base and ability to augment that knowledge be improved over the next few years. Such a challenge can only be met by an extensive, coordinated approach using the combined expertise available within government departments, research organizations, marine knowledge-holders, such as Indigenous peoples and fishers, technology and resource developers and the community at large.

Recommendations

Based on the work undertaken, insights gained from the engagement process, materials received from federal and provincial government departments and submissions from other interested parties, the Committee provided a series of recommendations as important actions to support and facilitate the development of an offshore wind industry in the Regional Assessment Study Area.

There are 34 recommendations grouped under the eight themes:

1. existing knowledge, gaps and necessary research;
2. socio-economic feasibility and consequences;
3. project development;
4. coexistence and compensation;
5. cumulative effects;
6. mitigation and compensation;
7. governance; and
8. education and training.

As a new sector with significant potential to contribute both to national and provincial renewable energy goals and to economic growth, the Committee believes it is important to establish a foundation that addresses environmental sustainability, stakeholder engagement, regulatory compliance and technological innovation. The Committee's recommendations therefore address the key challenges and opportunities identified during the Regional Assessment process and aim to accommodate the development of the offshore wind industry while safeguarding marine ecosystems, accommodating other ocean users and recognizing the strategic planning that needs to be undertaken to address supply chain needs and onshore infrastructural requirements.

Conclusion

The results of the Committee's analyses and their recommendations are meant to inform and improve future planning, licencing and impact assessment processes for these activities in a way that helps protect the environment and health, social and economic conditions while also creating opportunities for sustainable economic development.

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

The Committee will submit its Final Report directly to the Ministers on January 23, 2025. It will be the responsibility of the Ministers to make the Final Report available to Indigenous groups and the public.

1.0 Introduction

Offshore wind (OSW) energy has emerged as a vital component of the global renewable energy portfolio, offering substantial potential to meet rising energy demands while mitigating climate change. Many studies and reports have identified the richness of the wind resource off Nova Scotian shores and the need to capitalize upon that resource to decarbonize sources of energy.

1.1 Climate Change

Climate change is a pressing global issue that transcends national borders, impacting ecosystems, economies and communities worldwide. It creates significant impacts to natural ecosystems by disrupting the delicate balance of the environments. Each of the 10 warmest years in the historical record has occurred in the past decade (Lindsey and Dahlman, 2024). Rising temperatures alter habitats, pushing species to migrate to cooler areas, which can lead to increased competition and potential extinction for those unable to adapt or relocate. Ocean acidification, a result of increased CO_2 absorption, harms marine life, particularly coral reefs, which are vital to ocean biodiversity. Increases in the frequency and intensity of extreme weather events, such as wildfires, droughts, floods and hurricanes devastate ecosystems and reduce their ability to recover.

Cumulatively, these changes undermine the resilience of natural ecosystems, threaten biodiversity and the services they provide to human society. Effects are transferred to communities as resultant sea-level rise endangers coastal cities and small island nations, while shifts in weather patterns affect fisheries, agriculture, water supply and food security. Adverse effects will occur to shallow water fisheries, particularly shellfish, from increasing ocean temperatures and acidification. Further, warmer waters can lead to habitat loss and increased vulnerability to diseases, while acidification weakens shells and reduces survival rates. These changes will disrupt the food chain and threaten the livelihoods of communities and economies dependent on these fisheries.

Climate change also exacerbates social inequalities, disproportionately affecting vulnerable populations including Indigenous peoples who often depend directly on their local environment for cultural, economic and physical sustenance. Despite their vulnerability, Indigenous peoples possess valuable traditional knowledge and sustainable practices that are crucial for effective climate change mitigation and adaptation strategies. Ensuring their voices and rights are included in global climate policies is essential for creating equitable and effective solutions.

1.2 The Path to Achieving Net Zero

While the above trends have been known for decades, national and international responses and commitments to address the resultant problems have been slow to emerge. Canada, as an actor in the international community, is a signatory to the Paris Agreement (2015), which includes commitments to reduce greenhouse gas (GHG) emissions to hold global temperature increases to a maximum of 2°C above preindustrial levels, but preferably 1.50°C above preindustrial levels (Government of Canada, 2016). In 2016, Canada submitted its long-term GHG development strategy in response to the United

Nations Framework Convention on Climate Change. In 2021, the federal government passed the *Canadian Net-Zero Emissions Accountability Act,* which enshrines in legislation a commitment to achieve net-zero emissions by 2050. In Nova Scotia, the *Environmental Goals and Climate Change Reduction Act* (2021) mirrors the federal objectives and articulates 28 goals to facilitate necessary reductions in GHG emissions and move the province to the use of renewable energy. Specifically, there are commitments to have 80% of electricity generated from renewables and coal phased out by 2030, with a target to achieve net zero GHG emissions by 2050 (Government of Nova Scotia, 2021).

These commitments necessitate bold actions. Nova Scotia (NS) is still highly reliant on coal and other fossil fuels to generate electricity. As shown in Figure 1.1, 57% of energy in NS is currently obtained from non-renewable sources (Nova Scotia Power, 2024a).

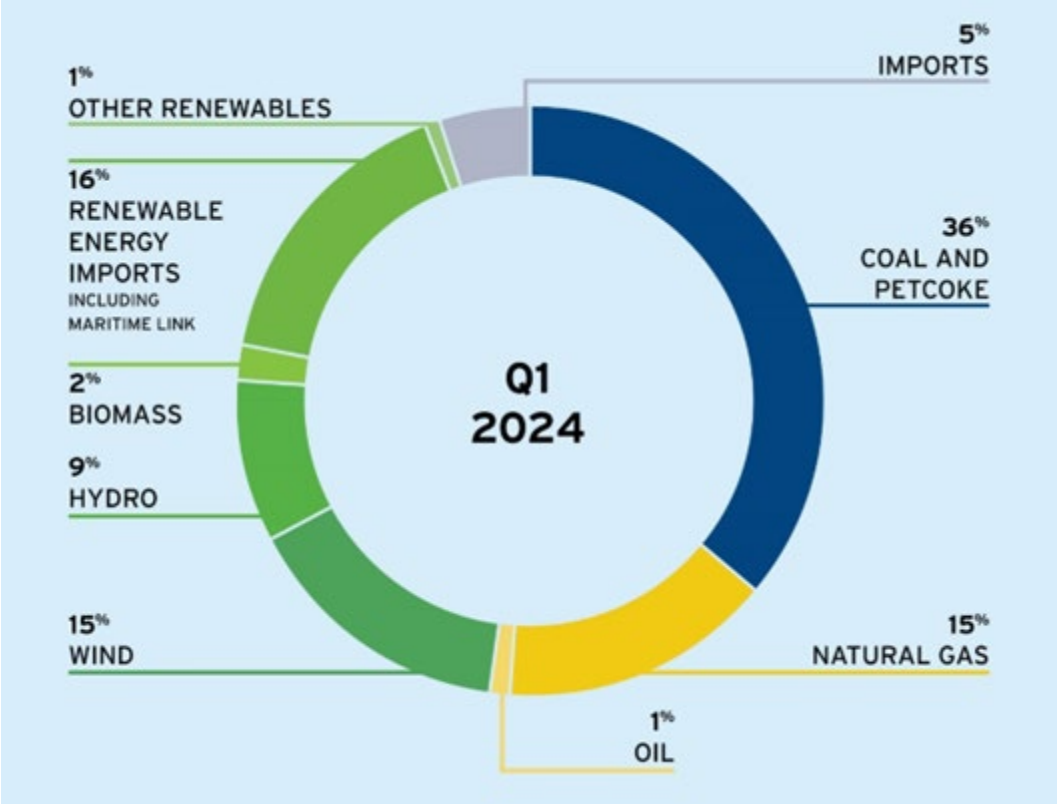


Figure 1.1. Energy Production Sources for Nova Scotia (Nova Scotia Power, 2024b)

Four power plants in the province rely on coal or petcoke as a fuel: Lingan, Point Aconi, Point Tupper and Trenton (CER, 2024). Generating electricity from these plants results in GHG emissions aggravating climate change as well as pollutants, such as particulate matter, that harm human health. To replace this, production will demand innovation and substantial investment. Both the federal and provincial levels of government are looking to OSW development as a potential new source of energy.

If OSW development can help replace non-renewable sources of electricity generation, GHG emissions will be minimized in the effort to get to net zero. But a new industry, such as OSW development, is not

accommodated without impact. There will be physical, ecological and socio-economic consequences of accommodating such development in the waters off NS, to those who currently use those waters and for the communities onshore that support both the new industry and existing marine activity; it is these consequences that are identified and discussed in the sections that follow.

1.3 The Offshore Wind Regulatory Context

Canada has an extensive coastline and exercises jurisdiction over its contiguous coastal waters in accordance with established principles of international law, much of which has been codified in the United Nations Convention on the Law of the Sea (UNCLOS), to which Canada is a signatory. UNCLOS outlines rights and responsibilities countries have related to the use of the oceans, the seabed and their resources, and the protection of the ocean environment. It establishes Canada's right to exploit and manage the OSW resource within its 200 nautical miles Exclusive Economic Zone (EEZ) and on its continental shelf beyond 200 nautical miles.

The offshore renewable energy industry is new to Canada and the regulatory framework is evolving. The intended framework for Atlantic Canada would essentially replicate the structure developed for offshore petroleum. In 1986, the federal and provincial governments entered into an agreement to promote social and economic benefits associated with petroleum exploitation in the offshore region. This was followed by the enactment of legislation[1] which established the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) as the life cycle industry regulator in NS. Bill C-49 received Royal Assent on October 3, 2024, to amend the oil and gas legislation that would enable the CNSOPB to also regulate the offshore renewable energy industry as the renamed Canada-Nova Scotia Offshore Energy Regulator (CNSOER). The mirror provincial legislation to Bill C-49, An Act to amend the Canada—Newfoundland and Labrador Atlantic Accord Implementation Act and the Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act and to make consequential amendments to other Acts, is Bill 471, *Advancing Nova Scotia Opportunities Act*, which gained Royal Assent on September 20, 2024.

The CNSOER would administer the requirements of the amended Accord Acts and the Offshore Renewable Energy Regulations currently being developed and will come into force on or about the same time as the amended legislation. The intention is to develop modern safety and environmental protection regulations that will apply to site assessment, construction, operation, and decommissioning and abandonment activities related to renewable energy projects and power lines in Canada's federal offshore areas (NRCan, 2024). NRCan is working to ensure that the development of these regulations is coordinated with coastal provinces and territories. Final publication and entry into force of the regulations is tentatively set for late 2024.

With a new regulator and industry specific regulations in place, a proposed OSW development project of 10 or more turbines is a "designated" project under the *Impact Assessment Act* (IAA) and subject to a

[1] The *Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act* and the *Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation (Nova Scotia) Act* (collectively referred to as the "Accord Acts").

federal impact assessment.[2] Projects with less than 10 turbines will be reviewed by the CNSOER and undergo a level of assessment considered appropriate to the level of risk. Of note is that the Minister of Environment and Climate Change (the Minister) has the discretion to require a project that is not a designated physical activity to undergo an environmental assessment where in his or her opinion, the carrying out of that physical activity may cause adverse effects within federal jurisdiction. They may also choose to exempt an otherwise designated project from an impact assessment (see section 10).

In addition to the proposed OSW legislation and the IAA, development projects and activities will also be subject to several other pieces of federal and provincial legislation that that may result in a requirement for specific permits, approvals or authorizations. Federally, this includes:

- an authorization pursuant to the *Fisheries Act* for the harmful alteration, disruption, or destruction of fish habitat;[3]
- a permit for handling stranded birds pursuant to the *Migratory Birds Convention Act, 1994;*[4]
- a permit pursuant to the *Species at Risk Act* to conduct an activity that may affect a listed species;[5] and
- a permit pursuant to the *Canadian Navigable Waters Act* for interference or obstruction of the public's right to navigation.[6]

The relevant Provincial legislation includes the:

- *Special Places Protection Act* which provides for the preservation, protection, regulation, exploration, excavation, acquisition and study of archaeological and historical remains and paleontological sites;[7]
- *Endangered Species Act* which provides for the protection, designation, recovery and other relevant aspects of conservation of species at risk in the Province, including habitat protection;[8]
- *Environment Act* which provides for the protection and prudent use of the environment and includes the goal of maintaining the principles of sustainable development;[9]
- *Sustainable Development Goals Act* which sets goals to fight climate change;[10] and

[2] Refer to Section 2 (44) of the Physical Activities Regulations: SOR/2019-285
[3] Refer to Section 35 (1) of the *Fisheries Act*
[4] Refer to Section 70 of the Migratory Birds Regulations, 2022 - SOR/2022-105
[5] Refer to Section 73 of the *Species at Risk Act*
[6] Refer to Section 5 of the *Canadian Navigable Waters Act*
[7] NS Special Places Protection Act: https://nslegislature.ca/sites/default/files/legc/statutes/specplac.htm
[8] NS Endangered Species Act: https://nslegislature.ca/legc/bills/57th_1st/3rd_read/b065.htm
[9] NS Environment Act: https://nslegislature.ca/sites/default/files/legc/statutes/environment.pdf
[10] NS Sustainable Development Goals Act: https://nslegislature.ca/sites/default/files/legc/PDFs/annual%20statutes/2019%20Fall/c026.pdf

- *Beaches Act* which provides for the protection of beaches and associated dune systems as significant and sensitive environmental and recreational resources.[11]

1.4 The Regional Assessment of Offshore Wind Development in Nova Scotia

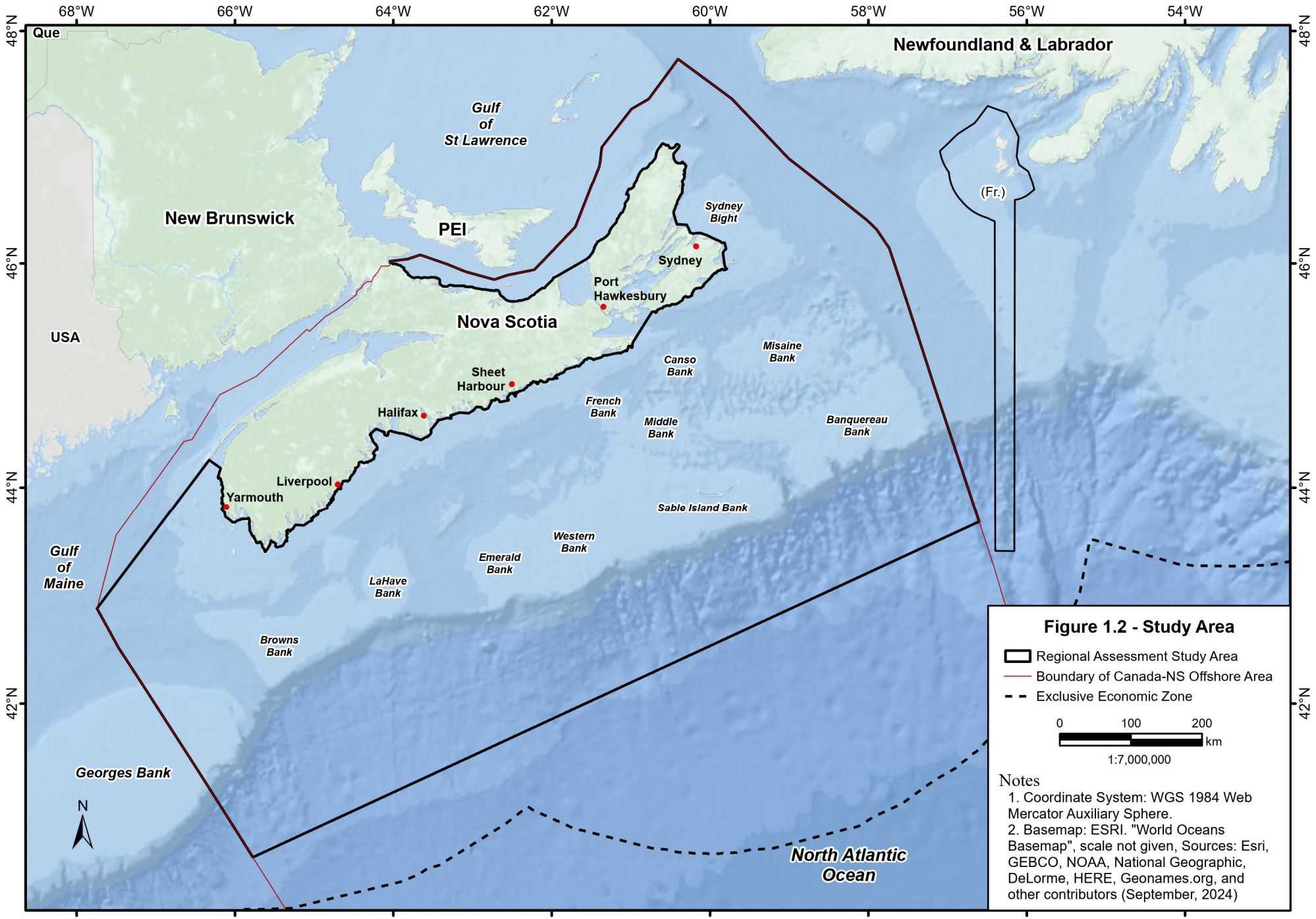
The IAA and its regulations establish the legislative basis for federal impact assessment in most regions of Canada. Impact assessments may be project-specific or regional.[12] Regional assessments do not evaluate a project. They consider potential impacts from a broad perspective, the results of which must be considered in future project specific impact assessments. The Minister is responsible for the conduct of a regional assessment including the following:

- determining whether the assessment will be undertaken by the IAAC or by an independent committee;
- establishing a Terms of Reference (TOR) which describes the scope of the undertaking and the expected engagement activities;
- how scientific information and Indigenous knowledge are to be gathered and used, including the knowledge provided by Indigenous women and Elders;
- the requirement for meaningful public participation, and how the information gathered must be made available to the public;
- the obligation of federal authorities to provide on request specialist or expert information or knowledge related to the physical activities considered in a regional assessment; and
- the reporting requirements and the timeline.

In April 2022, the Minister announced that a regional assessment for OSW energy development would be undertaken for both Newfoundland and Labrador and NS and instructed the Impact Assessment Agency of Canada (IAAC) to commence a planning exercise. In March 2023, the Minister, in partnership with the federal Minister of Energy and Natural Resources, and the NS Minister of Natural Resources and Renewables, signed an Agreement to conduct a Regional Assessment of OSW Development in NS (the RA) and appointed a five-member independent committee (the Committee) to undertake the process. The Agreement and Terms of Reference describe in detail the RA goals, objectives, activities and planned outcomes, as well as key aspects of its governance and administration. They were developed with input from the public, Indigenous peoples, and environmental, fishing, academic and industry organizations during a year-long engagement program including public review of both documents.

[11] NS Beaches Act: https://nslegislature.ca/sites/default/files/legc/statutes/beaches.htm
[12] Section 92 of the Impact Assessment Act (justice.gc.ca)

The approximately 300,000 km^2 area under consideration (the RA Study Area) is depicted in Figure 1.2 and includes the continental shelf and slope off NS. The scope of the RA includes identification of potential future development sites within the RA Study Area; an analysis of the potential environmental, health, social and economic effects and benefits of OSW development activities; and recommendations for mitigation and monitoring. The RA is not a legislated decision-making process and does not replace other project-specific permitting processes.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Gulf of St Lawrence
New Brunswick
PEI
Sydney Bight
Sydney
Port Hawkesbury
Nova Scotia
USA
Misaine Bank
Canso Bank
Sheet Harbour
French Bank
Halifax
Middle Bank
Banquereau Bank
Liverpool
Yarmouth
Sable Island Bank
Western Bank
Gulf of Maine
Emerald Bank
LaHave Bank
Browns Bank
Georges Bank
(Fr.)
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North Atlantic Ocean
Figure 1.2 - Study Area
Regional Assessment Study Area
Boundary of Canada-NS Offshore Area
Exclusive Economic Zone
0
100
200
km
1:7,000,000
Notes
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere.
2. Basemap: ESRI. "World Oceans Basemap", scale not given, Sources: Esri, GEBCO, NOAA, National Geographic, DeLorme, HERE, Geonames.org, and other contributors (September, 2024)

Several issues surfaced during the RA engagement process that touch on the regulatory context and are addressed here. First, it became apparent that the legal definitions for distinguishing "inshore" versus "offshore" waters with reference to the baseline ordinary low water mark are very different than how fishers understand and use these terms to describe the "inshore" and "offshore" fishery. The Committee is mindful of the difference and has attempted to address it as the context requires. Similar confusion was expressed about the provincial "internal" waters[13] being excluded from the RA Study Area. These areas are within the exclusive jurisdiction of the province. The reader is referred to the provincial Offshore Wind Roadmap for an understanding of how provincial bodies of water such as Chedabucto Bay and St. George's Bay are being considered in the context of "offshore" wind development through a regulatory process entirely separate and apart from the RA and the RA Study Area. Finally, with respect to the potential for OSW activities to impact Indigenous rights, the Committee is required to receive advice and perspectives from Indigenous peoples but is not involved in formal Consultation in the context of the Crown's duty to consult, nor has any mandate to make any determination as to the existence or alleged infringement of such rights.[14]

1.5 Underlying Premises

While the development of OSW projects within the RA Study Area may enable the federal and provincial governments to achieve targets with respect to GHG emissions, their development would generate physical, ecological and socio-economic consequences for the RA Study Area and the province. The mandate of the RA as detailed in the TOR is broad, and the challenge for the Committee is to attain a balance in its deliberations and recommendations between adopting an overly restrictive approach to the many unknowns and accepting a certain level of risk to facilitate an industry which has demonstrated elsewhere its capability to sustainably generate electricity and contribute to the greater environmental challenge associated with climate change. To facilitate their work the Committee has drawn on the following: the precautionary principle, Two-Eyed Seeing *(Etuaptmumk)* and adaptive management. Each is discussed briefly below.

Precautionary Principle: Although there is no uniform understanding of its meaning, the definition contained in Principle 15 of the 1992 Rio Declaration is widely recognized and provides guidance as to its application: *in order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.* As applied in decisions that will impact the environment, the underlying purpose is to encourage precaution in decision making, particularly when there are considerable scientific unknowns: i.e., a lack of scientific certainty should always be a cause to minimize risk of environmental damage. OSW development may be a practical approach to generate green energy, but

[13] In the TOR "Offshore Area" has the same meaning as Schedule I of the Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act (justice.gc.ca)
[14] TOR A1.1, 1.2

there are many facets of the marine environment about which little is known and that environment is dynamic and subject to constant change and adaptation. Caution is warranted.

Two-Eyed Seeing (Etuaptmumk): Much environmental management is based on western positivistic epistemology that adheres to *an illusion of certainty,* i.e., if sufficient data are compiled, the interactions and effects can be modelled and outcomes predicted (Reid *et al*., 2021). Given the complexity and dynamic nature of the marine environment and the consequences of climate change on that environment, any articulation of a certain outcome in that environment is questionable. There are other ways of looking at and considering a complex system including Two-Eyed Seeing (Etuaptmumk). Elder Albert Marshall defines this concept as *learning to see from one eye with the strengths of Indigenous knowledges and ways of knowing, and from the other eye with the strengths of mainstream knowledges and ways of knowing, and to use both eyes together for the benefit of all* (Bartlett *et al*., 2012). That the provincial government embraces this concept is reflected in its incorporation into several pieces of provincial legislation including the *Sustainable Development Goals Act* and the *Environmental Goals and Climate Change Reduction Act.* Both embrace the concept of *Netukulimk* and Two-Eyed Seeing (Etuaptmumk); this is defined in the legislation as *the use of the natural bounty provided by the creator for the self-support and well-being of the individual and the community by achieving adequate standards of community nutrition and economic well-being without jeopardizing the integrity, diversity or productivity of the environment.* To adhere to this concept, as the Committee must do by its TOR, requires both substantial engagement with Indigenous interests and consideration of pertinent research and scientific literature; it requires consideration of Indigenous interests in making recommendations while protecting the integrity, diversity and productivity of the environment.

Adaptive Management: This is an active approach to decision making that recognizes that in a dynamic environment, or where there are many unknowns, the uncertainties must be acknowledged — and to the extent feasible — addressed. At the same time, there needs to be recognition of the greater objectives that may be attained by action, i.e., by accepting risk in the face of unknowns. As discussed in sections 1.1. and 1.2, OSW development is considered a tested means to replace non-renewable sources of electricity generation and a tool to combat climate change. In the chapters that follow, the many data gaps with respect to the physical, ecological and socio-economic environment of the RA Study Area are identified and discussed and recommendations made as to where and how the OSW industry may be accommodated in the RA Study Area for the benefit of both the province and Canada. The Committee has kept both the precautionary principle and Two-Eyed Seeing (Etuaptmumk) front and center. However, the Committee is also aware that new research, new technologies and site-specific circumstances may arise that will challenge the recommendations. When this occurs, adaptive management could provide a platform whereby regulators and all involved parties, i.e., Indigenous leaders, industry, fishers and other stakeholders, would come together to detail what additional matters should be addressed. It is not a random process, but a process that should establish hypotheses to be tested specific to the circumstances that have arisen.

The Committee is aware of the potential that OSW development offers to meet national and provincial goals to address GHG emissions, of the concerns that have been articulated through the engagement

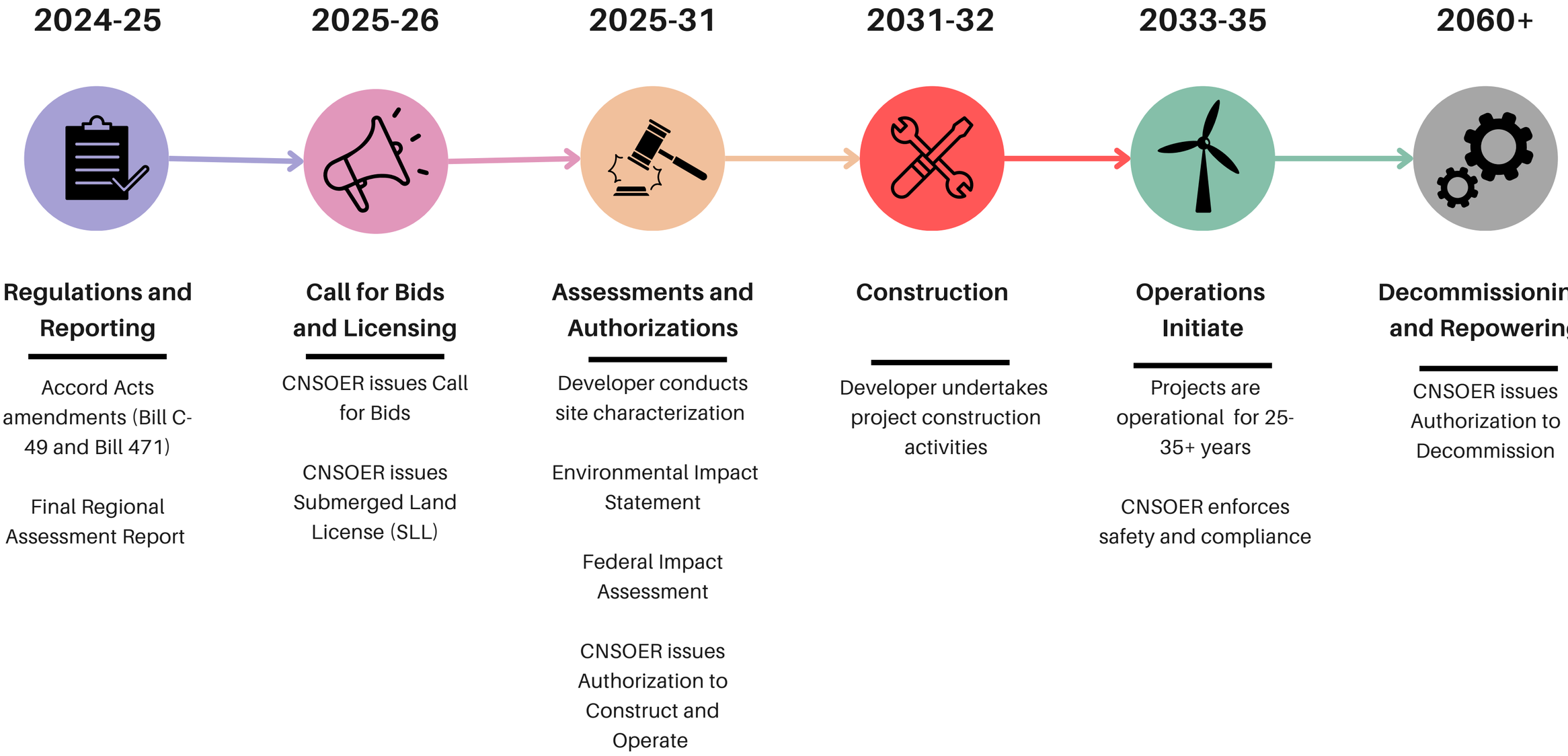
process and of the serious data gaps that exist. The above premises, in the opinion of the Committee, provide the tools to protect what is valued while providing an approach to decision making, when and where required, that considers new research, new technologies and site-specific requirements. These premises underpin the work that has been undertaken and influence how the Committee addresses cumulative effects assessment in section 7.

1.6 Timelines

The RA is one of several initiatives that are either underway or planned as the OSW regulatory framework evolves. There are many things that need to fall into place to allow the industry to move ahead in Canada and NS, and a delay in one component may impact the timing of others. Certain activities occur consecutively while others occur concurrently. Therefore, Figure 1.3 should be interpreted solely as the Committee's best effort to depict the related processes and timelines; the intent being to give the reader some context for the anticipated overall development timeframe and the potential deployment of the first OSW turbines in the RA Study Area.

The scheduled completion date for the RA is January 2025. One of the important objectives of the TOR is that the Committee's recommendations inform future decisions by government regarding where and how the industry will be developed in the region. NS Department of Natural Resources and Renewables (NRR) has expressed an intention to issue the first call for bids for future OSW development in 2025. The issuance of a call for bids and the evaluation of submissions would potentially result in a successful bidder (or bidders) being issued a submerged land license later in 2025 or early 2026, following which detailed site assessment work would commence.

The information obtained from the site assessment work would lead to the filing of an Environmental Impact Statement pursuant to the Physical Activities Regulations of the IAA and preparation of an application for authorization to construct and operate the wind farm. Throughout this effort (the various development phases and key activities are discussed in detail in section 3), the developer would be refining the wind farm's design, obtaining cost estimates and securing funding and planning for the construction phase of activity. Having obtained the necessary development approvals, and assuming the developer decided to proceed, the project would then advance into the installation and construction phase. A two-to-three-year period is anticipated for construction, influenced by factors such as weather, the number of turbines to be installed, the distance from shore (which affects direct costs and vessel travel time) and whether an offshore substation is required, and the availability of installation equipment and skilled labor. It can be reasonably expected that the first turbines may be installed sometime after 2030, but likely closer to 2035. It is the Committee's understanding that there will be multiple opportunities for engagement at various stages of the process outlined in Figure 1.3.



Disclaimer: Dates are approximations based on the Committee's interpretation of best available information as of fall 2024 and are subject to change.

Figure 1.3 Approximate Timeline for Offshore Wind Development in Nova Scotia

As previously discussed, Figure 1.3 does not include any reference to the timelines or processes associated with potential OSW development in "provincial internal waters". The province has indicated that it will not proceed with further consideration of OSW development in provincial internal waters until after the completion of this RA. Throughout the engagement process the Committee has heard that although provincial internal waters are not included in the RA Study Area, the Committee has been encouraged to consider the potential impact to the RA Study Area of any future development in these waters, i.e., cumulative effects.

1.7 Committee Processes and Procedures

The Committee has not undertaken any primary research in support of this report. It has relied on the diverse expertise, knowledge and experience of its individual members to review, question and deliberate upon the research and input of others, including, but not limited to, that undertaken by government departments and agencies, the fishing community, Indigenous peoples, academic researchers, non-governmental organizations (NGOs) and industry. The following guiding principles have informed the approach taken by the Committee:

i. to be open and transparent with respect to the challenges and limitations involved in meeting the TOR and to maintain this perspective throughout;

ii. to be receptive to the research and expertise of the many people in NS, Canada and beyond who can contribute to the RA process; and

iii. to ensure that the collective experience of the Committee is used to examine the data, studies and concerns that are provided and expressed to us in an equitable manner.

More specifically, the Committee has relied upon:

- subject matter briefings from government departments, agencies and third parties on a wide range of specific topics;
- engagement with the Grand Council of the Seven Districts, Assembly of Nova Scotia Mi'kmaq Chiefs (the 'Assembly'), Indigenous communities and community leaders, and Indigenous organizations;
- an extensive and inclusive public engagement program;
- feedback received from fishers, fishing associations/organizations and fishing companies, NGOs and potential developers; and
- information derived from contracts (detailed in section 2.5).

Several studies conducted in recent years merit specific reference (detailed in section 2.2) as being useful and directly relevant to the identification of Potential Development Areas (PDAs) within the RA Study Area. These studies have enabled a comparison of the conclusions reached independently using

the same data but have also provided a baseline level of understanding for the Committee to interpret other information gathered and submissions received.

The Committee is mandated to conduct the RA in a manner that promotes transparency and encourages public input and participation. To accommodate situations where participation may be dependent on a participant requiring that information provided by them to the Committee be treated as confidential, the Committee established a process to facilitate a confidentiality request. This procedure is outlined in the Committee's Confidentiality Procedure (iaac-aeic.gc.ca).

During the Committee's deliberations, it was important to recognize and address the potential for dissenting opinions. Given the complexity and multifaceted nature of the issues at hand, it is natural that Committee members may hold diverse perspectives and interpretations. Where these differences are considered significant and a level of consensus cannot be reached, each Committee member has the option of voicing a separate dissenting view in writing.

2.0 Approach, Activities and Outcomes

As stated in section 1.7 the Committee has not undertaken any primary research in support of this report. The Committee has conducted extensive engagement and has relied on the research, constraint mapping and input of others, including work undertaken by government departments and agencies, the fishing community, Indigenous peoples, academic researchers, NGOs and industry. The Committee has also sought information and insight from jurisdictions that have installed OSW farms, particularly those in Europe and on the eastern seaboard of the United States. In addition, the Committee has enlisted the support of several independent contractors with expertise to address specific issues (section 2.5).

2.1 Engagement

The TOR established engagement as a key pillar of the RA and focal point for the Committee noting that the Committee has:

- the authority to seek specialist or expert information or knowledge pertinent to the RA from both federal and provincial authorities, or from independent experts; and
- a directive to ensure that Indigenous peoples, other participants, particularly fishers and the public, are provided with opportunities to participate meaningfully in the RA; and
- a directive to establish three Advisory Groups and relevant Participation Plans to provide an accounting of the engagement activities and to ensure that participants were aware of the planned participation approaches and upcoming activities.

The overall objective of engagement during the RA was to collect and evaluate information, including community knowledge and information from participants, that will inform the Committee's analysis and recommendations. Based on feedback and views gathered during the planning phase of the RA, the Committee strove to establish an open and constructive dialogue and identify various opportunities for participation.

Engagement activities included responses to general communications; official notices and updates posted to the Registry; engagement/information sessions, in-person and virtual; focused meetings with individuals and organizations and virtual meetings with Advisory Groups.

All engagement sessions and meetings were logged in the appendices of the relevant Participation Plans, which acted as part of the public record of engagement.

2.1.1 Engagement Approach

2.1.1.1 Communications

Information sharing throughout the RA process was achieved via the Registry and the use of a generic email account to a contact list that was initiated during the planning process and grew to include over 800 recipients.

Participants were able to submit questions and comments to the Committee via the generic RA email (OffshoreWindNSEolienneExtracotiereNE@iaac-aeic.gc.ca) or via the public commenting tool. Both the email and the public comment tool were monitored regularly by the Secretariat, and communications received were forwarded to Committee members on a weekly basis. All correspondence was posted to the Registry (subject to any confidentiality considerations).

General Committee communications, e.g., general information, updates etc., were sent to participants via the RA email and posted to the Registry for public access and review; communications included:

- Participation Plans;
- Committee meeting summaries;
- monthly updates of the Committee's work;
- Committee procedures;
- engagement materials;
- Frequently Asked Questions;
- briefings provided to the Committee (subject to confidentiality requests); and
- Interim Report.

2.1.1.2 Participation Plans

A documentation of all engagement undertaken by the Committee was summarized in three Participation Plans:

1. Fisheries Participation Plan;
2. Public and Stakeholder Participation Plan; and
3. Indigenous Participation Plan.

The Participation Plans provide a summary of engagement activities, planned participation approaches and upcoming activities, and a tracking log of activities that occurred throughout the RA. Draft versions of each plan were circulated for comment at the beginning of the RA to Indigenous participants, the contact list and Advisory Group members, were amended as required and posted to the Registry. Engagement tracking logs within each plan were updated on a quarterly basis to track engagement activities.

2.1.1.3 Advisory Groups

In February 2023, IAAC sought Expressions of Interest from individuals and organizations with relevant experience who had an interest in being a member of one or more Advisory Groups. The purpose of the Advisory Groups was to evaluate information, help identify knowledge gaps and make recommendations to address these gaps. The three Advisory Groups formed were:

1. Indigenous Knowledge Advisory Group;
2. Scientific and Community Knowledge Advisory Group; and
3. Fisheries Advisory Group.

The Committee held initial introductory meetings with the Advisory Groups in July 2023 and follow-up meetings to solicit input on specific issues and on the results of the Interim Report. Two general requests for feedback were sent to all Advisory Group members in early 2024. The first sought advice on areas where OSW development in the RA Study Area might best be located, or areas that should be avoided. The second sought feedback on the Interim Report as well as feedback on the potential impacts posed by the electromagnetic fields (EMF) generated by subsea offshore transmission cables on marine species and the environment, and about potential impacts of OSW development on marine mammals, sea turtles, migratory and marine birds and bats.

2.1.2 Engagement Activities

Engagement activities occurred throughout NS, in New Brunswick (NB) and Prince Edward Island (PEI) and included virtual information sessions, public open houses, Indigenous community sessions and in-person meetings and briefings. The Committee met with Indigenous leadership and communities across the region, representatives from federal, provincial and municipal government departments, individual fishers and fisheries associations, OSW developers, NGOs and the public.

2.1.2.1 Indigenous Engagement

During the RA planning process, IAAC reached out to Indigenous contacts throughout the Maritime provinces and Quebec (Appendix 2.1) to establish a participants list. This list was used by the Committee for their initial outreach and introductions. Early meetings focused on sharing information about the RA, soliciting Indigenous participants' expressions of interest and providing a draft version of the Indigenous Participation Plan for input and feedback. The Indigenous Participation Plan identified the following engagement objectives:

- establish an open and constructive dialogue;
- encourage active and early participation, and opportunities for collaboration;
- consider Indigenous knowledge and Two-Eyed Seeing (Etuaptmumk) in accordance with the "ownership, control, access and possession" (OCAP) principles and with reference to existing Indigenous knowledge inclusion protocols;
- respect how Indigenous knowledge is held and the preferred means of communicating that knowledge;
- respect the unique nature of each community and, where reasonably possible, adjust the engagement process based on the preferences expressed;
- seek diverse perspectives including those of women and Elders;
- provide advanced detail of timelines with sufficient notice to enable meaningful participation and opportunities for collaboration;
- provide participation funding opportunities; and
- respect the principles inherent in the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP).

Pursuant to advice received from the Kwilmu'kw Maw-klusuaqn Negotiation Office (KMKNO), a meeting with the Assembly of Nova Scotia Mi'kmaq Chiefs (the 'Assembly') was arranged to introduce the Committee, the objectives of and processes associated with the RA and to inquire about the possibility of future meetings with Chiefs and Councils in communities across NS. With encouragement from the Assembly, the Committee reached out and sought to meet with all Chief and Council. Meetings were held with the following Chiefs and Councils:

- Annapolis Valley First Nation
- Eskasoni First Nation
- Glooscap First Nation
- Membertou First Nation
- Millbrook First Nation
- Pictou Landing First Nation
- Potlotek First Nation
- Sipekne'katik First Nation
- Wagmatcook First Nation

The Committee also met with the Abegweit First Nation and Lennox Island First Nation (PEI), and Wolastoqey First Nation, Elsipogtog First Nation and Mi'gmawe'l Tplu'taqnn Incorporated (NB).

During the spring 2024 engagement program, follow up community sessions were held as requested by respective Chiefs and Councils. These sessions included a presentation and a question/answer period in at the following communities:

- Eskasoni First Nation
- Glooscap First Nation
- Pictou Landing First Nation
- Potlotek First Nation
- Wagmatcook First Nation

The Committee also met with the Grand Council of the Seven Districts during their annual general meeting in June 2024, to provide a briefing and answer questions.

In addition to the above, meetings have taken place with the following Indigenous organizations:

- Atlantic Policy Congress of First Nations Chiefs Secretariat;
- Confederacy of Mainland Mi'kmaq;
- KMKNO – Archeology;
- KMKNO – Fisheries;
- Maritime Aboriginal Aquatic Resources Secretariate (MAARS); and
- Unama'ki Institute of Natural Resources (UINR).

Communication with all communities and the various organizations has been continuous throughout the RA process.

2.1.2.2 Public Engagement

In July 2023, the Committee held four virtual public information sessions. These sessions provided an opportunity for participants to meet the Committee, learn about the RA process and the timeline, and provide input on topics such as the design of the engagement program.

A fall engagement program took place from October 2023 through January 2024 and involved a total of 15 open house events in NS, NB and PEI in the following locations:

- Charlottetown, PEI
- Chéticamp, NS
- Dartmouth, NS
- Digby, NS
- Guysborough, NS
- Inverness, NS
- Moncton, NB
- New Glasgow, NS
- Port Hawkesbury, NS
- River Bourgeois, NS
- Sheet Harbour, NS
- Shelburne, NS
- Sydney, NS
- Wolfville, NS
- Yarmouth, NS

An afternoon and evening session was held in each of the above locations. Participants were encouraged to review information boards, watch a video on OSW and examine maps of the RA Study Area that depicted the locations of other ocean users and special areas, e.g., marine protected areas and critical habitat. Fishing activity was identified based on information sourced from DFO. Dialogue was encouraged. The data presented were both questioned and augmented. There was lively discussion at the mapping table often focused on the selection of potential locations for OSW development. Those involved were encouraged to mark up the maps; feedback forms and input boards were also set up to encourage feedback.

A second engagement program, took place in spring (April, May and June) 2024 and involved a total of 10 open house events in NS and PEI at the following locations:

- Charlottetown, PEI
- Chéticamp, NS
- Dartmouth, NS
- Guysborough, NS
- New Glasgow, NS
- Port Hawkesbury, NS
- Sheet Harbour, NS
- Shelburne, NS
- Sydney, NS
- Yarmouth, NS

Information boards provided more in-depth information on OSW project development and the RA process and included descriptions of the proposed Potential Future Development Areas (PFDAs) and the recommendations from the Interim Report. At each session the Committee made an illustrated presentation and encouraged questions. Subsequent discussions were very informative. Feedback forms and input boards were again set up to gather individual feedback on the RA process and the Interim Report.

The engagement programs were widely advertised on the Registry, postings on IAAC and various community and association social media pages, posters at local establishments and wharves, and announcements on local radio stations. Email invitations were also issued via email to the contact list.

2.1.2.3 Government Departments and Agencies

The Committee met with federal representatives from Fisheries and Oceans Canada (DFO), Environment and Climate Change Canada (ECCC), Indigenous Services Canada (ISC), Impact Assessment Agency of Canada (IAAC), Natural Resources Canada (NRCan), Parks Canada and Transport Canada (TC). The Committee also met with NS Natural Resources and Renewables (NRR), NS Environment and Climate Change (ECC), NS Communities, Culture, Tourism and Heritage (CCTH), NS Office L'Nu Affairs (NSOLA), as well as representatives from Canada Nova Scotia Offshore Petroleum Board (CNSOPB). A record of all meetings is documented in the Public and Stakeholder Participation Plan on the Registry.

In addition to briefings and meetings with government departments and agencies, information requests seeking input on impact producing factors and potential mitigation, monitoring or research were sent to federal and provincial authorities in June 2024. In addition to those agencies listed above, requests were also sent to Health Canada, Department of National Defence, Atlantic Canada Opportunities Agency and NS Fisheries and Aquaculture. All requests and responses were posted on the Registry.

2.1.2.4 Fisheries

The Committee recognizes the economic and cultural importance of the fishing industry to NS and how coastal fishing communities shape the social dynamics of a large portion of the province. It is not surprising that there was substantial concern expressed by this sector as to how a new industry might be accommodated in the RA Study Area, what the potential impacts could be to the various fisheries and the mitigation and offsetting measures that would need to be in place to protect it.

Of value to the Committee's understanding of the extent and importance of the fishery has been the feedback received from fisheries organizations, as well as individual fishers who took time to attend open houses and, in many cases, provided follow up information to the Committee. Their voice offers a unique perspective, sometimes not fully captured in other regulatory processes, and the Committee wishes to ensure that these perspectives were captured and incorporated into the report. The information received has helped to identify information gaps and limitations in the publicly available fishing data, increased the Committee's understanding of fishing concerns, species and gear types, and contributed to its selection of PFDAs (see section 6) as relatively low-conflict areas for siting potential OSW development.

Since future OSW development activities have the potential to impact Aboriginal or Treaty fishing rights protected by section 35 of the *Constitution Act*, 1982, including the section 35 right to fish throughout Mi'kma'ki, the Committee had discussions with Indigenous fishery representatives to understand their concerns and issues.

The Nova Scotia Fisheries Alliance for Energy (NSFAEE) includes representation from many groups in the seafood harvesting and processing sector in NS. The NSFAEE was developed from a shared belief that responsible development of offshore energy resources can coexist with a sustainable and prosperous fishing industry (NSFAEE, 2024). These NSFAEE members have a shared vision for co-existence and sustainability for their industry and believe that by working together, the fishery and OSW can co-exist towards a prosperous net-zero future to the benefit of all Nova Scotians (NSFAEE, 2024).

The Committee also met with groups of fishers who provided additional information regarding their specific fisheries and fishing areas. Sea cucumber fishers (Ocean Pride Fisheries and W.T. Grover Fisheries) are not included in NSAFEE and due to the small number of license holders (less than five), their catch data are not incorporated into DFO's database. Similarly scallop fishers' data are not incorporated into the publicly available database due to the small number of license holders (less than five).

Snow crab fishers in Area 22 are not part of the NSFAEE; these fishers identified a need for greater representation from Canso area fishers in the RA and articulated concerns about the liability and insurance issues that would arise from fishing in an operating in a wind farm.

During the open houses, the Committee met with several individual long-liners who fished tuna, swordfish and halibut; they represent a group with unique concerns based on their specific gear type, which might prove challenging to deploy near a wind farm.

Fishers expressed concerns that fishable areas are already being limited, e.g., by protected areas, etc. which would be compounded by large scale wind farms and noted that the fisheries are also being affected by climate change and the ensuing consequences on species, e.g., the northeastern movement of lobsters.

In each meeting the Committee learned more about the gear types and locations of fisheries and had valuable discussions around the potential for and challenges associated with attempting to co-locate fishing activity in operating wind farms.

2.1.2.5 Offshore Wind Developers

The Committee met early in the process with Marine Renewables Canada (MRC) and several of its members to gain the industry's perspectives on OSW development potential and related environmental and socio-economic issues. MRC is the national association for OSW, tidal, wave and river current energy, representing 180 members, including technology and project developers, suppliers, researchers, and communities. Following the initial meeting, an open invitation was sent offering prospective OSW developers a one-on-one session with the Committee. The following companies met with the Committee:

- Atlantic Canada Offshore Developments
- BlueFloat Energy
- DP Energy and SBM Offshore
- Northland Power
- OX2
- Reventus Power Limited
- Simply Blue Group

While the Committee appreciated the effort made by these companies, it determined that the most appropriate way to receive coordinated input from prospective developers was through an Information Request. The information was solicited via the provincial and federal governments in November 2023. The industry participants responded directly to governments in January 2024 (see section 2.2.6).

The Committee met a second time in June 2024 with representatives from both DP Energy and SBM to discuss their "Nova East Wind" proposed project.

MRC provided written feedback on the Interim Report to the Committee on July 10, 2024. Their feedback outlined the need for further analysis of the positive impacts of the OSW industry and on how OSW development areas could be modified in the future. MRC supports an approach that recognizes the use of mitigation measures to reduce conflict and impacts, allowing broader wind energy areas to be identified. They also recommended an approach that outlines clear constraints, data gaps and regulatory requirements that may help support future Impact Assessments.

2.1.2.6 Other

The Committee has received briefings from several subject matter experts from academia, specialists working in the private sector and from agencies in the United States and Europe. These include experiences and lessons learned in other jurisdictions, approaches being taken related to the coexistence of fisheries and OSW development, the mitigation of impacts and financial compensation. A record of all the Committee's meetings can be found on the Registry.

2.1.3 What We Heard

The potential for OSW development is widely recognized and frequently supported, but with caveats. A What We Heard Summary was developed after each engagement program and both summaries were posted to the Registry.

Important issues that were raised during the engagement process included:

- future OSW development activities have the potential to impact existing Aboriginal or Treaty rights protected by section 35 of the Constitution Act, 1982;
- compensation for direct losses, e.g., temporary or permanent displacement from fishing grounds, and for indirect losses, e.g., additional steaming time and cost of travel around wind farms;
- potential impacts to viewsheds, particularly from National and Provincial Parks and from coastal areas important to recreation and tourism;
- ensuring that developers follow through on decommissioning commitments/requirements;
- the impact OSW development will have on whales and other marine mammals;
- the impact OSW development will have on birds and bats;
- concerns about the inadequacy of port infrastructure in the province to support this new industry;

- the economic and social importance of the inshore fisheries;
- concerns about the feasibility of and liability associated with fishing within a wind farm;
- concerns over continual displacement and loss of fishing areas, e.g., from Marine Protected Areas, marine refuges, critical habitats for species at risk and aquaculture, and the likely additional displacement caused by OSW developments;
- concerns about accidents and the health and safety of workers, the public and the environment;
- the need to consider adaptative management approaches when selecting development areas; and
- "what is in this for Nova Scotians"? A lack of understanding of what the industry brings in terms of jobs and economic benefits, and concern that the province and its citizens receive an appropriate share if this industry proceeds.

2.2 Key Studies and Constraint Mapping

Several federal and provincial government departments, NSFAEE and industry representative have led or commissioned work to identify suitable locations for OSW development in Atlantic Canada. The reports generated used much of the same data that are publicly available and being considered by the Committee. Each study had its own objectives and analytical approaches that influence the outputs and conclusions. There are also limitations associated with the data and methodologies applied that need to be considered when interpreting the results. These studies represent an important body of work and have been considered in detail by the Committee.

2.2.1 DFO Marine Spatial Planning Atlas

As part of its Marine Spatial Planning Process, DFO has released and continues to update its Marine Spatial Planning Atlas (the Atlas). The Atlas incorporates and illustrates several important physical, ecological and socio-economic datasets that have been considered by the Committee and the other studies referenced below. The Committee used these data throughout the engagement process in the form of mapping products that helped characterize existing regional conditions in the RA Study Area.

2.2.2 Value Mapping Nova Scotia's Offshore Wind Resources – Aegir Insights (2023)

Aegir Insights (Aegir) is an international OSW consultancy based in Copenhagen. Aegir was retained by NRR to identify the relative cost of electricity that could be expected from various potential development locations and scenarios in a report titled Value Mapping Nova Scotia's Offshore Wind Resources. Levelized Cost of Energy (LCoE) is a measure of the average net cost of electricity generation of a facility over its lifetime that enables the comparison of different technologies, e.g., wind, solar, natural gas etc. on a consistent basis. To determine an LCoE from each area, the study first evaluated wind speed, water depth, distance to port and distance to grid connection. The resulting map identified areas that were then analyzed against a series of physical, biological, social, and economic constraints including (Aegir, 2023):

- sea ice cover;
- surficial geology;
- identified protected areas;
- seabird density and coastal colonies;
- commercial fishing activity;
- marine mammal sightings; and
- vessel density and shipping traffic.

Once these constraints were applied, the initial results were revised to identify areas that appeared to have less interaction or conflict with OSW development. The areas considered to have lower development costs and lower levels of interactions included portions of the Sydney Bight area of Cape Breton, Canso Bank, Middle Bank, Eastern Shore and Sable Island Bank.

The study acknowledges several limitations in the data used and recommends that the results be used to inform additional work.

2.2.3 Preliminary Considerations Analysis of Offshore Wind Energy in Atlantic Canada – CanmetENERGY (2023)

CanmetEnergy (Canmet) is a federal laboratory within NRCan dedicated to research and development of the energy sector. Canmet completed a study on the Preliminary Considerations Analysis of Offshore Wind Energy in Atlantic Canada that incorporated various publicly available spatial data into a GIS system including (Kilpatrick *et al.,* 2023):

- vessel density (2019) and vessel traffic routes;
- subsea cables and pipelines;
- aquaculture locations;
- distance from coast;
- commercial fishing effort (2005-2019);
- inshore lobster landings for the Maritimes Region;
- surficial geology;
- sea ice cover;
- water depth;
- wind speed;
- identified ecological areas, e.g., protected and important areas; and
- risk to marine birds based on data from Canadian Wildlife Service.

A multi-criteria methodology (weighted overlay) was then used to rank the data inputs and identify areas suitable for OSW development. To facilitate the analysis, six scenarios were developed and modeled to visualize areas that could represent OSW candidate sites. Each scenario was assigned different influence scores for the physical, ecological, or socio-economic inputs to show how the results could change based on the weighting assigned to the individual constraints. For example, a scenario that

assigned a higher value to ecological data layers would yield different results from a scenario that assigned a higher value to socio-economic data layers. The results for each individual scenario were shown, as well as results that considered combinations of individual scenarios.

Areas noted to have more favourable scores for OSW development across multiple scenarios were portions of Sable Island Bank, Middle Bank, Banquereau Bank, Northumberland Strait, Browns Bank and George's Bank. The results were presented as candidate OSW development areas to be examined in future work.

2.2.4 DFO Marxan with Zones Analysis for Potential Locations of Low-Conflict with Offshore Wind Development (2024)

As part of its ongoing Marine Spatial Planning process, DFO has also initiated a constraints analysis exercise to identify prospective areas for OSW with less risk of conflict (Nagel *et al*., 2024). The data used as part of this analysis include those that have been used in both the Canmet and Aegir Insights studies and consider a range of ecological and socioeconomic components to find suitable areas for OSW while avoiding overlap with certain features. That includes, but is not limited to:

- identified protected and ecologically sensitive areas;
- critical and important habitat for species at risk;
- seabird density and predictive foraging ranges for some species;
- surficial geology;
- distance to shore;
- water depth;
- sea ice;
- wind speed;
- commercial fishing data;[15]
- vessel density and traffic routes;
- existing oil and gas activity; and
- aquaculture leases.

The modeling employs an analysis using Marxan with Zones[16] to identify areas that avoid conflict with identified features by developing 18 scenarios that focus on certain objectives. For example, if the objective is to find areas that avoid existing shipping lanes, protected areas and areas of the highest

[15] As commercial fishing data in this analysis were not privacy screened, a larger database of commercial fisheries landings was used by DFO in this specific analysis.
[16] Marxan with Zones is based on the same principles as standard Marxan, but allows for multiple zones, zoning contributions, costs and the spatial relationships between zones to all be considered in spatial optimization. More information at: https://marxansolutions.org/what-is-marxan-with-zones/.

fishing activity, the analysis will develop multiple solutions for each scenario to find areas that meet those specified avoidance criteria.[17]

Different single-sector (a scenario focussing on one component) and multi-sector (a scenario considering more than one component) scenarios were simulated by the model (for fixed and floating OSW) to specify a target for constraint avoidance, e.g., avoiding 90% of commercial fishing activity, or excluding legally protected areas. The model then produced multiple solutions (100 runs) for each scenario and identified areas that most often met the target criteria. The summed solution, showing the areas selected most frequently, is what the Committee considered the most appropriate for its analysis. The Committee focused on the baseline multi-sector scenario results, as these incorporated both ecological and socio-economic considerations, as opposed to any of the single sector scenarios. Based on these results, the areas identified as being potentially suitable for fixed-bottom OSW development with less potential for conflict included areas around the Northumberland Strait, Sable Island Bank, Middle Bank, Sydney Bight, Canso Bank and Roseway Bank as well as some nearshore areas. The scenario for floating OSW development yielded similar results, but with some larger areas identified, including a section of Middle Bank.

The study results offer another perspective on areas presenting less risk for conflict with ocean users or ecological features. Like other studies referenced in this section, the results are to be considered in future work. Data gaps and limitations have been noted including those related to marine bird migration pathways and marine mammal movements.

2.2.5 Nova Scotia Fisheries Alliance for Energy Engagement Report (2024)

The NSFAEE consulted with its membership to identify areas within the RA Study Area that could be considered "low conflict" for OSW development. Publicly available fisheries data were supplemented by input received from member organizations and fishers that incorporated local knowledge and fishing experience across multiple industry sectors and species. The report identified areas near Sydney Bight and the Laurentian Channel, Western/Emerald Bank, the edge of Browns Bank and some small portions of Middle and Banquereau Banks as areas of lower conflict between the various fisheries and potential OSW development.

The Committee recognizes that this type of coordinated spatial analysis involving multiple fishing sectors is challenging and seldom undertaken and very much appreciates and commends all those involved for their constructive and helpful approach.

2.2.6 Industry Survey on Offshore Wind Areas

As indicated in section 2.1.2, the Committee issued an Information Request (IR) to NRCan and NRR to solicit information regarding the location and types of OSW development projects that prospective

[17] This study did not assess the potential for co-location. Given that co-location may be possible between offshore wind energy and other activities (such as commercial fishing, vessel traffic, oil and gas, and aquaculture), this tool could be adapted in the future to develop co-location scenarios for use by regulators and decision makers.

developers are contemplating in this region. Government subsequently surveyed prospective OSW developers to gather information on locations of interest, including related questions on the scale and sequence of proposed projects, possible transmission routes, pathways to market, shared infrastructure and port facilities. In response to the IR, NRCan and NRR provided a non-attributable summary of the responses received.

The highest level of interest was expressed in Middle Bank, by five developers, followed by Sable Island Bank, with four, and Sydney Bight, with three. Other areas identified by at least one developer were Western Bank, French Bank (floating foundations), Georges Bank, Digby Neck, Liverpool (floating foundations), Banquereau Bank, Misaine Bank (floating foundations) and the Northumberland Strait.

In addition to information related to preferred sites and project scale, developers were asked to identify areas that they considered unsuitable for development and the rationale for that determination. Many considered areas that could not accommodate fixed foundations, i.e., deeper than 65-70 m, as unsuitable, while others favoured floating foundation technology. Some discounted the Northumberland Strait, the western side of Cape Breton and the south shore due to intense fishing activity and/or visual aesthetics. Similarly, a few developers identified all nearshore areas as challenging due to fisheries and stakeholder concerns, while others discounted areas subject to sea ice and areas further than 110 km from shore.

2.2.7 Geological Survey of Canada's Updated Surficial Geology Compilation of the Scotian Shelf Bioregion, Offshore Nova Scotia and New Brunswick, Canada (2024)

Understanding the composition, seabed morphology, stability and sensitivity of the seafloor is critical information needed for ocean management and marine spatial planning. Some seafloor areas are too sensitive or unstable to support industrial development, and, with less than 10% of Canada's offshore territory adequately mapped, there is often insufficient baseline information to adequately inform decision making. The Geological Survey of Canada's (GSC) seabed characterization activities provide a regional framework in advance of development activities to inform governments, developers and regulators related to the design, siting and operation of seabed infrastructure (Philibert *et al*., 2024). That work includes an active data collection program in support of the OSW industry. Specifically, the Committee was able to supplement their analyses of potential development areas with the anticipated substrate and geological conditions.

2.3 Identified Data Gaps and Limitations

Many of the above studies and reports have disclosed data limitations and differing methodologies that need to be considered when interpreting results. For example, where there was a lack of data on a specific component, e.g., fishing activity, one model assumed no conflict and assigned a high compatibility score for OSW development. Feedback received during the engagement process, however, identified conflicting information, and in some cases, highlighted knowledge gaps that would be key to understanding potential conflicts with OSW and other ocean users. It is recognized that research studies and traditional knowledge, including Indigenous knowledge, cannot be considered in isolation. When

conducting a regional assessment of a nascent industry in a largely data poor environment, it is crucial to identify and consider these data and knowledge gaps and limitations to ensure a comprehensive and accurate understanding of the region to inform future planning and assessments. Addressing these gaps early allows for recognition of limitations, prioritization of data collection, and informs decisions based on the best available information. Additionally, identifying gaps and limitations can foster collaborative research efforts, optimize resource allocation and drive innovation. A detailed discussion of these areas and the gaps and limitations that need to be considered is provided in section 9.

2.4 Interim Report

Through summer and fall of 2023, it became apparent to the Committee that effective and meaningful engagement with fish harvesters, Indigenous participants, the public and experts was critical to the quality and credibility of the Committee's work and that the expected TOR timelines and deliverables could not be met. Following a request by the Committee, the Minister agreed to the submission of an Interim Report by the end of March 2024, focused on potential areas for development, to be followed by a Final Report in January 2025 addressing all other components of the TOR.

The Interim Report was submitted to Ministers on March 23, 2024, and posted publicly on March 25, 2024. The Interim Report provided and recommended:

- a summary of the RA governance structure;
- a description of the engagement undertaken up to February 2024;
- a map of areas that were considered PFDAs warranting closer consideration and evaluation for OSW;
- an accounting of the process that led to the identification and selection of these development areas;
- a recommendation to establish a 25 km coastal buffer leading to no proposed development at this time in the Northumberland Strait and Gulf of St. Lawrence; and
- three initial recommendations to the Ministers on topics that the Committee felt should be addressed on a priority basis.

The intention was for the Interim Report to be used as a key tool in the Committee's continued engagement process and to inform governments in their assessment of the potential for OSW development in the RA Study Area. Additional information and input received during the spring engagement program enabled the Committee to build upon the work described in the Interim Report and informed recommendations for the Final Report.

On July 23, 2024, the Committee received official feedback on the Interim Report from the Minister of Environment and Climate Change Canada, the Minister of Energy and Natural Resources Canada and the Minister of Natural Resources and Renewables, NS. The letter included reference to the following points:

- an expectation that larger areas would have been identified as PFDAs;
- a desire to see more support for recommendations (including discussion of available geophysical and socio-economic data) and exploration of the potential positive impacts associated with OSW development; and
- general support for the Committee's three initial recommendations (see section 10).

With respect to Interim Report Recommendation #3 seeking to advance the discussion on issues related to the co-existence of the fishery and the OSW industry, the federal and provincial governments agreed to participate with the Committee in a working group.

2.5 Contracted Experts

The Committee has the authority to contract experts and the following contracts were undertaken to support the Committee's work:

- **Black Point Consulting** to provide expertise on the capacity and limitations of the NS transmission grid, the NS Clean Power Plan and the investment that will be necessary to accommodate OSW and capture its benefits in the province.
- **Canadian Research Institute for the Advancement of Women (CRIAW)** to complete a Gender Based Analysis Plus study that included a data collection strategy focused on the intersection of sex and gender with other identity factors to allow the Committee to make recommendations on how future impact assessments for OSW should consider and address these factors.
- **DMDE Engineering** to identify the capital expenditures (CAPEX) and operating expenditures (OPEX) associated with OSW development, detail the existing capacity of the hard and soft infrastructure, e.g., ports, training facilities, and indicate the investment necessary to accommodate the needs and maximize the benefits of the OSW industry in NS.
- **21FSP Advisory Partners** to consider OSW supply chain opportunities and limitations and to identify gaps, constraints and challenges associated with advancing a new OSW industry in the region.

Collectively, this body of work has informed Committee recommendations on local benefits capture and skilled labour availability.

2.6 Lessons from Other Jurisdictions

The wealth of knowledge and experience in NS in the marine sciences, fishing sector and offshore oil and gas exploration will provide valuable insight to the development of a domestic OSW industry. To supplement this body of knowledge, developers, regulators and all interested parties look to jurisdictions with established OSW industries for lessons learned in design engineering, potential environmental impacts and appropriate mitigation strategies, necessary monitoring and research programs and the positive effects resulting from large scale OSW investment. The Committee has taken note of this body of knowledge, has met with OSW operators and has researched potential mechanisms for co-existence among multiple ocean users within an OSW farm area.

There are lessons to be learnt on many fronts while recognising that each jurisdiction is unique. The United Kingdom (UK), Denmark, the Netherlands, Germany and the United States, each has a larger population and economic base than NS, which provides a more robust springboard for research and development. While the UK, Germany, Denmark and the Netherlands are planning for and operating in much smaller marine areas, they have, of necessity, established OSW development goals several times greater than those identified by NS. The needs and pressures of each country are unique, yet Nova Scotians can learn from and feel better prepared about the prospect of OSW development because of their collective experience.

2.6.1 Research

There are agencies in each country accommodating or contemplating the development of OSW that are supporting pertinent research. Established in 2013 as a not-for-profit organization, Offshore Renewable Energy (ORE) Catapult is the UK's leading technology innovation and research centre for offshore renewable energy (Catapult, 2024a). There are eight technology and innovation centres creating a network of innovation hubs that bridge the gap between research and industry to make cutting edge industries productive and sustainable (Catapult, 2024a). As an example, in May 2024, ORE Catapult secured £86 million of capital funding from UK Research and Innovation (UKRI) to enhance its wind and turbine blade and drive train testing facilities in Blyth, Northumberland (Catapult, 2024b). In Aberdeen, ORE Catapult has opened the National Floating Wind Innovation Centre with funding from both the Scottish and UK governments (Buljan, 2024). This facility will enable companies to develop and derisk floating technologies that are essential to the success of the sector (Buljan, 2024). The scale of these investments is a demonstration of the UK government's commitment to research in support of OSW development and to make the investments required to enable the country to become a leader in the sector and to supply the rest of the world with services and product (Buljan, 2024).

ORE Catapult is one facet of the OSW research being supported in the UK. The Scottish Marine Energy Research (ScotMER) program is an initiative of the Scottish Government to identify research that is needed to inform licensing and other OSW development decision making. (ScotMER, 2024). The work is undertaken through seven receptor groups: ornithology, marine mammals, fish and fisheries, diadromous fish, benthic ecology, physical processes and socioeconomics (ScotMER, 2024). Each of the groups has representation from government, industry (both developers and the fishing industry), NGOs, statutory nature conservation bodies and academia (ScotMER, 2024). The groups identify knowledge and data gaps, define research needs, come together to identify priorities and determine how best to fund the work program either on their own initiative or collaboratively with other parties in Scotland, across the UK and beyond (ScotMER, 2024). This collaboration not only facilitates joint funding opportunities, but also generates evidence to inform decision making across boundaries (ScotMER, 2024).

The US Department of Energy's Wind Energy Technologies Office (WETO) funds research nationwide (WETO, 2024). For example, WETO is supporting The National Offshore Wind Research and Development Consortium in the US as a nationally focused, not-for-profit organization collaborating

with industry on prioritized research and development activities to reduce the LCoE of OSW in the US while maximizing other economic and social benefits. The Consortium was initially funded with $41 million, $20.5 million from the Department of Energy and a matching $20.5 million from the New York State Energy Research and Development Authority (NYSERDA). The goal of the Consortium is to produce innovations that directly respond to the technical and supply chain barriers faced by offshore wind project developers in the US, build strong networks connecting technology innovators, investors and industry and increase US content and job opportunities. Additional contributions have been made by state members including California, Maine, Maryland, Massachusetts, New Jersey and Virginia. Collectively, the existing funds have established the Consortium for a minimum of five years. The research agenda is extensive and includes projects that are geographically specific, projects that address transmission issues, projects that focus on engineering challenges including technology advancement, projects that examine monitoring techniques including the application of Artificial Intelligence, and many others (WETO, 2024). Recipients include research institutes, laboratories, universities and private companies (WETO, 2024). Other bodies in the US, such as the Bureau of Ocean Energy Management (BOEM) and New York State Energy Research and Development Authority (NYSERDA), have and continue to undertake their own research with focus on the interface between the developer and the regulatory authority. These bodies have issued valuable reports and delivered informative and collaborative webinars and conferences, which have provided important context for the evolution of the OSW industry research and development to date. Members of NYSERDA have met with the Committee and shared their experience and expertise on specific topics. These organizations should be regarded as important sources of research and information on potential project impacts, appropriate and tested mitigation, and necessary research as the OSW industry evolves in Nova Scotian waters.

The Responsible Offshore Science Alliance (ROSA) is an organization in the United States that supports collaboration on regional research to inform decision-making at the intersection of OSW and fisheries, and facilitates a coordinated approach needed to ensure credible data are collected and shared. ROSA collaborates with fishers, OSW energy developers, fisheries scientists, federal and state management experts, and others to identify regional research and monitoring needs, coordinate existing research and monitoring, advance understanding through collaboration, partnerships, and cooperative research, administer research, improve access to scientific data and share learnings. Since ROSA's inception in 2019, they have been laying the groundwork for effective regional science by defining research priorities, creating tools, and developing the structures to enable collaboration.

2.6.2 Marine Planning

Given the experience of comprehensive land use planning in the UK since the late 1940s, including the successful accommodation of a significant offshore oil and gas industry over the last fifty years, it is not surprising that processes and protocols have been established to control and authorize development in their marine waters. The Marine Management Organization in England was created in 2009 to protect the marine environment and support economic growth; the equivalent body in Scotland is Marine Scotland (Slater and Clayton, 2020). There are 11 marine plan areas in each of Scotland and England (MMO, 2014). Although the Crown Estate manages the seabed around England, Wales and Northern

Ireland and Crown Estate Scotland fulfills a similar function in Scotland, marine plans reflect not only the projected demands for development, e.g., from OSW to oil and gas development etc., but identified conservation priorities (Slater and Clayton, 2020). Overlaying this basic structure are the requirements for strategic environmental assessments and project specific assessments. There is a plethora of government agencies and NGOs involved in the deliberations associated with any new development. Since the British Energy Security Strategy (BESS), published in 2022, set a target of 50 GW of OSW development by 2030, including 5 GW from floating technology, there is work being taken on multiple fronts by all agencies involved (LCP, 2022).

2.6.3 Co-existence

The Scottish East Anglia ONE OSW farm in the southern North Sea, a joint venture between ScottishPower Renewables and Macquarie's Green Investment Group, is an example of a development that uses a communications agreement (entitled a "Statement of Common Ground" (SOCG)) as a tool to facilitate co-existence between marine users within its footprint (Scottish Power Renewables, 2021). The SOCG negotiated between the Commercial Fisheries Working Group (CFWG) and the development consortium was structured to reflect the topics of interest to the CFWG and to identify points of agreements and disagreement between the parties (Scottish Power Renewables, 2021). Key topics included the types of turbine foundations and the methods of scour protection to be deployed, the routing of subsea cables and the location of cable landfall, the location of offshore electrical platform(s) and of other necessary infrastructure (Scottish Power Renewables, 2021). The SOCG is referenced in the Commercial Fisheries chapter of East Anglia ONE's environmental statement (Scottish Power Renewables, 2021) and serves as a transparent record for the monitoring and assessment of the potential impacts on the fishery. It promotes coexistence by providing a platform for ongoing dialogue, information accounting and organized conflict negotiation between the OSW developer, the cable companies and fisheries (Scottish Power Renewables, 2021). By publishing a record of their negotiations and outcomes, transparency is enhanced between marine users operating within and outside the OSW farm.

The Netherlands Borssele OSW farm, located in the Dutch part of the North Sea, is another example of a development that promotes co-location with fisheries by dividing the project site into different areas of shared multi use (Noordzeeloket, 2023). This approach to multi-use was implemented as a product of the North Sea 2016-2021 Policy Memorandum which required that Dutch OSW farms open their sites to other marine users (Noordzeeloket, 2023). To indicate where these shared uses would be possible, an "area passport" guide was developed. The range of activities allowed within the Borssele OSW farm includes marine aquaculture (seafood and seaweed), other forms of renewable energy generation and storage (solar or tidal), nature promotion, e.g., oyster recovery, fish refuges and artificial reefs, and fixed gear fishing (Noordzeeloket, 2023). Documents from the Borssele I and II OSW farms show that species such as Atlantic Cod and lobster often use the turbine foundations as artificial reefs (Waycott, 2023).

The Dutch Government continues to demonstrate its commitment to identifying opportunities for multi-use within OSW developments. In 2023, it funded a report on *Advancing multi-use in offshore wind*

farms: Roadmap for the Dutch North Sea (GROW, 2023). The authors describe how shared use in OSW farms can be facilitated through appropriate choices in their planning and design under the headings of:

- nature transition – where nature protection and ecosystem strengthening are considered and promoted;
- food transition – where the sustainable production of food, i.e., fixed gear fishing, shellfish and seaweed farming are considered and promoted; and
- energy transition – where the generation, conversion and storage of sustainable energy, e.g., activities related to solar, wave, tidal and hydrogen production, are considered and promoted.

Given the lack of space that characterizes the Dutch offshore area, it is not surprising that they are at the forefront of exploring ways in which OSW farms can be used for other purposes. A "community of practice" tool has also been utilized to facilitate research and explore development options within the OSW industry including a proposal to establish "Mariparks," or offshore business areas within or adjacent to an OSW development. The "community of practice" process has been critiqued as a valuable tool to encourage participation and cooperation between stakeholders and a means to promote trust among ocean users (Steins *et al*., 2021).

2.6.4 Infrastructural Requirements and Employment Generation

As all OSW turbines need to be transported from land to offshore sites, ports are key to the industry's development. Module 2 of the NS Offshore Wind Roadmap indicated that the industry requires ports:

i) for manufacturing, i.e., where turbine components are built;
ii) for staging and marshalling, i.e., where parts are shipped, stored and/or assembled prior to being shipped to site; and
iii) for operations and maintenance, i.e., as bases for vessels and the crew involved in the operations of an OSW farm.

Section 3.3.1.1 further references the necessity for port infrastructure, section 4.6.4 provides data on the port infrastructure that exists in the province while section 8 explores in greater detail the investment that will be required if the offshore energy resource is to be accommodated to the greatest benefit of Nova Scotians. This isn't a challenge unique to NS. The scale of existing and proposed OSW development in UK waters has had profound consequences for that country's infrastructure, particularly its ports. The "Freeport" policy (Green Freeports in Scotland) created incentives aimed at investment in areas with existing port infrastructure, and several of the Freeports are at the center of growth in the renewables and OSW sector, e.g., Teeside (UK Department for Business and Trade, 2024). However, opportunities have also come to other ports. £50 million was invested in Invergordon on the east coast creating one of the largest laydown facilities of its kind in the UK and a multi-million pound investment was made to upgrade the 160 m dry dock gates, seals and pumping system at Kishorn on the west coast; the latter is one of the largest dry dock facilities in Europe and ideal for the handling of floating structures (KPL, 2024). Investments at this scale create industrial opportunities and employment, changes that can ripple through the local economy generating needs for housing and associated social

infrastructure. At Kishorn the authorities had the foresight to develop a 100-person accommodation block in anticipation of this need.

One of the world's largest fishing ports, Grimsby experienced an economic downturn as the fishing industry in the southern North Sea collapsed. Working with the industry, the coastal town has developed a new vision focused on the hundreds of OSW turbines, including the world's largest wind farm, Hornsea 2, located in the waters off its coast. Since Ørsted started development in 2014, £14 million has been invested in building an "East Coast Hub" (Ørsted, 2024). There are currently over 600 people working in long-term high skilled jobs in the town, with 74% of the workforce coming from within a one-hour commute (Ørsted, 2024). As the industry continues to grow, Ørsted is partnering with local educational institutions to support training for young people who seek to enter the industry (Ørsted, 2024).

Another example is Cuxhaven, Germany, a city of approximately 50,000 with traditional industries of fishing, tourism and a naval presence that has been transformed into an OSW logistics and manufacturing powerhouse. With the assistance of strategic government investment to upgrade port infrastructure, Cuxhaven was able to attract a Siemens Gamesa nacelle manufacturing facility, became an import port of choice for European onshore wind turbine components, and leveraged the presence of Siemens Gamesa and now its new monopile manufacturing tenant Titan Wind Energy to become an "installation" port where heavy lift and other specialized vessels use Cuxhaven as their construction hub. The increased level of activity and influx of skilled workers has done wonders for the local economy but has also presented challenges. Available housing has become scarce, driving up rents. A new housing development is underway that will provide accommodation for an additional 5,000 people. During an on-line discussion with the Committee, port representatives emphasized the need for communities and governments to carefully plan for the industry's arrival; financing the cost of the necessary port infrastructure, training and attracting the required labour force across a wide range of disciplines, and ensuring that the social infrastructure is expanded to accommodate and support growth (M. Itgen and A. Ehlers, personal communication, August 2, 2024). The social consequences of rapid growth in industrial activity are important topics that are discussed further in sections 5 and 8.

2.6.5 Compensation

At almost every open house event and conversation with fishers throughout NS, PEI and NB, there was apprehension that, although most participants were generally in favor of it, OSW development would displace them from fishing grounds and either directly or indirectly impact their livelihood. It is a contentious, yet very real subject and one that has confronted all jurisdictions seeking to capitalize on OSW while respecting the importance of the commercial fishery to communities and local and national economies.

Claims for compensation related to Atlantic Canada offshore oil and gas installations have focused on losses resulting from the interaction between fishing gear and the property of the energy companies. The CNSOPB's 'Compensation Guidelines Respecting Damages Relating to Offshore Petroleum Activities' is an example, where the compensation entitlement is determined by loss caused by debris and spills

(CNSOPB, 2017). Bill C-49 to amend the Accord Acts, does not explicitly establish requirements to address the issue of economic loss associated with exclusion or displacement due to OSW development. However, it does provide tools for governments to do so, i.e., terms and conditions for a submerged land license, future regulations, Impact Assessment requirements that become conditions of an authorization, and addresses matters of impacts associated from debris or attributable damage.

In the United States, BOEM has made it clear that there are no existing Federal policies or laws explicitly and specifically requiring compensation of economic loss from displacement attributed to offshore energy installations (BOEM, 2022). Similarly in the UK, there exists no legal basis for financial compensation associated with the loss of access to fishing grounds, disruption or displacement of fishing activities resulting from offshore renewable energy installations (FLOWW, 2015). Denmark appears to be the exception to the general trend, with the *Danish Fisheries Act* requiring "all fishermen who normally fish in the affected area must be compensated for the loss of income" (Danish Energy Agency, 2018).

As pointed out in a study sponsored by the European Commission, windfarms are a significant "game changer": their installations are in place for long periods of time, cover footprints that far exceed those of the offshore oil and gas industry and can present not just short term, but effectively permanent, constraints for other maritime activities, notably fisheries (European Commission, 2020). With the aggressive growth targets that would substantially increase OSW production worldwide, the OSW energy sector will increasingly exert more competition for space in areas where maritime space is often extremely coveted.

In the absence of a clear legislative path establishing the right to compensation for economic loss precipitated by OSW activities, many jurisdictions have opted to encourage 'voluntary' settlement agreements through guidelines as part of the licensing process. Examples include the FLOWW 'Best Practice Guidance' in the UK (FLOWW, 2015) which seeks to establish co-existence through early and sustained dialogue, avoidance of disruption or displacement where possible, and as a last resort "settlements agreed on a mutual basis…to counterbalance or offset any residual fisheries related impacts…" (FLOWW, 2015). BOEM's equivalent guideline seeks to "improve lessee communication, transparency, and accountability with fishing communities," and "recommends that the lessee consider establishing a compensation process if a project is likely to result in lost income to commercial and recreational fisheries" (BOEM, 2022). As noted in a recent summary of the US practice, "BOEM has conditioned its approval of each of the Construction and Operations Plans it has approved for New England projects on the developers establishing the fisheries compensation funds they committed to create", resulting in an enforceable condition that effectively fills the gap in the absence of a clearly legislated solution (Marine Affairs Institute, 2024). Stated another way, "By placing compensation in the lease process, BOEM can standardize a process that is currently piecemeal in its application" (James *et al*., 2023). Note that recent legislation from the state of Maine encourages "Maximize mitigation of and compensation for impacts to coastal communities, wildlife, fisheries and the marine environment" in any federal OSW leases (*Maine Wind Energy Act,* 2023).

Before the parties can begin to define the terms of a settlement agreement, voluntary or otherwise, the rules which govern access, and the use of the space need to be considered. Again, we find that there is a significant divergence of practice among jurisdictions with a recent study of the North Sea highlighting the differences in approach (Bonsu *et al*., 2024). Some jurisdictions have broadly defined safety exclusion zones, others have more narrowly excluded access and in the case of the UK only during the construction phase. Many permit some type of fixed gear fishery, while Denmark permits bottom trawling over the Hornsea export cable. The Netherlands has opened transit for vessels under 24 m through specified wind farms providing direct line access to fishing grounds. These are a few examples of the type of operating exclusions and conditions that will define the extent of any claim based on loss of access.

The question of who is entitled to seek compensation, for what purpose and over what time period are topics that also highlight the variability in approach established across jurisdictions. The BOEM model promotes compensation to individual claimants and impacted businesses in communities, and on a declining payment scale over a five year "adjustment" period calculated on the gross revenue lost. The UK practice recommends that claims be based on net income lost and recognizes that developers and fishers may, in addition to a scheme directed at individual losses to fishers, wish to consider "actions at a community level" which have resulted in funding for various community projects (West of Morecambe Fisheries Limited, n.d). In the US, nine States have initiated a discussion with the Federal government seeking a framework for a Fisheries Compensation Fund Administrator. In addition, they have noted their support for "transition or resilience funds that would be distributed to help the fishing industry", with a list of fundable activities including cooperative research, port infrastructure development, gear and vessel innovation and equipment upgrades and training (Special Offshore Wind Initiative, 2023). The Vineyard Wind 1 project offshore Massachusetts resulted in four separate funds being established, administered by four separate entities covering everything from direct impacts to fishers to research studies and technology grants (NYSERDA, 2022). The potential list of funding schemes is broad: this begs the question of the policy objectives that underpin the approach to any compensation framework.

There are other equally complicated aspects of this topic such as the criteria applied to determine claims eligibility, and the type of evidence required to support a claim; topics that are not discussed in detail here. It should come as no surprise that the process, instigated by the NYSERDA Fisheries Technical Working Group on compensation, followed by the nine States seeking a BOEM compensation framework, leading to the promulgation of BOEM's draft industry guidelines, required several years. The relatively new Danish Marine Plan (2023) is further evidence that coexistence and compensation issues are still being worked through some thirty years after the first offshore wind turbines were installed, and not yet to the satisfaction of all parties (McBride, 2023).

There are two additional topics that warrant mention. The first relates to the liability for losses that may occur through fishing activities permitted within an operating wind farm and the associated topic of insurance. If fishing is permitted, how should the liability for potential loss be allocated and insured? One NS fisherman has expressed the view that if the fishing industry is invited to fish (and essentially "mitigate" what would otherwise be a loss of revenue) in a wind farm, the operator should contractually

indemnify fishers for any resulting losses, effectively requiring the operator to manage the risk through its insurance program. Regardless, the potentially significant financial consequences that may result from collision with OSW structures, entanglement with array cables or damage to export cables is an important issue that needs an insurance remedy. The availability and cost of adequate levels of insurance has been raised by fishers as an obstacle to co-locating activities. What can be said with confidence is that the insurance industry is adept at allocating and insuring risks and the circumstances of the OSW industry should be no exception.

Last but far from least are questions related to governance structures that determine how funds are generated and allocated. Many jurisdictions require that compensation negotiation be led by the OSW developer in direct contact with the fishing industry and that the agreed compensation is a project expense borne by the developer. Nine states are seeking a third-party fund administrator to act as the party determining funding eligibility and disbursing agreed compensation funds paid into escrow by the developer. In Germany, the operators have no direct liability to pay fisheries related compensation but 5% of the OSW licensing fee is allocated to support fisheries (Bonsu, 2024), and reference has been made to the US Congress potentially authorizing some portion of lease payments for fishery compensation mitigation (Congressional Research Service, 2024).

If OSW development in the RA Study Area is to include compensation for economic loss to fishers due to exclusion/loss of access, the above summary provides an indication of the practices adopted in other jurisdictions and the myriad of issues that need to be considered.

2.6.6 Bidding Criteria

Once specific OSW lease areas are identified by governments and calls for bids are issued (the expectation is that this process will be administered in NS through the CNSOER), the rules must establish how bids will be evaluated and licenses awarded. This is the time when governments can attempt to implement strategic policy priorities and objectives. Should the bid focus be maximizing revenue, the basis on which oil and gas exploration leases have been awarded for the RA Study Area in the past, or should consideration be given to non-monetary “qualitative” components such as supply chain development or environmental stewardship? This is another area where the practice between jurisdictions has varied greatly, in part due to the widespread practice of state subsidization of projects to incentivize the attraction of investment (US DoE, 2022). Under EU law, for example, state subsidized bids can allow only 30% of the award to be based on non-monetary criteria (WindEurope, 2022).

The NS government has signaled that it intends to move away from a pure monetary bid criterion for OSW leasing.[18] Leaving aside the question of whether subsidies might be required to establish the industry offshore NS and how that might constrain the inclusion and weighting of non-monetary criteria,

[18] The Province of Nova Scotia has signaled that it intends to move away from a single criterion for OSW leasing. Legislative amendments enable offshore wind call for bids to be evaluated according to ‘criteria’ as opposed to ‘criterion’ for petroleum licences.

the general trend across jurisdictions is for OSW bid processes to include some level of non-monetary criteria in leasing decisions (Jansen *et al*., 2022). The open auction bid process designed solely to maximize state revenue has been criticized, the 2023 German OSW licensing round (for non-developed sites) being a case in point. It is noted that there are huge differences between the well-developed German OSW industry (where demand for green electricity is enormous and competition for leases is fierce), and the yet to be developed NS industry (where domestic demand is limited and establishing pathways to market for OSW energy is acknowledged to be a challenging but fundamental enabler for the industry to achieve scale) (NZA, 2024). It is also noted that the record high winning bids for the 7 GW of leases totaling $14 billion USD came from oil and gas majors BP and Total Energies (Radowitz, 2023). A study by Rabobank estimated that these bids increased the overall development costs by 60% ($1.3 billion Euros per GW), citing the following concerns with this maximization of revenue approach (Rabobank, 2023):

- it has the potential to crowd everyone out, including some of the established industry leaders, except those from the fossil fuel industry whose cash flow can subsidize OSW project development costs;
- high development costs reduce profitability and can result in projects being cancelled causing supply chain disruption and the failure of state governments to realize renewable energy targets; and
- the higher entry fees must be ultimately passed on to consumers, driving up the cost of energy.

It is interesting to note that the German government has indirectly identified its policy objectives by planning to allocate 90% of the bid revenue to fund grid connection costs, 5% to protecting marine biodiversity and 5% to support sustainable fishing (Rabobank, 2023).

Once the decision has been made to include non-monetary criteria, they need to be specified in the bid package and a weighting value assigned. It isn't uncommon to see criteria related to local procurement, particularly in jurisdictions where the industry is new and the supply chain immature, encouraging the use of domestic goods and services. Although economists have criticized this approach as distorting competition and raising electricity prices and investment risks, it has been widely adopted "for its ability to foster a nascent industry, bring jobs, and increase public support for renewable energy" (Lin, 2023). Taiwan is an example of the fine balancing act that is required here; one study concluded that the high percentage specification for local content has made Taiwan's offshore wind farms the most expensive to build globally, scared away investors and ruined the market for the Vestas turbine blade manufacturing plant which had been developed as part of the policy drive to increase local capacity (Liu, 2024). Estimating that a 35-turbine wind farm that complied with the Taiwanese local content requirements would cost an incremental $180 million USD more to construct, one commentator in CommonWealth Magazine has stated that at this kind of a premium wind farms won't be built and supply chains won't materialize regardless of how well-intended the policy objective (Liu, 2024). This level of premium has also caught the attention of the European Union (EU) which, in July of 2024, requested dispute resolution at the World Trade Organization alleging discriminatory practice that violated Taiwan's international trade commitments (Liu, 2024). It isn't just Taiwan that is potentially running afoul of trade

rules. The EU is reportedly paying close attention to the *US Inflation Reduction Act* which provides investment tax credits for achieving local content, wage and apprenticeship thresholds, an approach which is credited with "kicking-off" the subsidy race worldwide and forcing a re-ranking of the attractiveness of OSW markets (European Parliament, 2023).

While jurisdictions struggle to achieve the correct balance in how they can effectively and legally utilize the OSW bid process to encourage domestic supply chain development and increase local content, there is evidence of greater consideration being given to environmental stewardship and fisheries mitigation. The Committee has already noted (section 2.6.5) the BOEM practice of including fisheries mitigation efforts and compensation proposals in OSW bid processes. A recent study undertaken by the Institute for Energy and the Environment at the Vermont Law and Graduate School (the IEE study) has surveyed existing US state and European country OSW solicitation processes to assess the use of non-price criteria and how jurisdictions are leveraging offshore wind auctions to invest in the ecological enhancement of their marine and aquatic ecosystems (James *et al*., 2023).

Whether the non-price criteria are quantitative or qualitative, the IEE study concludes that they must be objective, measurable and capable of comparison between different proposals, and they must be enabled by an appropriate regulatory process. By noting that "Regulators are often given new tasks that must be completed under old mandates and with old tools", the IEE study highlights an important if sometimes overlooked point. To achieve desired non-price outcomes requires close collaboration between governments and the regulator, and in the case of the newly minted CNSOER, clear guidance and authority. The fact that Bill C-49 does not in its present format speak to compensation for economic loss due to exclusion or displacement, for example, is a potential gap that may require attention should government choose to implement some form of fisheries compensation program through the planned regulatory process. The following representative IEE findings from selected jurisdictions serve to highlight the recent attention being given to non-monetary quantitative and qualitative criteria in OSW bid solicitations:

- The state of New York OSW solicitation process managed through NYSERDA now includes two non-price categories: *Economic Benefits* which brings attention to workforce and supply chain development and labor standards, and *Project Viability* that evaluates project execution risk: the development experience of the proponent, stakeholder engagement efforts, including specific reference to disadvantaged communities, and mitigation plans for potentially impacted recreational and commercial fishers. Project Viability scores can, for example, be enhanced for projects using "acoustically quiet" foundation design or foundation installation technology solutions that reduce acoustic stress to sensitive marine life beyond current regulatory standards. It appears that project specific Environmental Mitigation Plans are not just a part of the post-lease award permitting process, as would be the case with lease awards based purely on price, but actually form part of the bid evaluation and require species specific risk identification plans for marine mammals, birds, bats, fish, invertebrates and benthic communities, plus monitoring and research programs to fill data gaps pre, during and post construction (NYSERDA, 2024).

- In the State of New Jersey, the solicitation approach has evolved over each of the three licensing rounds and clearly highlights the increasing level of importance being afforded to environmental objectives. In the first bidding round, fisheries impacts had to be addressed in the Environmental Protection Plan (EPP) with reference to existing baseline ecological studies and a description of how impacts might be mitigated. The second bid round required an EPP plus a separate Fisheries Protection Plan, and bidders were required to provide information on how they would share their findings on impacts to affected species, describe the baseline and monitoring data that they intended to collect and how the physical infrastructure could be used to provide direct ocean and ecological observations. In the third round of bidding more attention was paid to addressing potential cumulative impacts, plus a requirement for "a description of any commitments to fund additional research related to the assessment and avoidance of environmental impacts" (New Jersey Clean Energy Program, 2024).
- The Dutch government's decision to move to subsidy-free auction has allowed it to weight non-price criteria at 50% of the total bid. Two tenders held in 2022 contained non-price criteria: one focused on contributions to investment and innovation in the ecology of the North Sea, and the other on integration of OSW facilities into the existing grid. The scoring criteria were based on guidelines developed through public participation, and bids were assessed by an expert panel. More recent tenders have emphasized different priorities, focusing on environmental mitigation efforts in specific locations with high concentrations of cetaceans and seabirds, and including minimizing disturbance to harbour porpoise (Radowitz, 2024).
- In France, a recent 1 GW Normandy auction was conducted with non-price criteria that included recycling plans, community investment/community funding, and achieving the installed capacity objective using the fewest turbines (James *et al*., 2023).

Norway has chosen to emphasize non-price criteria in its pre-qualification selection phase of the bid process. These have included minimum equity requirements (20% of the total investment cost) and requests for bidders to provide electricity to the Ekofisk oil and gas facility (BAHR, 2023).

Maine is an interesting case study worthy of particular attention. It highlights the challenges presented by the arrival of the OSW industry through a lengthy and complex fifteen-year process that started with a desire to establish a floating wind demonstration project, and culminated in comprehensive OSW procurement guidelines that demonstrate significant commitment to ensure OSW is accommodated in a way that preserves existing industries and pays attention to the needs of coastal communities (Maine Offshore Wind Initiative, 2024).

In 2010, the Maine Public Utilities Commission attempted to establish a floating wind pilot/demonstration project, eventually approved over a decade later (Memija, 2024). In February 2023, after a lengthy engagement and consultation process, the State issued its Maine Offshore Wind Roadmap, a strategic economic development plan for OSW expressing the state's desire to advance development under three pillars: preserving Maine's marine economy, protecting the environment, wildlife and fisheries ecosystems of the Gulf of Maine, and preserving Maine's traditions and culture (Maine Offshore Wind Roadmap, 2022). In July of 2023, *An Act Regarding the Procurement of Energy*

from Offshore Wind Resources (LD 1895)[19] was passed, requiring that OSW procurement must be "consistent with the recommendations in the Maine Offshore Wind Roadmap" in the areas of (Maine Wind Energy Act, 2023):

- stakeholder engagement and capacity building and equity with reference to coastal and socially vulnerable communities;
- economic and community benefits including investments in ports, supply chains and the necessary workforce;
- diversity, equity and inclusion in employment and contracting;
- fisheries research, monitoring and mitigation; and
- environmental and wildlife research, monitoring, mitigation and conservation.

The direction on fisheries investment is wide reaching, requiring a fishing community investment plan with a stated annual target rate of investment designed to:

- support innovation and adaptation in response to environmental change, shifting resource economics and changes in fishing practices associated with offshore wind power development;
- protect seafood-related working waterfront infrastructure;
- assist persons fishing commercially at an entry level; and
- assist persons fishing commercially who seek to provide the responsible entity with offshore services.

Potential investment strategies within the plan include such things as subsidizing commercial lending interest rates, providing loan guarantees and funding programs or grant programs to support fishers, fishing-related businesses and "entities established to provide support services to the fishing industry" (Maine Wind Energy Act, 2023).

Maine has yet to issue its first call for proposals. It will be interesting to see how the broad spectrum of non-price bid criteria identified in the procurement guidelines are applied in practice and how successfully they promote the general co-existence policy objectives articulated in the legislation.

While not directly related to OSW bidding, the Government of Newfoundland and Labrador recently issued a call for bids regarding crown leases for onshore wind development (Government of Newfoundland and Labrador, 2023). The instructions to bidders adopted the principle of "Full and Fair Opportunity" similar to Canada's East Coast oil and gas industry (Government of Newfoundland and Labrador, 2023), requesting detail on "how individuals and companies in the province will be given a full and fair opportunity to compete for employment opportunities and provide goods and services on a competitive basis" (Government of Newfoundland and Labrador, 2023). Bid submissions were to highlight benefits and activities in the province in areas that included employment, project

[19] An Act Regarding the Procurement of Energy from Offshore Wind Resources https://www.mainelegislature.org/legis/bills/getPDF.asp?paper=SP0766&item=5&snum=131

management, education and training, procurement, supplier development, research and development, and gender equity and diversity.

A review of the various bidding approaches being adopted and implemented for OSW leasing indicates a seemingly endless combination of options for non-price criteria, tailored and recalibrated over time to reflect the maturity of the industry and evolving government policy considerations.

3.0 Offshore Wind Development

The first commercial-scale OSW farm was commissioned in Denmark by Ørsted in 1991 (Ørsted, 2024). It consisted of 11 x 450 KW turbines for a total project capacity of roughly 5 MW (Ørsted, 2024). Since then, the OSW industry has grown exponentially reaching approximately 70 GW of capacity installed worldwide at the end of 2023 (WFO, 2023). The plans for the next decade and beyond suggest an acceleration in growth, with the 2023 Global Wind Energy Council predicting an additional 380 GW of installed capacity worldwide by 2030 and, referencing the International Renewable Energy Agency's 1.5°C global warming case, a staggering 2000 GWs by 2050 (GWEC, 2023). The enormous capital investment being made is driving down the Levelized Cost of Energy (LCoE) and making OSW an increasingly competitive and attractive source of green energy (GWEC, 2023).

As the industry expands and develops, individual offshore turbines are getting larger as individual project size increases. The average capacity of offshore wind turbines installed in 2021 was 7.4 MW (Shields *et al*., 2023). Current development projects planned for the east coast of the United States will employ 16+ MW turbines (NREL, 2022). One developer of a project within the RA Study Area is considering 15 MW turbines. In the push to increase the power output from a single turbine and achieve the scale and efficiency desired by developers seeking to improve project economics, and national governments seeking to meet GHG emissions targets, China has recently installed an 18 MW turbine in Guangdong province (Lewis, 2024). Turbine manufacturer Mingyang is now planning to deploy a 20 MW version (Singh, 2024). The maximum achievable wind turbine size is debated, but likely to be constrained by the availability of the equipment required to install such large structures (Hartman, 2023). Individual projects now regularly exceed 1 GW of installed capacity (Equinor, 2023).

In terms of the potential scale of the industry for offshore NS, the Committee has noted the provincial government plans to have 5 GW of offshore leases issued by 2030, which establishes a mid-term baseline to inform its analysis (Province of Nova Scotia, 2023). The TOR limits the scope of the RA to the components and activities directly associated with the generation of OSW electricity and its transmission to shore. By implication, it does not include the work that would be required to (a) upgrade the existing electricity grid to accommodate this new energy source, (b) provide new onshore transmission lines to enable large scale export of power from NS, (c) upgrade existing port infrastructure to support the construction and operating phases, or (d) construct hydrogen generation facilities now in the planning phase for locations in NS. That said, these associated works and activities will have cumulative effects on environmental and socio-economic components/factors that are within the scope of this RA, a discussion which follows in sections 5 and 8.

The following sub-sections provide detail on OSW technology and equipment, the activities involved in the various phases of a development project, the supply chain and the environmental impacts commonly associated with commercial scale OSW development.

3.1 The Technology of Offshore Wind

OSW development involves the generation of electricity from wind blowing across the sea (National Grid, 2022). OSW farms are more efficient than onshore wind farms due to stronger and more consistent wind speeds and the lack of physical interference that landforms or human-made objects can present (National Grid, 2022). Essentially, stronger wind speeds and greater consistency mean more electricity is produced per equivalent unit of generating capacity, which can translate into more favorable development economics. The increased cost of construction in the marine environment is being offset by the increasing efficiency and scale of OSW farms making OSW an important part of the global energy mix (National Grid, 2022).

3.1.1 How Electricity is Produced

The technology for generating electricity from OSW is essentially the same as it is onshore (National Grid, 2022). Wind turbines use long blades to capture the wind's kinetic energy, i.e., energy from the movement of air (IRENA, 2022). Wind blows over the specially designed curved blades creating both lift and drag (similar to the effect on airplane wings or helicopter rotor blades), which causes the blades to turn (IRENA, 2022). The blades are connected to a drive shaft that turns an electric generator, which produces (generates) electricity. Typically, a gearbox is incorporated in the design to speed up the rotation of the drive shaft which allows for the use of a smaller, more efficient and economical generator (IRENA, 2022). Modern turbines can be adjusted remotely from an onshore operations center to allow operators to optimize electricity generation regardless of the wind direction or speed (Dincer and Ishaq, 2022).

3.1.2 The Components of a Wind Farm

The main components of OSW farms are the turbines, their foundations, cables and substations (NYSERDA, 2024) (see Figure 3.1). These components are discussed in greater detail in the following sub-sections. The turbine captures the wind's energy and generates electricity (NYSERDA, 2024). The turbine is mounted on either a fixed foundation attached directly to the seafloor (such as a pile driven monopile depicted in Figure 3.2) or a floating foundation, which is secured to the seafloor via various anchor and chain assemblies (NYSERDA, 2024). A network of array cables links each turbine and delivers electricity to an offshore substation where it is gathered and stabilized before being further transported via an export cable to landfall and connected to the offshore infrastructure (NYSERDA, 2024).

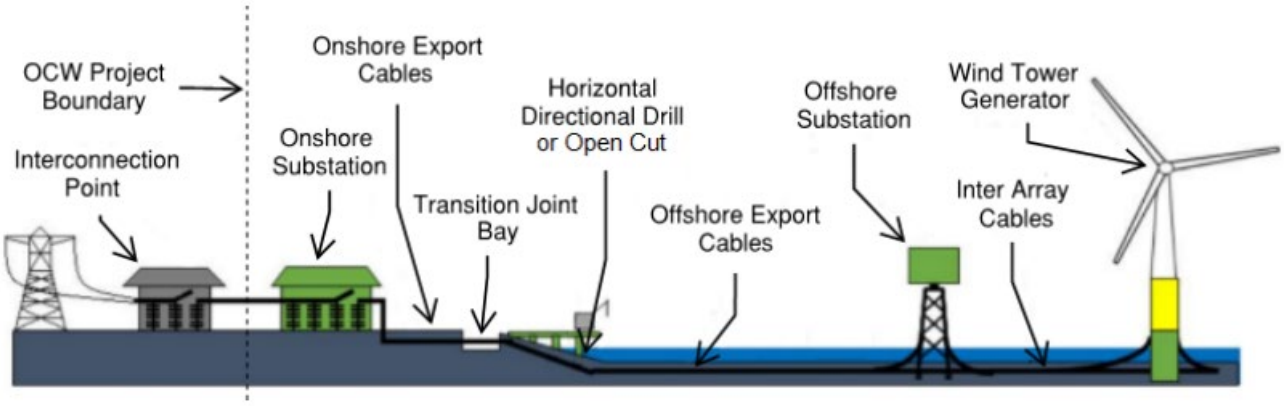


Figure 3.1. An Offshore Wind Farm Showing Fixed (Monopile) Foundations (Ocean Wind LLC, 2022)

Electricity from the turbines moves through undersea array cables to an offshore substation where it is gathered and stabilized before being exported through a buried export cable where it makes landfall and is connected to onshore infrastructure. Developments that are close to shore may not require an offshore substation and transmit electricity directly to shore (NYSERDA, 2024).

3.1.3 Turbine Components

The main turbine components depicted in Figure 3.2 include the blades, the nacelle (containing the generator), the tower and the foundation (in this case shown as a fixed monopile) (NYSERDA, 2024). Foundations, the means by which turbines are supported and kept in place is an important topic from both an overall capital cost perspective, the type of environmental impacts associated with individual designs, and the different type and scale of economic benefits likely to accrue to the province depending on the type of foundation selected. To assist the reader in understanding the significance of turbine selection in the context of the subsequent discussions on impact producing factors, mitigation and socio-economic impacts, a detailed discussion on foundation types follows in section 3.2 (BVG Associates, 2023).

Typically, turbines have three blades that range in size depending on the design and rated capacity of the unit (the amount of power the wind turbine can produce). Turbine blades are made primarily of fiberglass and carbon fiber material and are connected to the rotor hub (US Department of Energy, n.d.). The hub supports the blades of the turbine and houses the variable pitch system which helps optimize the blade angle and rotation speed according to wind conditions. The hub is connected to the generator housed in the nacelle along with the gearbox and other associated equipment that converts the mechanical energy from the blades into electrical energy (NYSERDA, 2024). The nacelle is fastened to the top of the tall tubular steel tower (at a height which optimizes use of the wind resource and keeps the turbine blades at a safe distance above the water) which connects to the turbine foundation (NYSERDA, 2024).

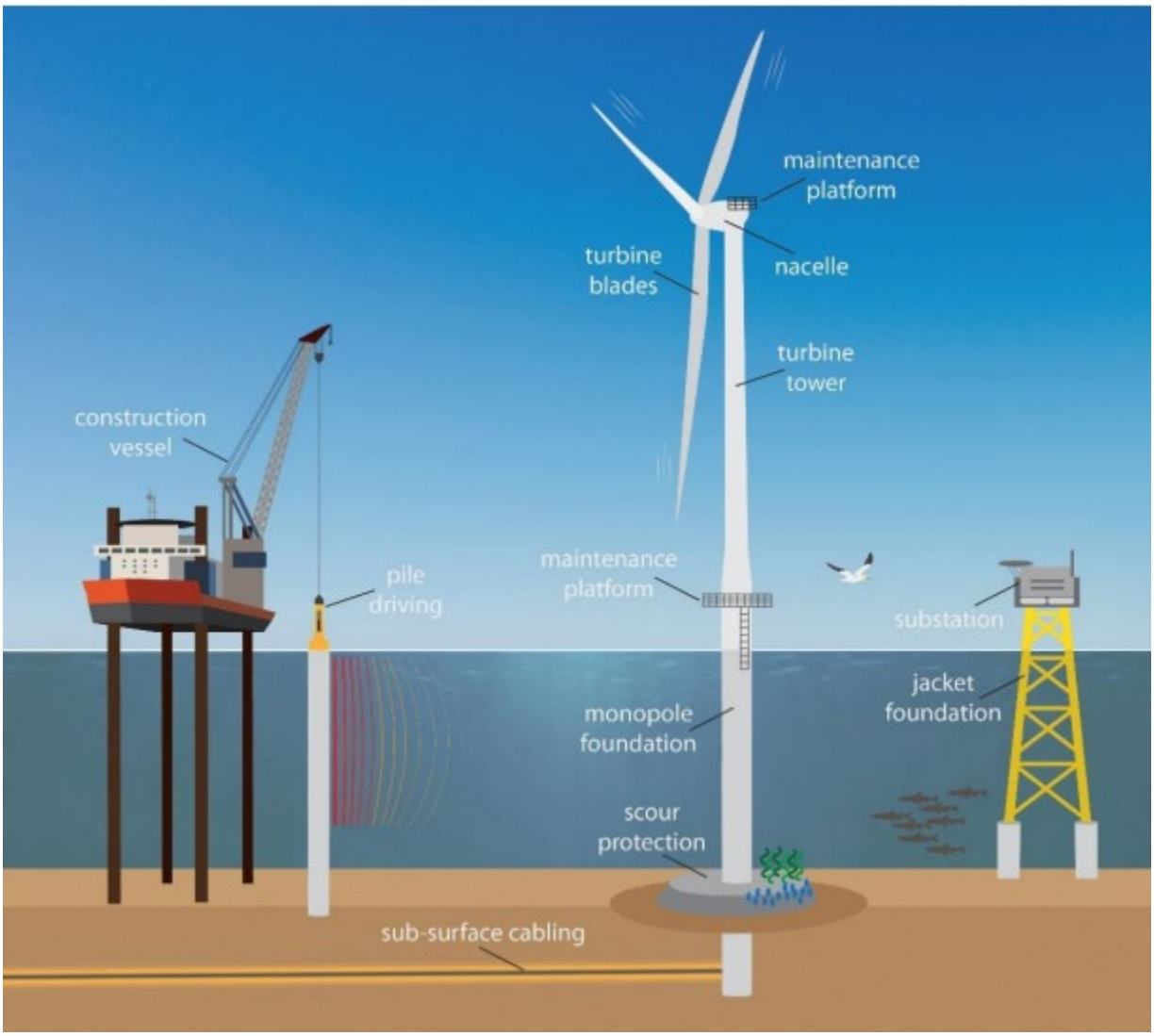


Figure 3.2. The Anatomy of an Offshore Wind Turbine (Biodiversity Reseach Institute, 2024)

As discussed in the opening section of this chapter, turbines used in OSW farms are typically much larger than those used on land. Due to the increased speed and consistency of the wind resource, the larger turbines produce exponentially more electricity per unit, and the efficiency increase can offset the high cost of construction, operations and maintenance in the marine environment. For example, as wind speeds double from 5 to 10 km/hr, the wind can produce eight times more energy (IRENA, 2022). The higher velocities explain why wind speeds over the ocean can provide greater economic return for the cost of development than those on land (IRENA, 2022). The dimensions of OSW turbines are increasing as a function of higher rated capacity. Figure 3.3 below provides comparisons of some turbine sizes globally.

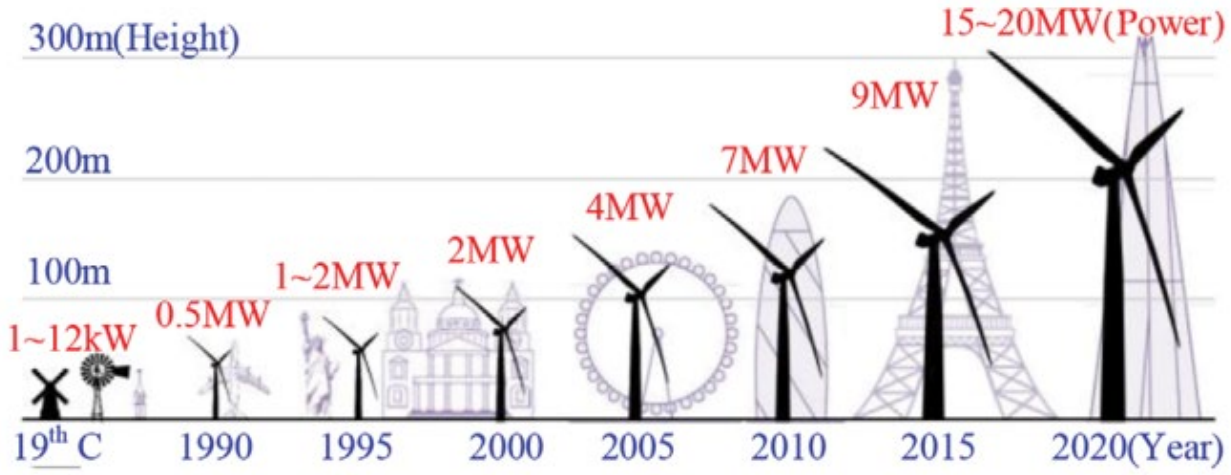
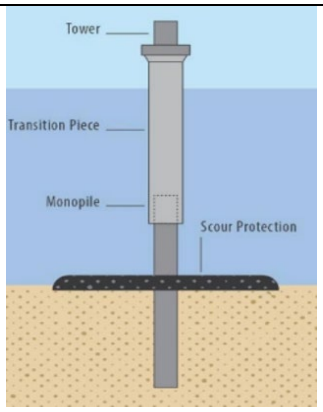
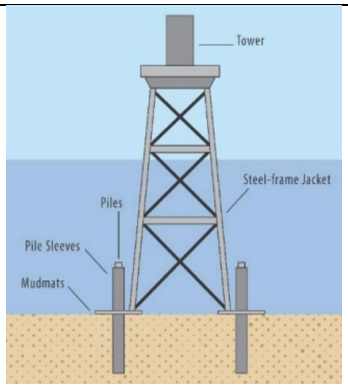
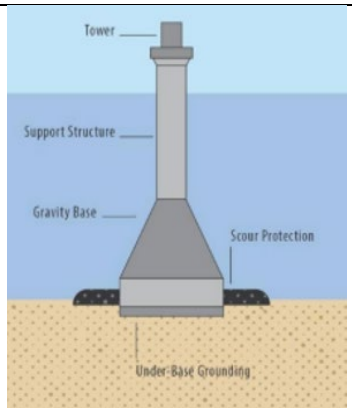


Figure 3.3. Evolution in height and power of wind turbines (Chen *et al*., 2021)

3.1.4 Turbine Foundations

Turbine foundations are made of steel, concrete, or a combination of both and are categorized as "fixed" or "floating" depending on how they are connected to the seafloor (Tang and Kilpatrick, 2021). The various types from each category are depicted and discussed in Tables 3.1 and 3.2. As the name implies, fixed foundations are attached directly to the seafloor, currently in water depths of up to 100 m although the preferred monopile structure (approximately 80% of the worldwide installations to date) are all in less than 60 m of water (Tang and Kilpatrick, 2021). Floating turbine technology is typically considered in water depths ranging from 100 m to 1,000 m and requires an anchor mechanism that provides buoyancy to the wind turbine to restrict the pitch, roll, and heave motions of the structure in turbulent waters (Tang and Kilpatrick, 2021). For some countries, such as those with a narrow continental shelf, floating turbine foundations offer the only opportunity for large-scale OSW deployment (MRC, 2024a). Approximately 80% of the total ocean area is too deep for today's fixed foundation technology (BVG Associates, 2023).

Table 3.1. Fixed Foundation Types

Type	Description	Image
Monopile	Monopiles are made of tubular steel and are a proven technology with mature supply chains. They can be mass produced and the vessels to transport and install them already exist. Where suitable substrate (sand and gravel) and water depths (less than 60 m) exist, they are the preferred and most cost-effective foundation type currently making up over 80% of the offshore turbines installed to date. The foundations are typically driven into the soil to depths up to 30 m, with a rock mattress placed around the base at the seafloor to protect from scour/sediment erosion. Depths: Less than 60 m water depth.	
Jacket	Jacket foundations are more complex to design, labour intensive to fabricate and costly to install than monopiles. However, they are more tolerant of varied geotechnical conditions. They are also stiffer structures and for deeper water locations generally require less steel than monopiles. They are typically installed using a combination of a mudmat (to provide adequate area for load distribution to the soil) and piles. Depths: Deeper waters up to 100 m water depth.	
Gravity-base structures	Gravity Base Structures (GBS) are the oldest and simplest foundation type, relying on the weight of the ballasted concrete base to provide load distribution and stability. The volume of materials needed makes them very expensive for deep-water sites. Depths: Between 15 m to 40 m water depth.	

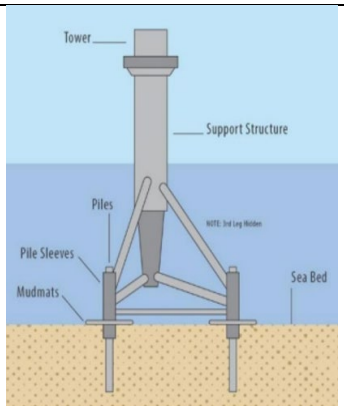
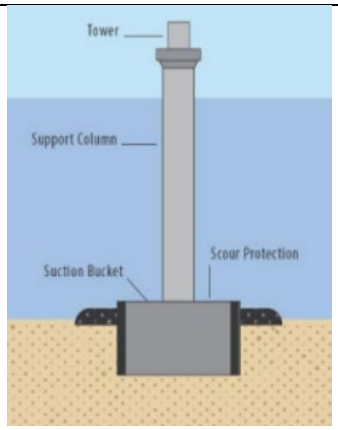
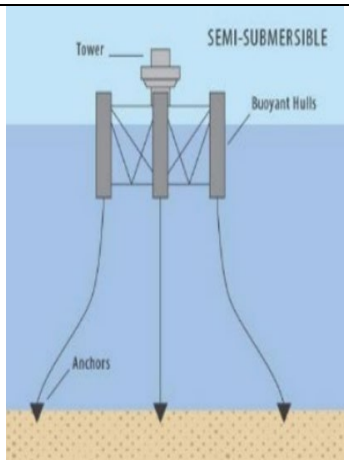
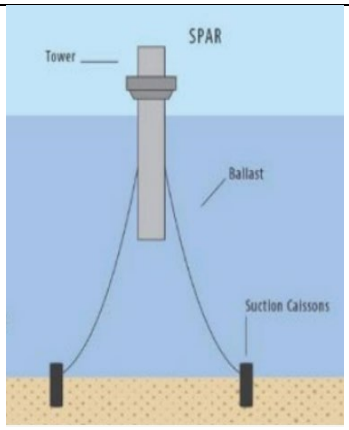
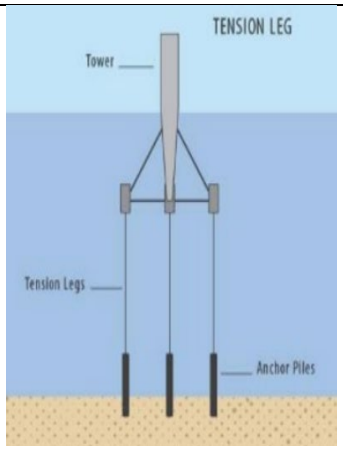
Type	Description	Image
Tripods and tripiles	Tripod foundations combine monopile and jacket structures producing a central column frame with triangular supports that insert into the seabed. The legs of the tripod foundation are spaced from 20 m to 40 m apart. The use of these is rare, as they have not proven to be cost-effective options for OSW. Depths: Between 25 and 60 m water depth.	
Suction bucket	Suction buckets (also referred to as suction anchors, suction piles or suction caissons) are a form of fixed platform anchor similar to a monopile but using a large diameter open bottomed tube embedded in the sediment and sealed at the top. They don't require any pile-driving and offer the advantages of silent installation and relative (compared with jackets and monopiles) ease of removal at decommissioning. There is limited experience using this technology in OSW applications. They require very specific soil types and because of their shallow embedment are not suitable in conditions of high sediment mobility. Depths: Between 30 m to 50 m water depth.	
Sources: Boslan, 2022; Chen *et al*., 2024; ICF, 2020; Ørsted, n.d.; Vázquez *et al*., 2022.		

Table 3.2. Floating Foundation Types

Type	Description	Image
Semisubmersible	Floating foundations have their origins in equipment deployed for the oil and gas industry. Semi-submersibles consist of multiple columns, to provide stability and multiple bracing and pontoon mechanisms to provide additional buoyancy. The foundation is kept in position by heavy, widely spread, taut mooring lines and drag anchors. An attractive feature of semisubmersibles is their suitability over a wide range of water depths. The design and cost challenges continue to drive innovation as the industry moves into deeper water. Depths: Starting at approximately 40 m water depth.	
Spar	The spar concept is a large, deep-draft, floating cylinder, ballasted to help maintain buoyancy and stability. The foundation is kept in position by catenary (curved) or taut spread mooring lines with drag or suction anchors. A spar has good stability, and its design is simpler than the semi-submersible, but fabrication, transportation and installation are more challenging because of its tall structure. Depths: Greater than 100 m water depth.	
Tension Leg Platform (TPL)	Like a semi-submersible, a TLP consists of columns and pontoons. Its unique feature is the mooring system, which consists of vertical tendons which restrain the turbines movement. A TLP also has good stability and can be used in a range of water depths, but its construction and anchoring system costs are higher than other floater designs. Depths: Starting at approximately 40 m water depth.	
Sources: Du, 2021; Meng, *et al.*, 2024; Vázquez *et al*., 2022.		

The choice of foundation type used to support a wind turbine depends on several environmental, geophysical and socio-economic factors (Empire Engineering, 2021). Several of the more important ones are discussed briefly discussed in Table 3.3.

Table 3.3. Foundation Selection Consideration

Environmental/Geophysical Considerations	Socio-economic Considerations
Water depth. To date, the deepest fixed monopile installation occurred in 58 m of water off the coast of Scotland. While other fixed foundations are technologically capable of being installed in water depths of up to 100 m, costs may be prohibitive. Currently floating turbines are being installed in waters up to 300 m.	**Local fabrication capabilities or location of manufacturing facility.** If components can be sourced locally, the developer may be influenced in its selection based on the available supply. Economics often favour well developed supply chains with sufficient capacity to meet demand in a timely fashion.
Seabed conditions and composition. Monopiles cannot be driven into some bedrock types and require a certain type and depth of substrate. The various forms of anchor systems supporting floating foundations are also dependant on suitable seabed conditions to prevent dragging.	**Transport and installation strategies.** Large structures may be difficult and costly to transport, favouring water side fabrication/assembly reasonably close to the ultimate installation location.
Metocean conditions. Weather and sea state conditions determine the window for installation and maintenance and may impact foundation selection.	**Operations and maintenance.** Distance from shore means higher transportation costs and favour foundation types with comparatively less maintenance demands.
Turbine design specifications. Increase in overall turbine size and mass impact the forces and loads to be managed which in turn influence foundation selection.	**Decommissioning concerns.** Ease and cost of dismantling a site at the end of its working life varies between foundation types.

Sources: Durakovic, 2023; Gray, 2021; Kurth *et al*., 2024; Lin *et al*., 2021.

3.1.5 Array Cables and Transmission Cables

Submarine cables are critical to the operation of all OSW farms. Array cables carry the alternating current (AC) produced by the turbines and various types of data that allow for continuous performance monitoring from a remote facility through optical fibers (BVG Associates, 2024). Array cables connect the turbines to one another and carry the electricity either directly to landfall without the requirement

of an offshore substation (where the distance to shore permits) or more typically, connect to an offshore substation where the power is converted to high voltage direct current (HVDC) (BVG Associates, 2024). This energy is then exported to landfall via a transmission cable (BVG Associates, 2024).

The type and configuration of array cables differs substantially depending on foundation type. In fixed foundations, the cables are static; they exit the foundation and are typically buried in the seabed. With floating foundations, the cables are dynamic; they exit the foundation and hang in the water column with enough flexibility and length to react to the movement of the foundation and the loads created by forces such as wave action and tidal current (BVG Associates, 2024). Figure 3.4 depicts two types of potential dynamic cable configurations.

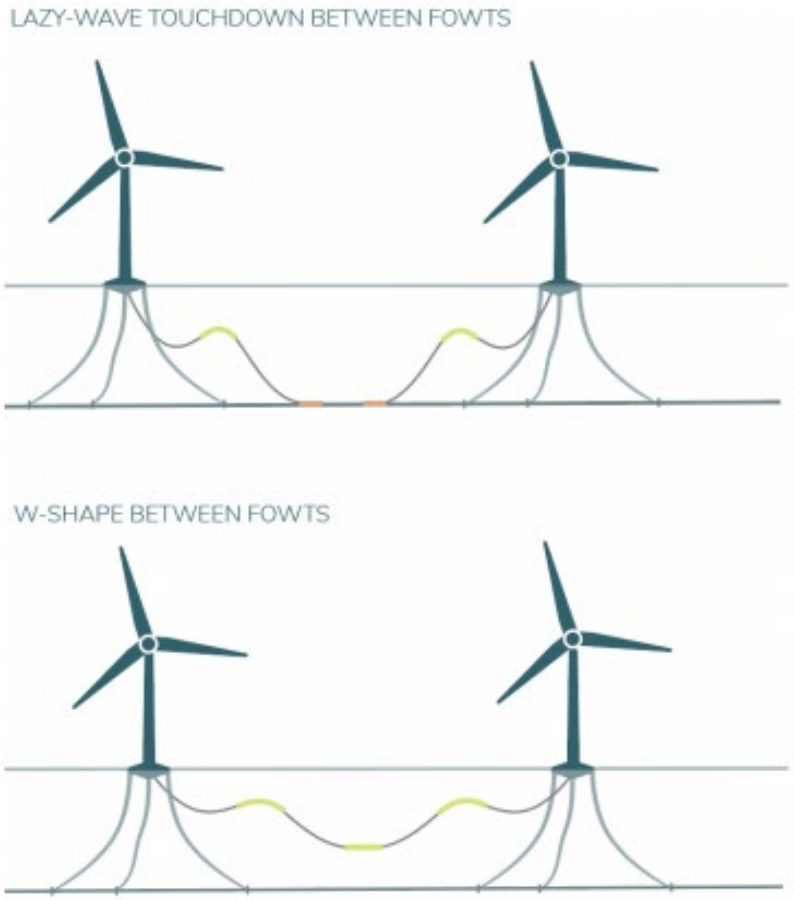


Figure 3.4. Two Types of Cable Configurations for Floating Offshore Wind Turbines. Lazy wave: attached buoyancy modules provide lift at midwater cable section. W-shape: Buoyancy modules also used to suspend entirety of cable, so it does not touch the seabed. Although not pictured here, a dynamic cable can be used without accessories between the hang-off and touchdown (known as a catenary configuration, which would be best for benign, deep-water conditions) (WFO, 2024).

The combination of the mooring systems that stabilize floating foundations and the dynamic cables that transport the power comprise in-water infrastructure that must be considered from the perspective of potential environmental impacts.

Cables used in the marine environment are expensive, technologically complex and can be easily damaged (BNOW, 2022). Since cable failures have caused extensive losses for developers and insurers, and disruption to consumers, where possible they are buried in the seabed or covered for protection (BNOW, 2022). The installation of cables is discussed further in section 3.2.2.

3.1.6 Substation

Offshore substations and, as required co-located converter stations (where the AC power is converted to DC before transmission), are facilities placed on foundations like those used for turbines and are subject to the same selection constraints (NREL, 2024). To date, the foundations have typically been fixed monopiles or jackets. Substations are designed to stabilize and maximize the voltage generated offshore, reduce potential issues such as electrical losses and safely transmit electricity to shore (NREL, 2024) (see Figure 3.1 above).

The basic components of a substation include grid transformers, switchgear and auxiliary power units, with storage areas for maintenance equipment (NREL, 2024). A basic substation design is meant to be unmanned and serviced on a regular schedule. More complex designs can include helicopter decks, boat landings and living accommodations (NREL, 2024; BOEM, 2015).

3.2 The Offshore Wind Development Cycle

The timeline of the overall development cycle has been discussed in section 1.6 and depicted in Figure 1.3. The typical activities undertaken within each development phase are described below.

3.2.1 Planning and Development Phase

The planning and development phase of an OSW project commences prior to any official licensing process and is well underway in NS, the Regional Assessment being a representative example. It involves government, regulators and developers, each of whom undertakes preliminary studies, desk top evaluations of data and in some cases physical data collection[20] to assist in identifying suitable development locations. Each participant has its own set of objectives and evaluation criteria, but in general terms developers and governments (supported by regulators) seek to identify a project location that is technically viable, profitable, and will result in positive net-benefit impacts for communities, the environment and the economy (Iberdrola, 2024).

[20] In Nova Scotia, a developer may seek approval to conduct site assessment work in advance of securing an exclusive license for a particular site. In these circumstances, the developer assumes the financial risk of being unsuccessful in the bidding process.

Prior to the issuance of a call for expressions of interest or bids for a specific development area, governments typically assess (BNOW, 2022):

- hypothetical energy output potential;
- site conditions such as water depth, waves, currents, and seabed characteristics/structure;
- location, capacity and condition of port infrastructure to support both the construction and operating and maintenance phases;
- location of suitable sites for grid interconnection and the cost of required upgrades;
- anticipated impacts on nearby coastal communities;
- abundance and frequency of the various marine wildlife species using the area;
- existence of other ocean users and the potential for successful integration of OSW facilities; and
- commercial viability in consideration of the above factors.

Assuming a suitable area is identified, and the regulator is directed to issue a call for bids, developers may compete to secure an exclusive licence to conduct further site assessment and undertake a process that may eventually result in an authorization to construct an OSW project. As discussed under section 2.6, the criteria for assessing bids have yet to be established for the NS licensing process. Bid criteria constitute an important topic that is linked to the socio-economic aspects of the Committee's TOR and is discussed separately in section 2.6.6.

Successful bidders will typically undertake detailed site assessment work, project engineering and design. The work is an inter-disciplinary and iterative process that proceeds in parallel with the regulatory process and the compiling of an environmental impact statement. Representative site assessment work includes (BNOW, 2022):

- meteorological and oceanography surveys (metocean) to evaluate wind, wave and currents;
- geophysical and geotechnical surveys to examine the seabed and subsurface;
- bathymetric surveys to map water depth and underwater features;
- biological surveys to collect data on the presence and abundance of fish, marine mammals, birds turtles, benthic habitat and avifauna;
- data analysis to detect archaeological and cultural resources and unexploded ordinance;
- fisheries surveys and data gathering related to other ocean users (commercial shipping and vessel traffic, civil commercial aviation and military);
- engagement and liaison with community and ocean user interests and;
- socio-economic impact studies including viewshed analysis.

The results of these studies and analyses input into the engineering and design process that includes (BNOW, 2022):

- turbine sizing and foundation selection;
- field design (turbine location and configuration, substation and cable design and placement);
- consideration of installation challenges, methods and equipment availability;

- procurement strategies involving an assessment of suitable port infrastructure, local supply chain capabilities and labour availability; and
- project economic modelling and financing.

The regulatory process that proceeds in parallel with the above-described activities has been discussed in section 1.3. An important component of the environmental impact assessment process requires developers to engage the public about the project details and address concerns that are raised. In addition, there are many permits and authorizations required from various government agencies before a developer is issued an authorization to construct a wind farm (as discussed above in section 1.3), and the CNSOER will play an important coordinating role throughout the entire process (section 5.2). The amended Accord Acts and Offshore Renewable Energy Regulations (see section 1.3 above) will provide greater detail on this process and the plans and procedures that must be submitted, reviewed and approved.

3.2.2 Construction and Installation Phase

The construction and installation (CI) of an OSW project requires a significant amount of planning and coordination. It requires the use of multiple port facilities, a wide variety of vessels (identified below in section 3.3.1.1), and adherence to health and safety standards and protocols (BNOW, 2022). Depending on the project location, the number of turbines and their foundation types and whether a substation is involved, construction may take place over two or more years. Weather is a significant limiting factor in establishing a construction timeframe: the annual weather window in the RA Study Area is reasonably anticipated to be April to October (BNOW, 2022).

To the extent possible, assembly and preparatory work occurs onshore to minimize the higher cost of working offshore and eliminate exposure to weather interruptions (BNOW, 2022). Subject to supply chain issues and timely availability of scarce installation equipment, the typical component installation process and sequence is set out below (BNOW, 2022):

- The offshore substation foundations are transported to the site via barge or other specialized vessel and installed using a heavy-lift vessel crane. Typically, a jacket foundation is used, but if piles are required, they are driven into the seabed using a hydraulic hammer. The substation usually comes preassembled and installed as a single unit, placed on the foundation by a heavy lift vessel and welded into place.
- Turbine foundations are installed using large offshore construction vessels with capabilities specific to the type of foundation. If a gravity base foundation is being used, the seabed will have to be prepared in advance to achieve a stable and level surface. Fixed foundations generally require some type of rock mattress deployed around the base of the foundation to protect against scour (current induced sediment transport). Except for jacket foundations, a transition piece between the foundation and the tower is set into place and bolted or grouted at the connection point.

- For fixed bottom foundations, the static array cables are deployed and placed with a cable laying vessel, often supplied by the manufacturer of the cable. In soft sediments, a cable channel of about one meter depth is created using a water jet deployed from a remotely operated vehicle (ROV). Once the cable is installed, the material suspended from the jetting process then settles to bury the cable. In harder sediments, a trench plow or mechanical cutting tool is used to establish a cable path, and the displaced material is backfilled once the cable is in place. A team of offshore workers pulls the cable into each foundation using winches where it is then connected to the turbine power generating mechanism in the nacelle. A similar operation takes place at the offshore substation where the array cables are pulled in and connected to cable termination joints. For deeper water installation of dynamic cables, the stern deployed approach from a cable laying vessel may not be suitable for a vertical installation, requiring vessels that typically deploy cables and anchor chains for the oil and gas industry (WFO, 2024).
- The export cable is installed in much the same way as the static array cables. Prior to trenching, the cable would be placed immediately adjacent to the cable route. If sufficient burial depth cannot be achieved through jetting or trenching, a rock mattress may be installed over the cable to bury and protect it. In extreme cases, horizontal drilling may be required to create a cable pathway. The export cable terminates at a purpose-built shore base facility. In the shallower waters approaching landfall, the cable laying vessels' draft requirements may result in smaller vessels and equipment completing the work. A modified cable laying sequence is required for working in shallower waters and to protect coastal environments. Where trenching is not possible at the landfall location, e.g., presence of bedrock at or near surface, sensitive habitat, or road or rail lines existing along the coastline, horizontal drilling may be required to create a cable pathway for a conduit and cable to be pulled through. The export cable terminates at a purpose-built shore base facility.
- Assembly of fixed turbine tower, nacelle and blade components usually occurs offshore at the turbine installation site, while floating turbine assembly occurs at a port facility and is towed to its offshore location and installed.

3.2.3 Operations and Maintenance Phase

Once all equipment has been installed, tested and commissioned, the wind farm enters its operations and maintenance (O&M) phase. Operations refer to the activities necessary to the production of power and management of the assets, including remote condition-monitoring, environmental monitoring, weather monitoring and forecasting, electricity sales and other administrative functions. Maintenance includes those activities required for the upkeep and repair of the assets (BNOW, 2022). A well-executed operations and maintenance plan[21] is crucial to optimize the performance and longevity of the wind farm, reduce downtime and maximize energy output. Most OSW farm components are covered by

[21] The O&M Plan will include regular inspection and replacement of equipment known to wear over time, the lubrication of gear boxes and generators, oil and filter changes, inspection of scour protection foundations and cables, assessing and repairing any wear and tear on blades, gearbox and safety equipment, and ensuring the

manufacturers' warranties which include requirements for how equipment is operated and maintained. The regulatory authorization to commence operations will also have operating conditions and mitigation requirements developed through the project environmental assessment and subsequent authorizations.

The typical project operating life span of an OSW farm is in the range of 20 to 25 years (with potential for extending this period) dependent on the environmental conditions and quality of the O&M program (BNOW, 2022).

3.2.4 Repowering and Decommissioning

When OSW farms reach the end of their operational lives, end-of-service initiatives are undertaken to either "repower" the facility and extend the operating phase, or "decommission" the facility by dismantling, removing and disposing of project infrastructure (Hall *et al*., 2020; Jadali *et al*., 2021; Spielmann *et al*., 2021; Topham and McMillan, 2017).

Repowering is not equivalent to periodic infrastructure replacement achieved through regular maintenance. It involves large-scale replacement of numerous project components at the same time (Berry *et al*., 2024). Repowering may allow operators to upgrade to newer, more efficient technologies without needing to replace infrastructure that has a longer life span (Topham and McMillan, 2017). For example, the electrical cables of an OSW farm have an estimated operational life of 40 years, longer than many turbine components. While repowering can extend the life of a farm, it is not an indefinite option. Eventually, the project will cease production and be decommissioned.

Decommissioning involves the disassembly and removal of all or almost all[22] project infrastructure (Berry *et al*., 2024). The disassembly process is generally the reverse of construction. Structural components are transported to a port or harbour, where they are broken down into smaller pieces for recycling or disposal (Spielmann *et al*., 2021; Topham and McMillan, 2017). Once the project equipment has been removed, the operator may be required to restore aspects of the marine environment damaged by the project and monitor the recovery of the area (Hall *et al*., 2022, Hernandez *et al*., 2021). Worldwide, only five OSW farms have been fully decommissioned; all were relatively small projects located in shallow waters (Spielmann *et al*., 2021). Larger scale wind farms will demand significant and costly decommissioning processes.

As part of the project approval process, operators will often be required to provide evidence of financial security guaranteeing their decommissioning commitments in both a form and amount determined by regulations (Jensen, 2020). This is common regulatory practice in the offshore oil and gas industry.

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accuracy and proper calibration of remote sensors. Monitoring and inspection of subsea infrastructure is conducted using ROVs.

[22] In cases where certain project components may serve a new purpose, such as providing valuable habitat for fish, or the removal would have significant negative impacts on the marine environment, they may be subject to unacceptable safety concerns and consideration may be given to partial decommissioning (Hall *et al*., 2022; Hernandez *et al*., 2021).

Concern over operators abandoning sites and failing to properly complete decommissioning activities have been raised by many Nova Scotians throughout the RA engagement process, in part as a response to the recent experience of the instream tidal industry in the Bay of Fundy (Jones, 2023). The solution entails requiring operators to provide adequate forms of financial security that can be readily accessed to clean up abandoned or improperly decommissioned sites. The current versions of the Accord Acts include requirements for the oil and gas industry to ensure facilities are appropriately decommissioned. This has been successful in NS as evidenced by the decommissioning of three production projects: Cohasset-Panuke in 2006, the Sable Offshore Energy Project in 2021 and Deep Panuke in 2021. Like the petroleum industry, the amendments to the Accord Acts included in Bill C-49 include financial requirements for the ORE industry that must be in-place for the duration of the work, including decommissioning and abandonment (see Bill C-49 clause 183.2).

3.3 The Offshore Wind Supply Chain

The OSW industry is a capital-intensive undertaking at a large scale, with the cost of installing 1 GW of power estimated in the range of $3 to $4 billion USD.[23] These numbers would price the ten-year global target of an additional 380 GW (GWEC, 2023) at well over a trillion USD. Based on this estimate, the cost of a 15 GW project, before grid connection, could be between $60-80 billion CAD. Based on this estimate by GWEC (2023), this amount suggests that the cost of production for a 1 GW OSW project may be decreasing with increasing scale. The industry is becoming an economic juggernaut that many consider to be a generational opportunity that can drive economic development while simultaneously enabling governments to achieve emissions targets and facilitate the energy transition away from GHG producing forms of making electricity.

The supply chain that underpins and facilitates OSW development at the multi-GW scale is complex and extensive. In response to the Biden administration's 2021 announcement of a target to install 30 GW of OSW by 2030, the US Department of Energy's National Renewable Energy Laboratory (NREL) completed two studies; the first provides a comprehensive description of the OSW industry supply chain and an understanding of what is required to accomplish the 30 GW objective (Shields *et al*., 2022), and the second assesses the US supply chain readiness and the level of investment and time required to develop the capacity to deliver a domestic capability of installing 4-6 GW annually by 2030 (Shields *et al*., 2023).

The NREL reports are highly instructive to understanding the economic opportunities and the supply chain challenges associated with the introduction of the new OSW industry. Of course, there are significant differences between a country wide target of 30 GW of installed capacity by 2030 vs a provincial 5 GW lease target by 2030, and the available port and manufacturing infrastructure and labour force demographics in the United States versus NS. That said, the steps required to analyze the overall task — including the readiness and availability of the required vessels, ports and manufacturing

[23] The recent Hornsea Two windfarm, currently the world's largest a 1.32 GW, is estimated to have cost $3.64 billion USD, which suggests the 1 GW cost benchmark may be coming down and likely related to the scale being achieved with the size of the project (Blackridge Research, 2024).

base and the supply of skilled labour — that enable a realistic estimate of the domestic supply chains' capacity to participate now, and with some level of investment, the future, is comparable. And in the absence of this information in the NS context, the Committee was challenged to address the question asked by many of those who have participated in this RA process, 'What is in this for Nova Scotians?' It is a fair question that deserves a considered answer.

It is beyond the Committee's remit, resources and timeline to undertake anything like the NREL analysis, and note has been taken of the pending Marine Renewables Canada Request for Proposals that is looking to characterize the Atlantic Canadian supply chain for the emerging OSW industry (MRC, 2024b). However, the Agreement and TOR include references requiring the Committee to provide information on "economic conditions" (Agreement, s.1.2(a)), the "…health, social and economic components and the systems that may be affected by future offshore wind development activities within the Study Area (Agreement, s.1.5) and "communities" and "economy" when "…identifying and considering potential positive and adverse effects…" (TOR, A1.6(m)).

In an attempt to provide at least a partial answer to the question of what the OSW industry might mean for NS, and by implication identify some of the important constraints impacting Nova Scotia's "economy", e.g., its ability to participate and generate economic benefits, the kind of investment that will be required to support the development of the OSW supply chain, and the major challenges presented to port communities and the availability of skilled labour, the Committee has worked with subject matter experts and undertaken a very high level socio-economic impact analysis the results of which are discussed in section 8.

3.3.1 Supply Chain Key Components

NREL compiled a hierarchical breakdown of all major fixed bottom and floating wind Tier 1 (top-layer, completed) components, before further breaking these down into the Tier 2 (second layer) sub-assemblies and Tier 3 (bottom layer) sub-components. The Tier 1 components list included:

- wind turbines;
- monopile foundations;
- monopile transition pieces;
- jacket foundations;
- gravity-based foundations;
- floating semisubmersible platform;
- mooring system;
- cables;
- offshore substations; and
- onshore electrical.

The detailed hierarchical mapping of the various sub-assemblies and sub-components involved in each of these Tier 1 components (see figures on p.54-72; Shields *et al*., 2023) paints a robust picture of the depth and inter-connectedness of the entire major components supply chain. To complete the overall

supply chain picture also requires an assessment of the enabling port and vessel infrastructure necessary to successfully complete and then operate OSW projects. In the NREL assessment, an $11 billion investment in marshaling ports, fabrication ports and large installation vessels in the US is estimated to be required by 2030 to support the manufacture, transport and installation of major OSW components (NREL, 2023). Ports and vessels feature under the 'Transportation and Installation' section of the recently released Nova Scotia OSW Supply Chain Categories found in Module 2 of the Nova Scotia OSW Roadmap as presented in Figure 3.5. Requirements for skills, materials and services are part of the supply chain offering opportunities for community, provincial and regional interests to participate in the development of OSW.

Figure 3.5. Offshore Wind Supply Chain Categories (Province of Nova Scotia, 2024)

Marine vessels and port infrastructure are two critically important supply chain categories that warrant special attention. Without timely access to special purpose installation vessels and ports that are in short supply worldwide, project costs escalate, and timelines slip. Without an ability to supply required port infrastructure when required, the domestic supply chain participation rate will be substantially compromised. The US analysis shows that half of the existing installations required to meet the 30GW target were at risk of not being installed because of limited port and vessel availability (Shields *et al.*, 2023).

3.3.1.1 Marine Vessels

Throughout all phases of an OSW farm lifecycle, marine vessels are required. During the planning and development phase, geological and environmental surveys are conducted to gather data to support the design and environmental impact assessment. The construction phase requires the use of a wide variety of specialized vessels, many of which are currently in short supply and presenting significant bottlenecks to project development worldwide. Similar categories of vessels are required during the O&M phase, just fewer of them (ACPA, 2021). Although few OSW farms have been decommissioned to date, the decommissioning of any modern-day OSW farm would require a similar type and number of vessels as used during the construction phase. Table 3.4 outlines the types of vessels required by the OSW industry by development phase. It is an important consideration in the planning for any successful launch of Nova Scotia's OSW industry.

Table 3.4. Common Offshore Wind Vessels and Equipment by Development Phase

Vessel/Equipment	Project Phase		Purpose
	PC/CI/RD	O&M	
Wind Turbine Installation Vessel	X		A purpose-built vessel for the installation of OSW turbines. Self-elevating unit with moveable legs capable of lifting the hull above the sea (for fixed installations). Equipped with a large crane for installing components.
Heavy Lift Vessels (HLV)	X		Used to lift, hold, and position large wind turbine components and the substation platform during installation. Can also be used for foundation installation.
Platform supply vessel (PSV)	X	X	Used to transport construction materials and equipment.
Accommodation vessel	X		Used to accommodate personnel at sea during construction and decommissioning. Also referred to as a floating hotel.
Anchor Handling Tug Supply Vessels	X	X	Primarily for towing and escorting of other ships such as barges. Can also be used for

Vessel/Equipment	Project Phase		Purpose
	PC/CI/RD	O&M	
			trenching, salvage, anchor handling, and firefighting.
Barges	X	X	Used for transporting and storing large components and often used in tandem with tugs.
Cable Installation Vessels (CIV)	X		Commonly purpose-built vessels for laying and burying subsea cables, i.e., array and export cables, into the seafloor.
Crew Transfer Vessels (CTV) and Helicopters	X	X	Transports crew and marine mammal/bird observers to and from the site.
Remote Operated Vehicle	X	X	An autonomous, underwater vehicle, equipped with cameras, used in all phases for various applications such as inspections and small repair tasks. Similar vehicles may be involved in environmental studies and monitoring.
Dredger Vessels	X		Used to prepare the seabed for cable laying.
Construction Vessel	X	X	A multi-functional vessel often used for O&M activities.
Ocean-Going Heavy Transport Vessels	X		Ocean-going vessels that may transport components, e.g., monopiles, from their place of manufacture to the site or an interim storage facility.
Pile-driving Hammer Engines	X		Drives the wind turbine generator's foundation into the ocean floor.
Scour Protection Vessels	X	X	Place a layer of stone on the seafloor around the foundations of the wind turbine generator and substation platform to stop sediment from being removed. Also used to cover parts of offshore cable.
Service Operation Vessels	X	X	Transports crew to the site and provides offshore living accommodation and workspace.
Survey Vessels	X	X	Performs geotechnical or geophysical surveys.
Tugboats	X	X	Transports equipment and barges to sites.
Sources: Corio, 2022; NYSERDA, 2017; US EPA, n.d.			

Vessel/Equipment	Project Phase		Purpose
	PC/CI/RD	O&M	
Notes: PC=Pre-construction phase, CI=Construction and installation phase, O&M=Operations and maintenance phase, and RD=Repowering and decommissioning phase. For images of these vessels, see Shields *et al*., 2023.			

3.3.1.2 Port Infrastructure

The global shift to renewable energy is creating opportunities and challenges for ports around the world. Nova Scotians have witnessed this firsthand over the last 12-18 months with ports in Halifax, Sydney and Sheet Harbour providing logistical support to OSW projects located in the northeast US. As with access to specialized vessels, the successful development of an OSW industry is also heavily dependent on the type of port infrastructure required to support the various phases of an OSW project's lifespan. Ports are where wind turbine components, foundations and other equipment get fabricated, transported, stored and/or assembled. O&M activities are frequently planned and executed from a port, which acts as a coordinating and integrating hub. Finally, components removed during the decommissioning process are taken to ports for further breakdown and disposal.

There are some common attributes to the port facilities needed to accommodate OSW development projects (BNOW, 2022). These include:

- proximity to project sites;
- sufficient marginal wharf to moor large vessels;
- sufficient water depth to accommodate large, heavily laden vessels carrying OSW components;
- adequate quayside space and heavy lift pads with sufficient load bearing capacity;
- sufficient space for manufacturing, storage, assembly and load out operations;
- crane capacity to transport and lift components;
- launch and wet storage facilities;
- an available and trained workforce to support increased port usage; and
- connectivity to other modes of transportation, e.g., railway and major highways.

In addition to their direct impact on the success of OSW development and operation, ports also act as economic engines for their communities and regions. As NS explores OSW opportunities, it will be important to understand the role its ports must play and what is needed to ensure they meet industry demands while at the same time continuing to adequately service existing users and other industries. In the context of capturing the economic benefits typically associated with OSW development, the availability of adequate port infrastructure cannot be overstated. This topic is explored further in sections 4.3 and 8.

4.0 Existing Conditions

This RA focuses on an offshore area adjacent to NS that includes a large region commonly known as the Scotian Shelf and including Sydney Bight, a portion of the southern Gulf of St. Lawrence between NS and Prince Edward Island and the Northumberland Strait. The RA Study Area encompasses areas from <100 to 4,300 m water depth and includes regions previously assessed for seabed features by WWF Canada (2009), Greenlaw *et al.* (2012), Eamer *et al.* (2020, 2021, 2022) and DFO (2023a). The main seabed features are shelf, slope and canyon/basin areas. The area is also a transition zone between subpolar waters from an extension of the Labrador Current and the variable waters of the Gulf Stream (King *et al.*, 2016; Bernier *et al.,* 2018). The Outer Scotian Shelf region in northern portions of the RA Study Area includes large banks covered in sand and gravel with lesser patches of shell beds and boulders. Sand ridges, waves and ripples formed by storms and currents occur in this area, with sand ridges recorded as high as 18 m (WWF Canada, 2009; Eamer *et al.,* 2021).

Following the initial engagement process, it was decided that, because of extensive other activities in the area, offshore wind development should not at this time be initiated in the eastern Northumberland Strait and the southern portion of the Gulf of St. Lawrence (see sections 2.1.3 and 2.4). This section of the report, therefore, deals only with the existing conditions in the RA Study Area that apply to the Scotian Shelf and Sydney Bight areas.

4.1 Ecosystem Overview

The Scotian Shelf (the Shelf) is a complex, diverse and biologically productive area that has extensive interrelationships both with the adjacent land, and, through the influence of major ocean currents, with much of the North Atlantic Ocean, the Labrador Sea and the Gulf of St. Lawrence. It is considered a distinctive Ecosystem Production Unit (EPU) based on a “reasonably well-defined food production system” (Pepin *et al.*, 2014; Kenchington *et al.*, 2016) and supports important fisheries and species and habitats of high conservation value. While in origin it is part of the North American Coastal Shelf, it is partially separated at the southern end by the deep Northwest Channel, and at the northern end by the Laurentian Channel (Figure 4.1).

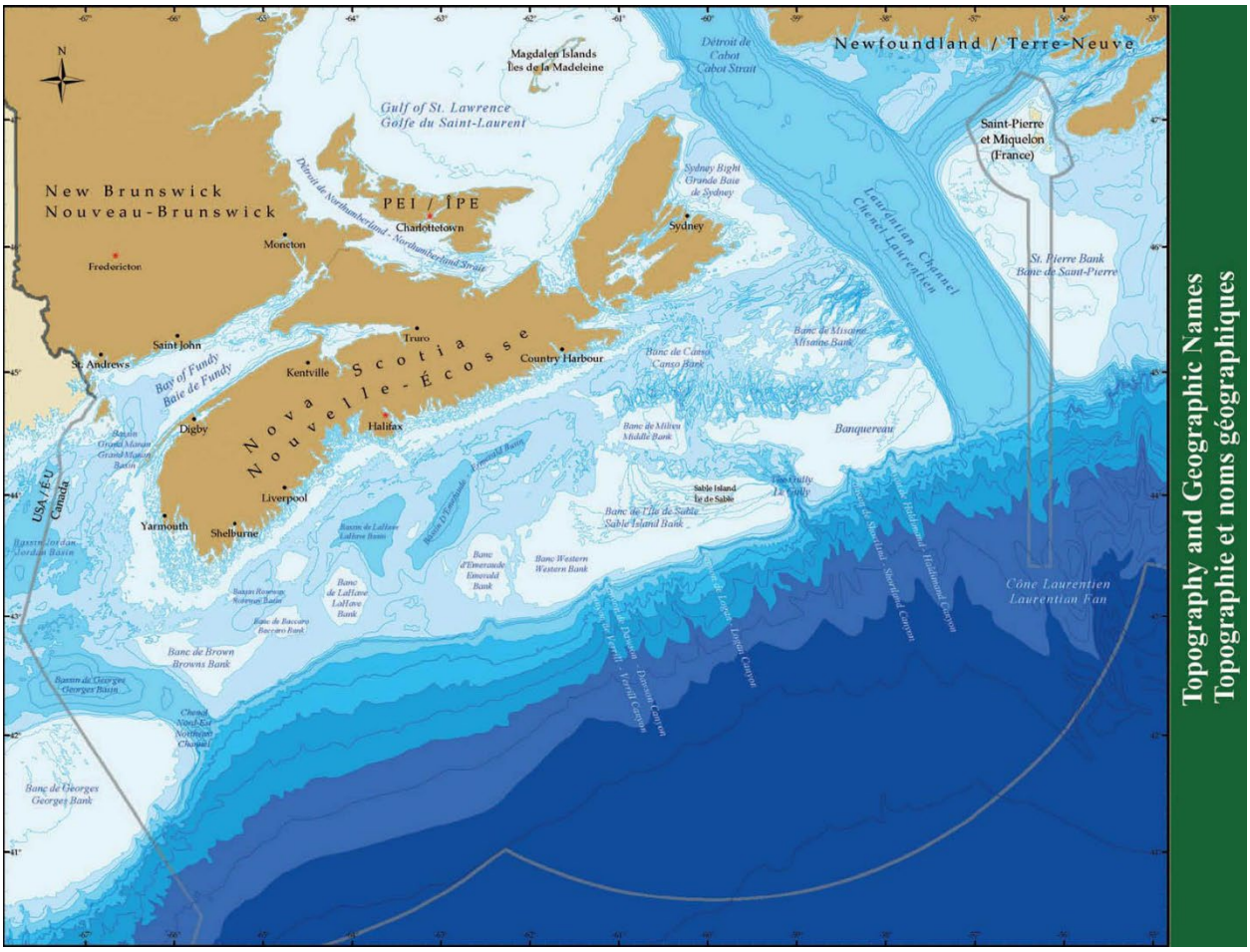


Figure 4.1. Geographic Extent of the Scotian Shelf (Breeze *et al*., 2005)

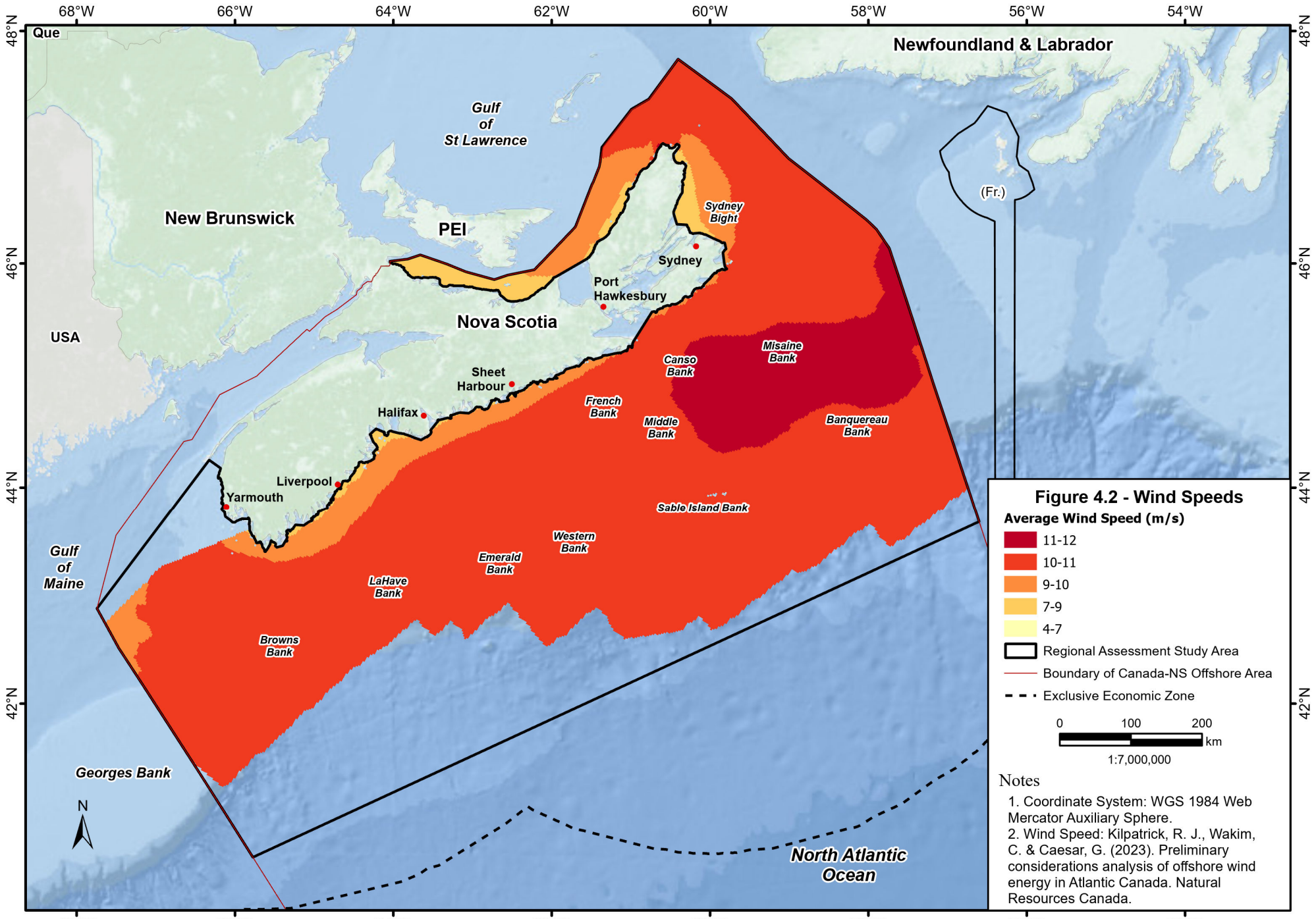
The ecological system is fairly typical of coastal waters at this latitude, with food webs that reflect the prevailing conditions of water depths, mixing patterns, salinity, substrate characteristics and nutrient and light availability. Like other coastal areas with significant human activities, e.g., fishing, transportation, pollution etc., this ecological system is subject to change, and with the effects of global warming becoming more obvious, the development of a new industry such as OSW needs to be considered in that context.

Due to the large size and ecological complexity of the Scotian Shelf, there are many uncertainties and research gaps that make predictions of the environmental effects of OSW in this area difficult. Nonetheless, with increasing access to a great variety of remote sensing techniques, underwater drones, and tagging programs, knowledge of the changes in the physical and chemical environment, of the presence, movements and interactions of organisms, and of the productivity of the ecosystem is increasing. The remaining uncertainties can and should be resolved using these techniques in a coordinated program of research as OSW farms receive regulatory approvals and are assembled (see section 10).

4.2 Physical Characteristics of the Scotian Shelf

4.2.1 Wind Conditions

It is recognized that the Scotian Shelf experiences strong and persistent winds that are among the best in the world for OSW power generation. Average velocities of 9 – 12 m/sec calculated at 100 m above sea level (He *et al.*, 2016) occur over much of the region, with the highest values occurring further to the east (Aegir, 2023; NRCan, 2023). These winds are stronger, more consistent and usually less turbulent than winds onshore and have attracted attention from prospective offshore wind developers. Since the energy production potential is exponentially related to the wind speed, captured energy would be considerably greater in locations on the Shelf further offshore to the east where the velocities are higher (see section 3.1 and Figure 4.2).

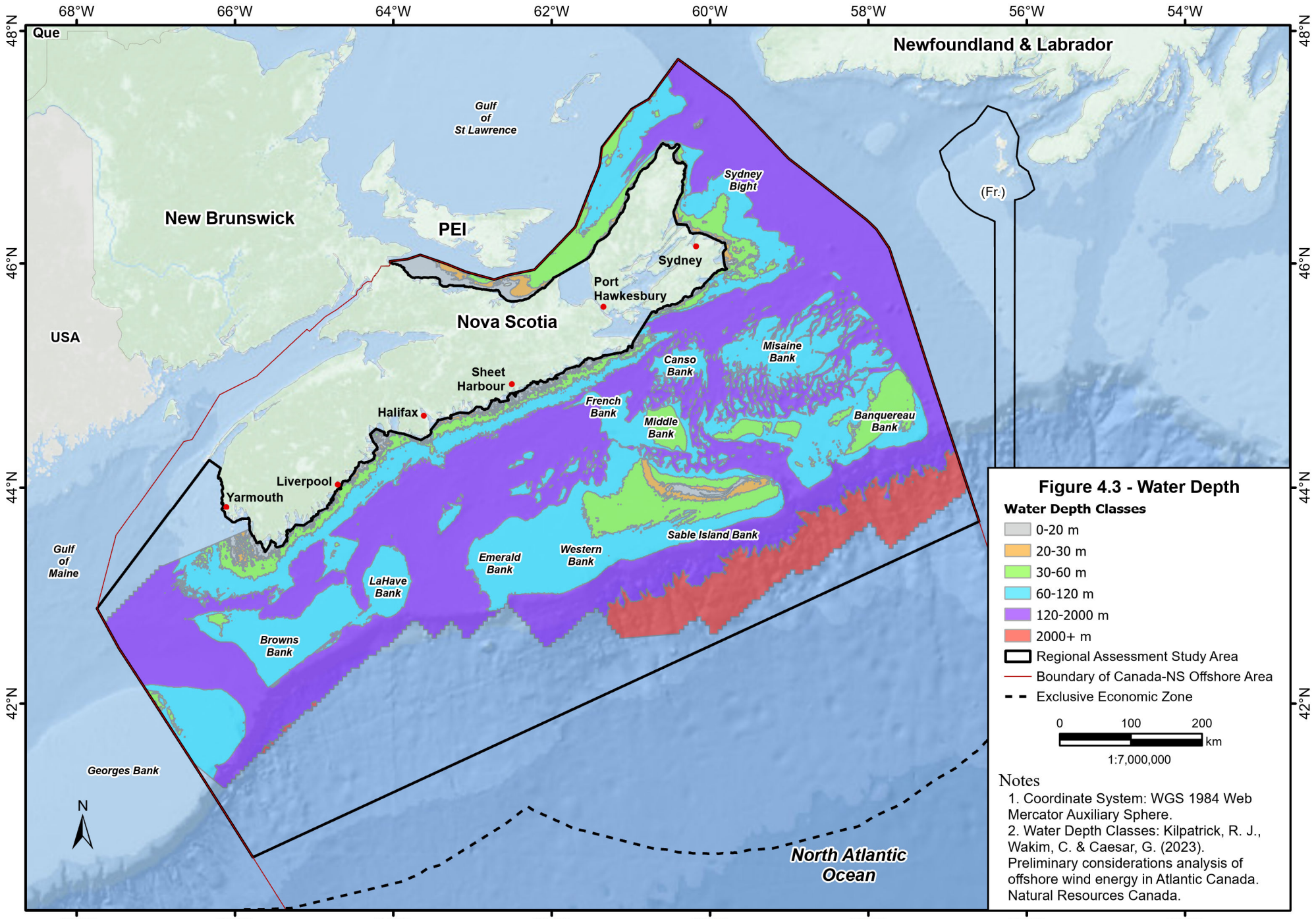

68°W
66°W
64°W
62°W
60°W
58°W
56°W
54°W
48°N
46°N
44°N
42°N
Que
Newfoundland & Labrador
Gulf of St Lawrence
New Brunswick
PEI
Sydney Bight
Sydney
Port Hawkesbury
Nova Scotia
USA
Misaine Bank
Canso Bank
Sheet Harbour
French Bank
Halifax
Middle Bank
Banquereau Bank
Liverpool
Yarmouth
Sable Island Bank
Western Bank
Emerald Bank
Gulf of Maine
LaHave Bank
Browns Bank
Georges Bank
North Atlantic Ocean
(Fr.)
N
Figure 4.2 - Wind Speeds
Average Wind Speed (m/s)
11-12
10-11
9-10
7-9
4-7
Regional Assessment Study Area
Boundary of Canada-NS Offshore Area
Exclusive Economic Zone
0
100
200
km
1:7,000,000
Notes
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere.
2. Wind Speed: Kilpatrick, R. J., Wakim, C. & Caesar, G. (2023). Preliminary considerations analysis of offshore wind energy in Atlantic Canada. Natural Resources Canada.

The Shelf, however, is also subject to storms and extreme weather during which wind velocities and significant wave height increase dramatically (Guo and Sheng, 2015; Wang and Sheng, 2020). This presents a challenge for turbine design. In addition, with climate change, it appears that the frequency of extreme weather events is increasing.

4.2.2 Water Depth

Water depths on the Scotian Shelf vary from 0 m on Sable Island to about 300 m in some basins and troughs (Figure 4.3) (Boyd *et al*., 1988; Loder *et al*., 1997; Breeze and Horsman, 2005). The part of the continental shelf known as the Scotian Shelf varies in width from 125 km in the east to 230 km in the west and covers some 120,000 km², with an average depth of 90 m. The shelf is bordered by deep waters: the Laurentian Channel to the east is over 400 m deep, while the continental slope to the south rapidly attains depths of over 3,000 m. A series of shallow banks, 25 m to 100 m below the surface, culminate at Sable Island. These banks are separated by basins and troughs ranging from 160 m to 300 m in depth. A submarine canyon, the Gully, over 1,000 m in depth, forms a deep notch at the edge of the continental shelf.

Numerous channels exist between the banks. The sides of the channels also vary from relatively shallow to steep (Loder *et al.*, 1997), which affects the nature of the substrate, the composition of the benthic organisms and hence the type of fishing, if any, that can be carried out there.


68°W
66°W
64°W
62°W
60°W
58°W
56°W
54°W
48°N
46°N
44°N
42°N
Que
Newfoundland & Labrador
Gulf of St Lawrence
Sydney Bight
(Fr.)
New Brunswick
PEI
Sydney
Port Hawkesbury
Nova Scotia
USA
Misaine Bank
Canso Bank
Sheet Harbour
French Bank
Halifax
Middle Bank
Banquereau Bank
Liverpool
Yarmouth
Gulf of Maine
Sable Island Bank
Western Bank
Emerald Bank
LaHave Bank
Browns Bank
Georges Bank
N
North Atlantic Ocean
Figure 4.3 - Water Depth
Water Depth Classes
0-20 m
20-30 m
30-60 m
60-120 m
120-2000 m
2000+ m
Regional Assessment Study Area
Boundary of Canada-NS Offshore Area
Exclusive Economic Zone
0
100
200
km
1:7,000,000
Notes
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere.
2. Water Depth Classes: Kilpatrick, R. J., Wakim, C. & Caesar, G. (2023). Preliminary considerations analysis of offshore wind energy in Atlantic Canada. Natural Resources Canada.

Approximately 2.4% (7,187 km^2) of the 300,000 km^2 RA Study Area is less than the 60 m depth currently considered suitable for fixed bottom structures. In the Interim Report the Committee assumed that advances in technology over the expected development timeline for 5 GW of leases would potentially push that number to 70 m, and any depths greater than 70 m would be feasible for floating structures. Water depth at any location, combined with the slope and substrate characteristics, is an important factor in determining not only the most applicable foundation type, but also the species present, the food web characteristics and the nature of fisheries conducted.

4.2.3 Marine Geology

The RA Study Area encompasses most of the Scotian Shelf and Slope. The shelf is relatively shallow with many areas < 100 m water depths. The shelf edge, where the seafloor begins to fall away steeply, lies at about 200 m depth (DFO, 2014). The Shelf was formed over successive episodes of glaciations during the Quaternary period when the advance and retreat of ice resulted in widespread erosion, deposition of till and creation of the bedforms now found across the shelf. The substrate types, resulting from successive periods of glaciation, are important determinants of the dominant species and food webs found in the different areas of the Shelf.

The surficial geology (Figure 4.4) consists of several types: exposed bedrock (particularly close inshore); glacial till; isolated patches of postglacial sand and gravel (in Sydney Bight and the Sable and Emerald Banks); and postglacial mud and glaciomarine mud in the deeper basins (MacLean *et al.*, 2013; Eamer *et al.*, 2020). At the edge of the ice flow, near the shelf break, large banks were formed as successive sandy and less consolidated tills were layered with glaciomarine, glaciofluvial and coastal sediments forming the deep banks that we have today (King, 2001).

The basement rock of the Scotian Shelf consists of lower Paleozoic metasediments (part of the Meguma Group) with intrusions of Devonian granites (King and MacLean, 1976; Bell and Howie, 1990) which extend seaward toward outcrops of Jurassic, Cretaceous, Late Cretaceous and Tertiary formations (King and MacLean, 1976) with Precambrian and Cambrian sediments, metasediments and volcanics to the north (MacLean and King, 1971).

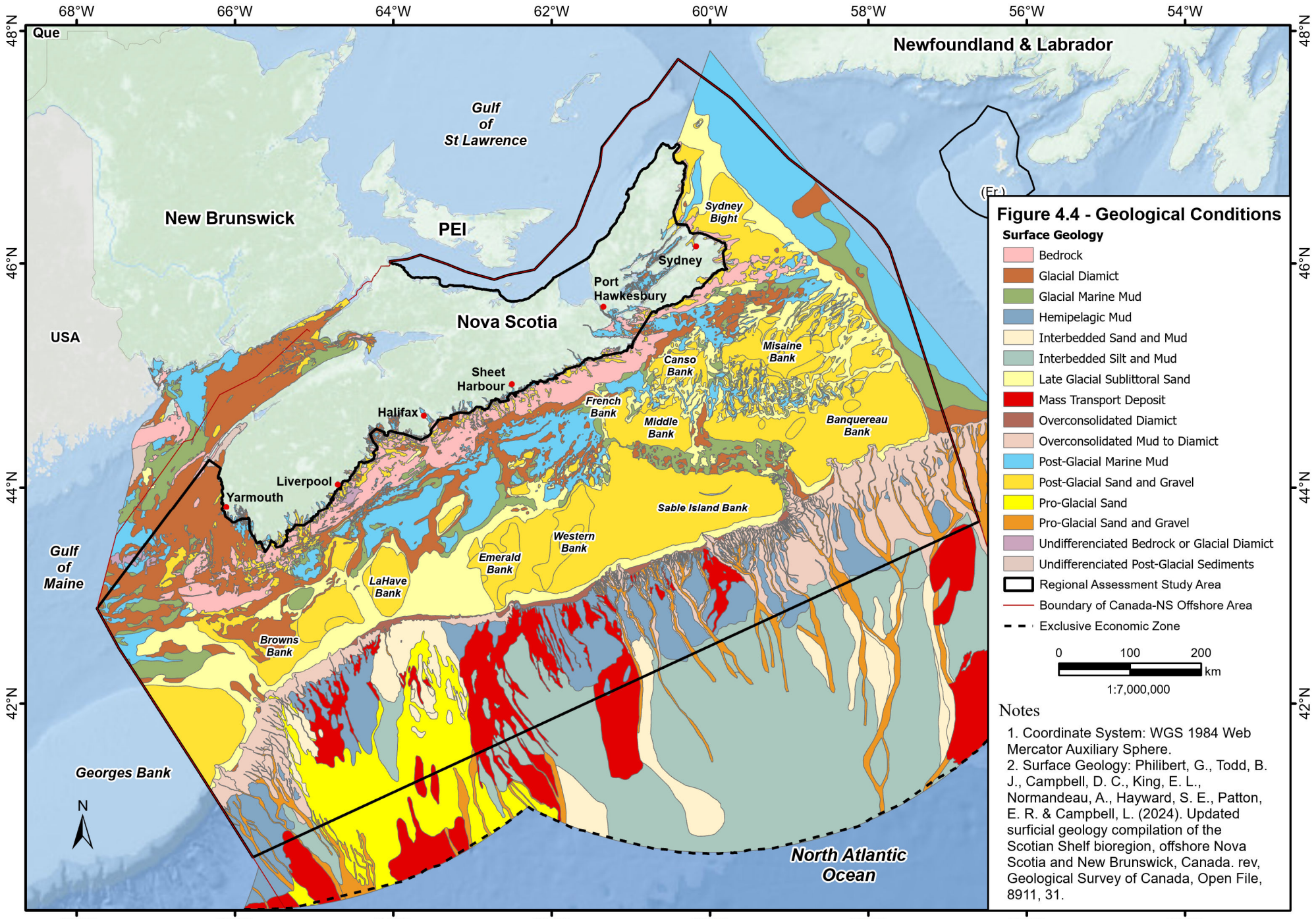
The Scotian Shelf can be divided into the inner, middle and outer shelf regions. The inner portion of the shelf extends from the coast out to approximately 25 km offshore and is an extension of coastal bedrock (Zwanenberg *et al.,* 2006). The bedrock is predominantly granite, with competent schist, shale or quartzite (Philibert *et al.*, 2024). The surface is highly irregular ranging from several mounds of glacial material to underlying bedrock (MacLean and King 1971; King, 2001). The middle shelf is an area of complex topography containing many small-sized banks and basins of various depths with extensive deposits of silt and glacial till that vary in thickness from a few metres to upwards of 50 m. Slumped deposits resulting from periodic mass sediment failures along the shelf slope (Mosher *et al.*, 2004) and occasional extensive shell beds are also found in this portion of the shelf. The outer shelf is a series of relatively flat shallow banks including Sable Island which is the only emergent portion of Sable Island bank. At one time, the entire bank had been exposed during past glacial retreats (Shaw *et al.*, 2002). The

post-glacial sands form large sand ridges which cover most of the bank and occur in water depths less than 40 m to 80 m (Li *et al.*, 2012). From these processes, the morphology and migration of these sand ridges are influenced by storms that pass through the area from storm-driven currents, waves, and other processes. The sand ridges of Sable Island Bank are oriented NE-SW and migrate eastward (Li and King, 2007). Ridge size decreases from west to east due to changes in water depth, grain size and decreased dynamic conditions (Li and King, 2007). Sable Island itself is morphologically similar to a barrier island and is comprised of reworked sand and gravel with its boundaries and topography ever changing due to local currents, storms and sediment deposition (Byrne *et al.*, 2014).

The slope steeply declines away from the shelf and is dissected by many transverse submarine canyons, the largest of which is The Gully. The surficial geology of the slope is a gradient consisting of mainly mud, sand, till (at the shelf edge) and bedrock outcrops (Piper and Campbell, 2002). The seafloor is mainly mud in water depths > 600 m (Hill and Bowen, 1983) and winnowed sands over topographic highs (Piper, 2001). The upper slope is underlain by seaward progressing tongues of till, iceberg pits and scours (Piper *et al.*, 2002, Piper and Campbell, 2002). The continental slope consists of muds that show evidence of benthic life, e.g., bioturbation, shells (Piper and Campbell, 2002). Numerous circular salt diapirs occur along the slope (Wade and MacLean, 1990) and pockmarks are widespread on the eastern Canadian margin and the Scotian Slope (Fader, 1991).

Substrate is an important factor in OSW development. In the relatively shallow waters of less than 60 m, much of this area is likely suitable for fixed foundation designs, provided there are no large quantities of glauconite which tend to liquify under stress (Westgate *et al.*, 2022; Bruggerman *et al.*, 2023). Geotechnical characterization of the seafloor and subsurface sediment is required to determine the site suitability for infrastructure installation, including foundations and cables. The foundation characteristics are different for each piece of infrastructure installed, as well. For example, a cable is more affected by the upper soil mobility because the cable needs to be protected, i.e., buried or covered, to avoid contact and potential breakage. In comparison, monopile OSW foundations will be more dependent on the shear strength and bearing capacity (compressibility and friction angle) of the soil the foundation is to be emplaced in. Additional studies and research are required to fill many of these data gaps.

It is noted that the geology description is limited to the Scotian Shelf Bioregion which has been the focus of many studies over the last few decades. There is much less information publicly available for the west side of Cape Breton and north part of the province, i.e., the Northumberland Strait. In the interest of time and given that the Committee has not recommended any sites for OSW development in these areas (see section 6), additional research has not been conducted.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Gulf of St Lawrence
New Brunswick
PEI
Nova Scotia
USA
Sydney Bight
Sydney
Port Hawkesbury
Misaine Bank
Canso Bank
Sheet Harbour
Halifax
French Bank
Middle Bank
Banquereau Bank
Liverpool
Yarmouth
Sable Island Bank
Western Bank
Emerald Bank
LaHave Bank
Browns Bank
Gulf of Maine
Georges Bank
North Atlantic Ocean
N
Figure 4.4 - Geological Conditions
Surface Geology
Bedrock
Glacial Diamict
Glacial Marine Mud
Hemipelagic Mud
Interbedded Sand and Mud
Interbedded Silt and Mud
Late Glacial Sublittoral Sand
Mass Transport Deposit
Overconsolidated Diamict
Overconsolidated Mud to Diamict
Post-Glacial Marine Mud
Post-Glacial Sand and Gravel
Pro-Glacial Sand
Pro-Glacial Sand and Gravel
Undifferenciated Bedrock or Glacial Diamict
Undifferenciated Post-Glacial Sediments
Regional Assessment Study Area
Boundary of Canada-NS Offshore Area
Exclusive Economic Zone
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km
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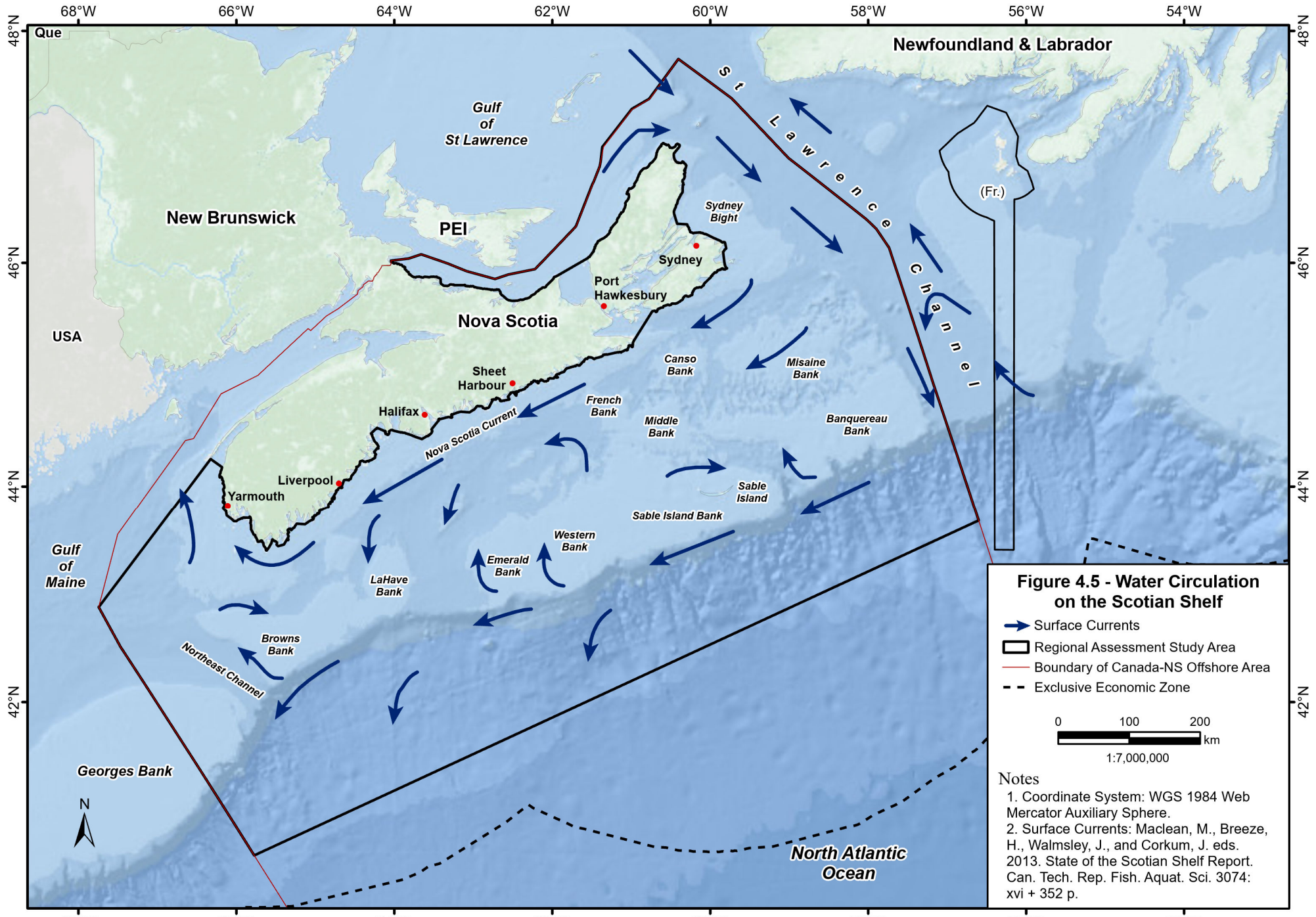
Notes
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere.
2. Surface Geology: Philibert, G., Todd, B. J., Campbell, D. C., King, E. L., Normandeau, A., Hayward, S. E., Patton, E. R. & Campbell, L. (2024). Updated surficial geology compilation of the Scotian Shelf bioregion, offshore Nova Scotia and New Brunswick, Canada. rev, Geological Survey of Canada, Open File, 8911, 31.

4.2.4 Circulation

Water circulation over the Scotian Shelf is determined by outflows from the Gulf of St. Lawrence and the Labrador Sea, the pattern of banks and channels on the Shelf, the depths and the wind. It is also strongly affected by the North Atlantic Oscillation (NAO) which influences the wind direction, precipitation and surface water mixing (MacLean *et al.*, 2013). In addition, variations in the strength and direction of the Gulf Stream affect both the pattern of circulation and mixing of the surface waters over the Shelf, as well as periodic introduction of potentially invasive southern organisms (MacLean *et al.*, 2013).

There is a general northeast-to-southwest flow from the Strait of Belle Isle, through the Cabot Strait and along the Scotian Shelf to the Gulf of Maine (Hebert *et al.*, 2021, 2023). The outflow of less saline water from the Gulf of St Lawrence divides: part remains close to the Nova Scotian coast as the Nova Scotia Current, whereas another portion follows the shelf break and flows into the Gulf of Maine through the Northeast Channel. Across the Scotian Shelf itself, the circulation follows the major channels (Figure 4.5).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44°N
42°N
Que
Newfoundland & Labrador
Gulf of St Lawrence
St Lawrence Channel
(Fr.)
New Brunswick
PEI
Sydney Bight
Sydney
Port Hawkesbury
Nova Scotia
USA
Canso Bank
Misaine Bank
Sheet Harbour
Halifax
French Bank
Middle Bank
Banquereau Bank
Nova Scotia Current
Liverpool
Yarmouth
Sable Island
Sable Island Bank
Western Bank
Emerald Bank
Gulf of Maine
LaHave Bank
Browns Bank
Northeast Channel
Georges Bank
North Atlantic Ocean
N
Figure 4.5 - Water Circulation on the Scotian Shelf
Surface Currents
Regional Assessment Study Area
Boundary of Canada-NS Offshore Area
Exclusive Economic Zone
0
100
200
km
1:7,000,000
Notes
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere.
2. Surface Currents: Maclean, M., Breeze, H., Walmsley, J., and Corkum, J. eds. 2013. State of the Scotian Shelf Report. Can. Tech. Rep. Fish. Aquat. Sci. 3074: xvi + 352 p.

This circulation pattern has several important aspects (Loder *et al.*, 1991; Hannah *et al.*, 2001; Rutherford *et al.*, 2021; Greenan *et al.*, 2004):

- it is seasonally variable;
- it affects the vertical distribution of nutrients and planktonic organisms (including fish larvae);
- it influences the tendency for the water column to separate into layers of differing density, i.e., to stratify; and
- it determines whether the region is going to absorb CO_2 from the air or release it back into the air.

There is little reason to suppose that this circulation pattern will be greatly influenced by the development of OSW on the Scotian Shelf, except in relation to the local vertical mixing of surface waters. However, the driving forces listed above are themselves being influenced by climate change, particularly with respect to the increasing outflow of lower salinity waters from the melting of the Greenland icecap (Moon *et al.*, 2023), and fluctuations in the NAO, both of which directly affect turbulence levels in surface waters (Hebert *et al.*, 2021).

4.2.5 Temperature, Salinity and Surface Water Mixing

Temperature is a major determinant of ecosystem processes and productivity and directly affects the distribution patterns of many of the species occurring on or near the Shelf. Monitoring of water temperatures on the Scotian Shelf has been conducted for more than one hundred years, but with increasing frequency and detail since the 1980s (Loder *et al.*, 1997). The temperature regime of Scotian Shelf waters reflects the interaction of several influences, both oceanographic and atmospheric: global atmospheric temperatures, the strength and direction of the Gulf Stream, inflow of Labrador Sea water, the NAO and vertical mixing of surface waters on the Shelf itself. Temperature variations from year to year are among the most variable in the whole of the North Atlantic Ocean and vary widely across the Shelf (DFO, 2003).

The seasonal temperature range of the waters over the Scotian Shelf decreases with depth (DFO, 2003). Surface waters vary from 16°C during the summer months to < 2°C in winter, whereas waters deeper than 150 m vary little seasonally, staying around 8°C. In some places, e.g., Emerald Basin, there may be a transient intermediary layer of colder water during the winter, with a warmer, more saline layer beneath it, and a less dense, warmer layer above (DFO, 2003). In general, surface water temperature tends to decrease from the shoreline across the Shelf toward the northeast, because of the influence of cooler water from the Gulf of St. Lawrence and the Labrador coast, thus dividing the Scotian Shelf into a warmer western half and a cooler northeastern portion (Shackell, 2011).

Evidence for what appears to be persistent warming of the water in response to climate change comes not only from direct measurements (Rutherford *et al.*, 2021; Mills and Sheehan, 2023), but also from the observations of fishers who are finding that the centres of distribution of several important species, e.g., lobster, snow crab and halibut, appear to be shifting to the northeast, requiring fishers to travel further to harvest them. Periodic fluctuations in water temperature on the Shelf have, in the past, been linked

primarily to the NAO, and deep-water temperatures on the Shelf have increased steadily over the last decade (Hebert *et al.*, 2023; Mills *et al.*, 2023). There is a recent suggestion, however, that this trend may be slowing or ending (Withers, 2024). The cause is at present uncertain. It may either be because the melting of glaciers in Greenland is increasing the inflow of cooler waters to the Labrador Current, which deflects Gulf Stream waters and changes local mixing patterns; alternatively, it may be related to a new Atlantic Niña that may be developing in the west central Atlantic (Tuchen, 2024).

The salinity of the water over the Shelf is generally lower than either the Gulf Stream to the south or the Labrador Current in the north (Breeze *et al.*, 2002; MacLean *et al.*, 2013*)*. However, these conditions may be expected to change if more lower salinity water derived from glacial runoff in Greenland is introduced into the Labrador Current. Salinity and temperature together determine the density of the water, and therefore the occurrence and persistence of stratification in the deeper waters of the Shelf (Figure 4.6) (DFO, 2018a).

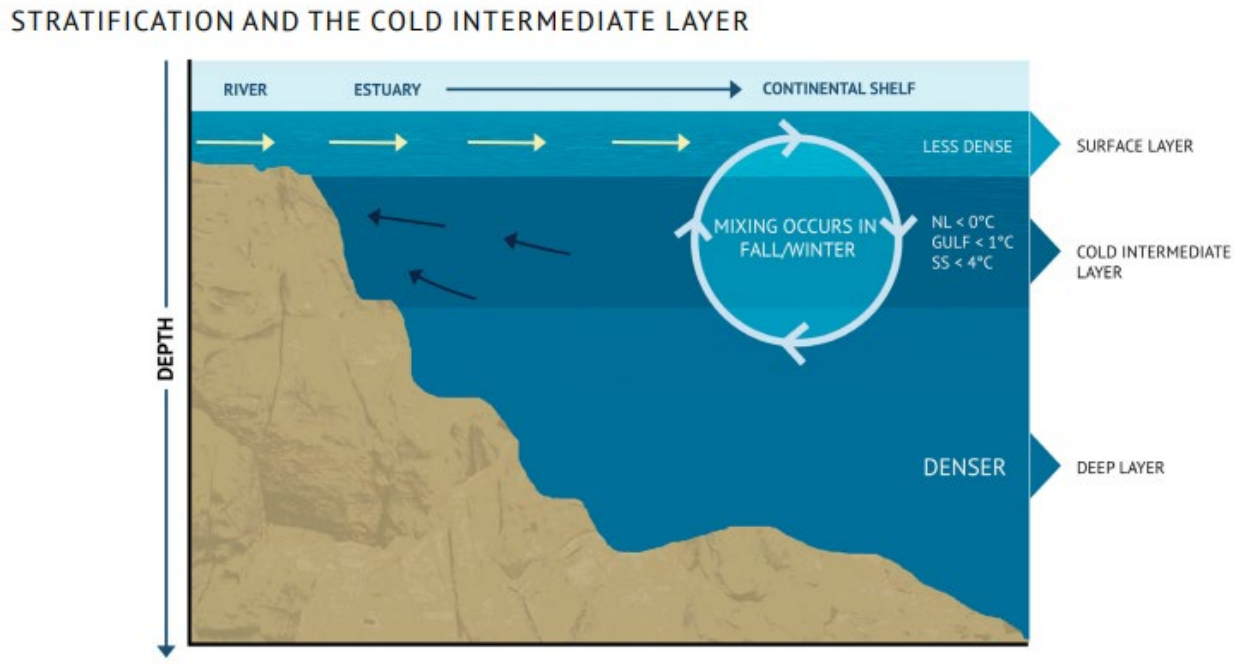


Figure 4.6. Stratification and the Cold Intermediate Layer (Bernier *et al*., 2018)

4.2.6 Wave Conditions

The Scotian Shelf is subject to strong winds, and therefore, the Shelf, being shallow in places, experiences significant waves that can have major effects on the stability of deposited sediments (Amos *et al.*, 1996, 1999; Li *et al.*, 1997). Mean wave heights vary from 1.5 m in July to 3.4 m during winter months (DFO, 2023a). Piper (1991) estimated 10-year significant wave heights to be 10 – 12 m on much of the Shelf, but this has been recently revised to >15 m (DFO, 2023a). Guo and Sheng (2015) suggest that 50-year extreme waves might be considerably greater than 15 m. The increasing intensity of storms associated with climate change will represent a significant challenge to OSW development. Wave-generated turbulence is also an important factor in determining the distribution and stability of bottom

sediments, the strength and stability of stratification in the water column, and therefore is an important influence on both the productivity of the water column and the scour protection necessary to support fixed wind turbine foundations.

4.2.7 Changes

Like most shallow coastal waters, the Scotian Shelf is subject to change over time. Indeed, it has been changing since the end of the last glaciation, when the land rose as ice disappeared; much of the present RA Study Area was probably occupied land between 12 and 5 thousand years ago (Atlantic Geoscience Society, 2001). Following a prolonged period of rebound, the land began to sink again and from 2000 BCE to the present time, sea level in the area has continued to rise relative to the land level on the Shelf itself (Grant, 1970; Roland, 1982; King and Fader, 1986; Shaw *et al.*, 2002; Hundert and Piper, 2008). This process is ongoing, but is being modified by global climate change, particularly rising temperatures and glacial melting, which suggest that the rate of sea level rise is accelerating.

The position of the Scotian Shelf, between currents derived from Arctic and subarctic regions, the Gulf of St. Lawrence to the north and the warmer waters of the Gulf Stream to the south, makes it difficult to predict local environmental conditions in this ecosystem over the decades when OSW may be developing. For example, Scotian Shelf warming and changes in Gulf Stream dynamics have influenced plankton abundance, biomass and community composition on the Scotian Shelf through the 2010s and early 2020s (Casault *et al.*, 2023). Additional analysis is required to characterize the mechanisms driving the changes, their relationships to higher trophic levels and therefore the future state of the Scotian Shelf plankton (Robicheau *et al.*, 2022).

4.3 Ecological Characteristics and Structure

As noted already, the Scotian Shelf is subject to strong winds and significant waves that affect the stability of deposited sediments (Amos *et al.*, 1996, 1999; Li *et al.*, 1997). Except near shore and near coastal islands, where firm substrates allow macrophytes to grow, e.g., seaweeds and kelp, the basis of the food web is phytoplankton. Primary productivity varies with location on the Shelf, reflecting mixing processes, temperature, light and nutrient availability, and season (Platt *et al.*, 2003; Greenan *et al.*, 2004; Fuentes-Yaco *et al.*, 2011). Recently, the spring bloom of phytoplankton has been initiated earlier in the season, apparently in response to global warming (Johnson *et al.*, 2018), and its intensity has varied according to the depth of mixing of the surface water, its turbidity and nutrient levels. The end of the spring bloom is largely determined by a decline in nutrients, especially phosphates, as the phytoplankton are removed from surface waters by grazing, death and settlement. A smaller bloom occurs in the fall when the stratification of the upper layers breaks down and recirculation of nutrients recurs.

A major determinant of productivity level is the availability of nutrients, especially nitrogen and phosphorus. Nitrogen can be obtained from the air above, but phosphorus is mostly derived from land drainage, and thus is generally more abundant closer to shore. In the case of the Scotian Shelf however, its connection with the outflows of the Gulf of St. Lawrence and the Labrador Current — which may also

deliver phosphorus — supports primary productivity. In addition, the collapse of the cod stocks in the 1990s (COSEWIC, 2010a) eliminated predators which released controls on small, fatty fish species.

An evaluation of numerous indices of species, processes and conditions on the eastern portion of the Scotian Shelf has demonstrated that nearly all have undergone significant changes since the 1970s. The magnitude of change was rapid and was reflected in a community shift from a large bodied, groundfish-dominated system to a pelagic (phytoplankton, fish, seals) and large invertebrate-dominated system (Bundy, 2005). This in turn led to an explosive growth in the grey seal population which now recirculates nitrogen and phosphorus from deeper waters, returning them to the surface (Parks Canada, 2021; Lysak, 2013; CBC News, 2023). This shift is an example of what has been termed a "trophic cascade", a phenomenon in which the removal of top predators in an ecosystem results in substantial changes in the relative abundance of predators and prey throughout a food web (Shackell *et al.*, 2010). This trophic cascade also resulted in the concurrent increases in small pelagic fish and benthic invertebrates such as lobster, northern snow crab, sea cucumber and northern shrimp, decreases in zooplankton, and increases in phytoplankton (DFO, 2010; Robicheau *et al.*, 2022).

The movement of warmer waters from the south is also raising concerns of an increase in the frequency of invasive species and harmful algal blooms that could affect important fisheries on the Scotian Shelf, as appears to be happening elsewhere (Dai *et al.*, 2023).

4.3.1 Plankton

Plankton are organisms that principally float in the water column. Some are microscopic plants (the *phytoplankton*), or floating algae, that constitute the basis of the local food chain. Others are animals, i.e., *zooplankton*, that generally feed directly on phytoplankton, or on another important (but often overlooked) component – the microbes such as *bacteria* and *fungi.* An important component of the plankton on the Scotian Shelf, especially in summer, are larval stages of fish (the *ichthyoplankton*).

To photosynthesize, phytoplankton need to spend most of their time near the surface where the light levels are adequate. Their productivity is largely dependent upon the combination of light levels, temperature and salinity of the water, and nutrient (nitrogen, phosphorus) availability. These factors vary across the Shelf, depending upon the mixing of waters from the different sources, i.e., the Gulf Stream, Labrador Current and St. Lawrence, and the vertical mixing processes in the water column at each point.

On the Scotian Shelf, diatoms and dinoflagellates are the largest and most common phytoplankton (Breeze *et al.*, 2002). Blooms of phytoplankton occur in late winter/spring and again in the fall (DFO, 2000). Trends in the magnitude and duration of the spring bloom on the Scotian Shelf indicate that blooms begin earlier now than they did in the 1960s and 1970s and are more intense and persist longer (Zwanenburg *et al.*, 2006). The mechanisms underlying the timing and productivity of the blooms on the Shelf are still being studied (Craig *et al.*, 2015; Ross *et al.*, 2017; Ruckdeschel *et al.*, 2020), but they are important variables affecting both fisheries production and the exchange of CO_2 with the atmosphere (Shadwick *et al.*, 2010; Craig *et al.*, 2017).

The next step in the food chain (Belgrano *et al.*, 2018) is the zooplankton, which provide the intrinsic link between primary production and secondary consumers, e.g., fish, birds, turtles and mammals, and support the fisheries (Figure 4.7).

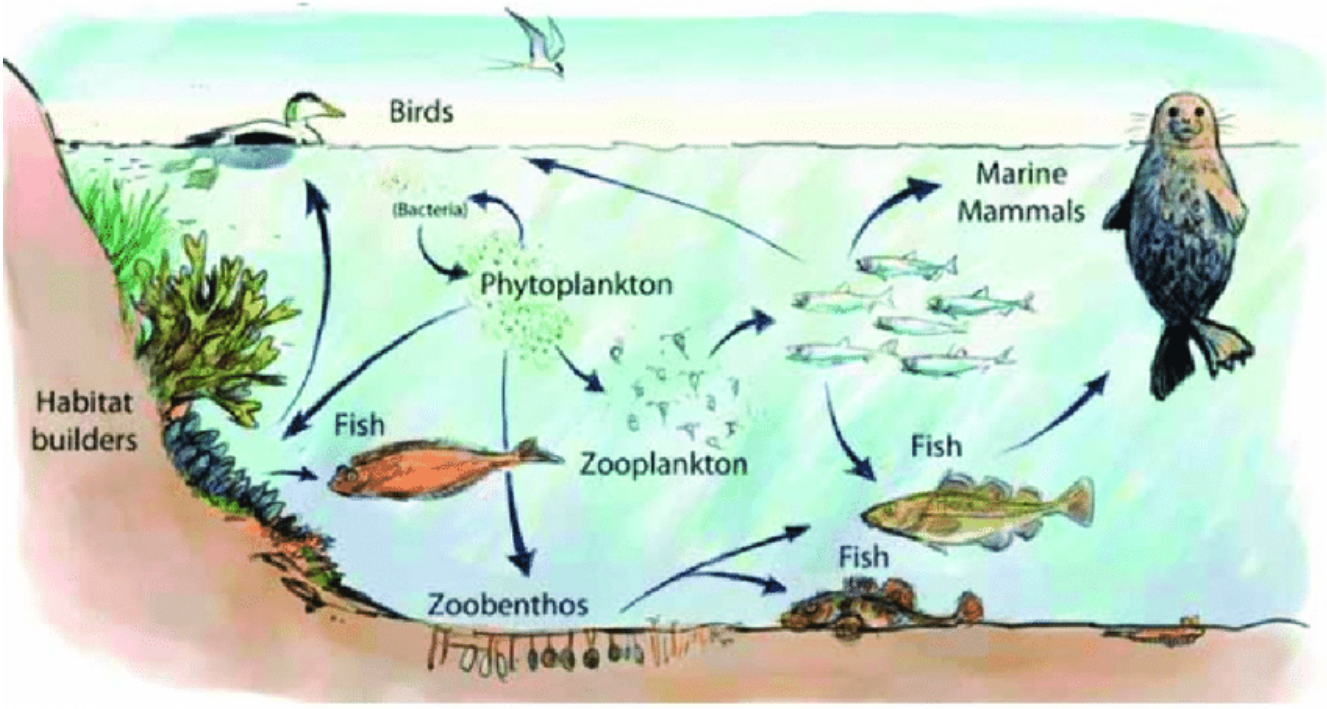


Figure 4.7. Food Web Diagram

The composition of the zooplankton on the Scotian Shelf is fairly typical of shallow coastal marine environments: primarily an array of small crustaceans (copepods, especially *Calanus finmarchicus,* which makes up ~70% of the biomass of zooplankton), krill, larval stages of fish and benthos (section 4.3.2), which constitute the main prey of larger species including many fish and some mammals. In addition, several species of jellyfish (especially moon jellyfish and lion's mane jellyfish) are important predators on smaller zooplankton such as the copepods, but themselves are also prey for several fish (including ocean sunfish) and sea turtles. Most of these planktonic species (except the jellyfish) undergo daily vertical migrations through the water column, remaining below the photic (lighted) zone during the day and rising to feed at night when they are less visible to their own predators. The larger species of zooplankton are critical food not only for many fish, but also for birds, turtles and even the largest of the mammals, including the North Atlantic right whale. On the Scotian Shelf, zooplankton levels have been lower in more recent years than in the 1960s/70s (the reverse of the phytoplankton trend) and may be beginning to recover from the lows observed in the 1990s (Harrison *et al.*, 2007). The fact that the causes of these changes are still unclear is reflective of the limitations to our existing knowledge of the Scotian Shelf ecosystem.

The biology of zooplankton has been studied for a long time (Breeze *et al.*, 2002), but what is still poorly known is how they are affected by major changes in water masses in coastal shelves such as the RA

Study Area (Ruckdeschel *et al*., 2020). Evidence suggests that some of the principal changes in zooplankton productivity on the Scotian Shelf, which affect fish abundance and movements (etc.), are related to major shifts in the masses of water derived from the Gulf Stream, Nova Scotia Current and Labrador Current (etc.) (DFO, 2000; Hayes, 2003; Ruckdeschel *et al.*, 2020). These shifts change the nature of vertical stratification of the water at any location, its temperature and its salinity, all of which are important determinants both of species' composition and productivity. Understanding these effects is important for assessing some of the effects of offshore wind development because it is expected that turbulence from operating turbines will affect the degree of mixing taking place in surface waters of the shelf, therefore affecting biological productivity (see section 5.4.2). The availability of remote sensors mounted on buoys or remotely operated vehicles (ROVs) is an essential asset for resolving these uncertainties (Prairie *et al.*, 2012).

4.3.2 Benthos

Organisms that live on or near the bottom are collectively referred to as *benthos*. There are numerous species, many of which are still poorly known in this region. Their distribution is usually dictated by the nature of the bottom sediments: exposed bedrock for example, is only habitable by species that can adhere to the rock surface (such as corals and sponges— which, when well-developed can become habitat for other species), whereas gravel, clay, sand or mud each offer habitats for a substantially different array of species. Some are embedded in the bottom (known as the *infauna* e.g., polychaete worms, clams and some crustaceans), and others (the *epifauna*) move about on the surface, e.g., lobster, crab, sea cucumber, whelks and scallops (MacLean *et al.*, 2013). Corals and sponges are not harvested in this region, but they provide important habitat for a wide array of other species (Shackell *et al.*, 2013; Beazley *et al.*, 2018; Robicheau *et al.*, 2022; Hebert *et al.*, 2024.) Many corals and sponges in this region are recognized as Species at Risk. Since they mostly occur in the deepest waters of the RA Study Area, they are less likely to be directly at risk from OSW and are not discussed further (Campbell and Simms, 2009; DFO, 2010, 2012a).

The benthic community is largely dependent upon food that has descended through the water column, either in the form of faecal matter or as dead and dying organisms (and their associated bacteria) from the upper layers. Consequently, this community is very much influenced by the physical condition of the water column above – its temperature, oxygen level, or whether it is mixed or stratified.

4.3.3 Pelagic Organisms

This term refers to all larger aquatic organisms that are capable of independent swimming and includes fish, turtles and marine mammals. Many of these are migratory species that come to the RA Study Area annually for breeding or feeding and provide a biological connection with the whole of the Atlantic Ocean, the Arctic and/or Europe.

4.3.3.1 Fish

There are records of 196 species of marine fish occurring as regular inhabitants of the Scotian Shelf, and over 200 species in deeper waters (between 1,000 and 4,000 m) at the edge of the Shelf (MacLean *et al.,*

2013). In addition, there are several species that breed in fresh water but develop in the marine environment, e.g., Atlantic salmon, American smelt, American shad, alewife and blueback herring, or like the Atlantic eel breed at sea and grow in fresh water. These migratory species spend varying amounts of time at sea. Some travel widely through the North Atlantic, whereas others are more likely to remain close to land in areas such as the RA Study Area. For many species the details of their at-sea movements and behaviour in this region are still poorly known.

There are two major groups of marine fish: *demersal* or groundfish, which live near the sea bottom for much of their adult life, and *pelagic* species that utilize the water column above. The latter group includes a great variety of species, from small schooling fish, e.g., herring, capelin and larvae/juveniles of most of the demersal species, to large bodied species such as sharks, tunas, swordfish and ocean sunfish, which may range widely over the Atlantic Ocean. These large distance connections emphasize an important fact: that the RA Study Area is biologically connected to a large part of the globe, and that all human modifications made here require careful consideration. Some species in each category are the basis of important commercial and recreational fisheries in this region and are listed in Table 4.1 with rankings according to the *Species at Risk Act* (SARA), the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and Fisheries and Oceans Canada (DFO).

Table 4.1. Summary Table of Important Invertebrates in the RA Study Area

Species Common Name
American lobster
Rock crab
Queen snow crab
Scallop, e.g., sea scallop, Iceland scallop
Shrimp, e.g., northern shrimp, sevenspine bay shrimp
Spiny crab
Toad crab
Lesser bobtail squid
Shortfin squid
Spoonarm octopus
Sources: Rondeau *et al.*, 2016, Coomber *et al.*, 2021, DFO Aquatic Species at Risk Critical Habitat and Distribution Geodatabase, Species at Risk documents, and COSEWIC reports and stock assessments.

The diversity and abundance of fish reflect the diversity of habitats and the processes affecting the productivity of different regions of the Scotian Shelf. Some are permanent members of the fish community on the Shelf, while several others are migrants that range widely across the Atlantic Ocean, e.g., bluefin and other tunas, Atlantic swordfish, white shark etc. (DFO, 2013; COSEWIC, 2011). During the 1980s, a major cooling event occurred in bottom waters over the Eastern Shelf apparently as the result of an increased inflow of cooler waters (DFO, 2003). Subsequently a more intensive stratification of the water column has been observed, both of which are associated with water flows from upstream

areas (DFO, 2003). These changes appear to have had several consequences including: changes in the relative abundance of some species; the appearance of new species such as capelin and Greenland halibut (Zwanenburg *et al.*, 2002; Wood Canada Ltd., 2022); the reduction of average body size of some groundfish; and increases in the abundance of seals (DFO, 2003).

As indicated above, the collapse of groundfish stocks released some species from predation, which augmented their abundance and contributed to benthic invertebrates, e.g., shrimp, crab, and lobster, becoming the key fisheries species (Myers and Worm, 2003). Rising water temperatures across the region have also led to decreases in populations of cold-water species such as Northern shrimp and snow crab (Bernier *et al.*, 2018).

4.3.3.2 Fish Species of Special Status

Of the 190+ fish species that may be expected to be present in the RA Study Area at one time or another, 23 are recognized by COSEWIC as either Endangered (six species plus four separate stocks of the Atlantic salmon), Threatened (10 species) or of Special Concern (five species). Of these, two species (white shark and the Inner Bay of Fundy stock of the Atlantic salmon), are also recognized as Endangered under SARA, together with two (northern wolffish and spotted wolffish) recognized as Threatened, and one (the Atlantic stock of the striped wolffish) identified as being of Special Concern. Further details of the occurrence, movements and habitats (where known) of these 27 stocks are provided in Appendix 4.1.

These species are a mix of pelagic and demersal fish and constitute a group for which any environmental modification could represent an unacceptable additional hazard. Demersal species, for example, may well be affected by changes in substrate, and both demersal and pelagic species may be affected by the presence of new electromagnetic fields, together with increases in noise or vibrations and changes in the temperature, oxygen or nutrient levels in the water column (section 5.4.2).

Appendix 4.1 lists fish species of special status that may be present in the RA Study Area. Species of special status are those listed on Schedule 1 of the SARA, or species assessed as endangered, threatened, or of special concern by COSEWIC. Populations that are highly unlikely to occur in the RA Study Area are excluded, e.g., Atlantic cod Laurentian North population.

Table 4.2. Summary Table of Important Fish in the RA Study Area

Sub-categories	Species Common Name	Species Status according to SARA, COSEWIC and DFO
Demersal fish	American eel	COSEWIC status: Threatened
	American plaice	COSEWIC status: Threatened; fish stock in critical zone
	Atlantic cod	COSEWIC status: Endangered; fish stock in critical zone
	Atlantic halibut	-
	Atlantic wolffish	SARA status: Special Concern
	Cunner	-

Sub-categories	Species Common Name	Species Status according to SARA, COSEWIC and DFO
	Fourbeard rockling	-
	Greenland halibut	DFO Fish stock: Cautious zone
	Greysole/ witch flounder	DFO Fish stock: Cautious zone
	Haddock	-
	Northern wolffish	SARA status: Threatened
	Silver hake	-
	Smooth skate	COSEWIC status: Special Concern
	Spotted wolffish	SARA status: Threatened
	Thorny skate	COSEWIC status: Special Concern
	White hake	COSEWIC status: Threatened., DFO Fish stock: Critical zone
	Winter flounder	DFO Fish stock: Critical zone
	Winter skate	COSEWIC status: Endangered
	Yellowtail flounder	DFO Fish stock: Critical zone
Pelagic fish	Acadian redfish	COSEWIC status: Threatened
	Alewife/blueback herring	-
	American shad	-
	Atlantic bluefin tuna	COSEWIC status: Endangered
	Atlantic herring	DFO Fish stock: Critical (spring spawners) and Cautious (fall spawners) zones
	Atlantic mackerel	DFO Fish stock: Critical zone
	Atlantic salmon	COSEWIC status: Special Concern; DFO Fish stock: Critical to healthy zone depending on rivers
	Atlantic saury	-
	Basking shark	-
	Butterfish	-
	Capelin	-
	Great white shark	SARA Status: Endangered
	Pollock	-
	Porbeagle shark	COSEWIC status: Endangered
	Shortfin mako shark	COSEWIC status: Threatened
	Spiny dogfish shark	-
	Striped bass	COSEWIC status: Special Concern

Sources: Rondeau *et al.*, 2016; Coomber *et al.*, 2021, DFO Aquatic Species at Risk Critical Habitat and Distribution Geodatabase, Species at Risk documents, and COSEWIC reports and stock assessments. Fish stock status is based on the DFO Sustainable Fisheries Framework.

4.3.3.3 Introduced Species

On the Scotian Shelf, there are at least 22 introduced or invasive species (DFO, 2018b). Monitoring programs have focused on tunicates (violet, golden star and vase tunicates) and the European green crab (DFO, 2018b). In addition to these species, the marine alga known locally as oyster thief *(Codium fragile)* has substantially changed coastal ecosystems in Atlantic Canada. This alga was first observed in coastal waters of the Scotian Shelf in 1989 at Mahone Bay. By 2007, it had become established along large sections (445 kms) of the coast (DFO, 2018b). There is concern that this species may replace native marine algae, such as kelp, and thus affect the sea urchin-kelp bed dynamics of the Atlantic coast ecosystem (DFO, 2018b). Additionally, the replacement of kelp beds by *Codium* has been facilitated by another invasive species, the coffin box bryozoan (DFO, 2018b).

Other species have been recorded in recent years, mostly in waters of the Bay of Fundy where more intensive research has been conducted. These species are listed in Appendix 4.4. It is possible that some of these species occur also in the RA Study Area, but limited surveys have so far failed to record them. This may be remedied as further research is conducted in anticipation of OSW development. In that connection, the examination of RA Study Area waters using environmental DNA techniques (eDNA) may well identify other species that are moving in response to climate change (see section 10).

Appendix 4.2 contains a list of aquatic invasive species observed in Nova Scotia. For each species, basic information on the species' identity and locations of occurrence is shown. Locations where each species has been observed in NS are listed in the table by subregion (subregions 1-5 in Appendix 4.3). Since the full distributions of aquatic invasive species are often unknown, it should be noted that a lack of observation within a particular area does not mean the species is absent from that area, just that it has not been observed there. Note also that observation within a subregion does not mean that the species is present throughout the entire region (DFO, 2024a).

4.3.4 Marine Mammals

More than 21 species of marine mammals are known to occur within the RA Study Area, either persistently, or seasonally in transit between the Arctic, Gulf of St. Lawrence and tropical areas. Details of each of these species are provided in Appendix 4.4.

The existing and available information indicates that marine mammal species that are known or considered likely to be present include several baleen whales, toothed whales, dolphins and porpoises, and seals. Much of the information available on the presence of marine mammals in the RA Study Area comes from the DFO sightings database, but increasingly information is being derived from non-government agencies such as academic research groups, fishers and citizen-based observer organizations. The development of remote techniques for tracking or passively recording sounds etc., is adding greatly to the paucity of information originally available.

For the larger species of baleen whales, there is evidence that global ranges are changing, especially in arctic and subarctic waters, as sea ice diminishes (Moore *et al.*, 2019). Despite a general shift towards northern latitudes from further south, humpback, sei, fin and blue whale species were detected less on

the Scotian Shelf area after 2010. The cause is thought to be due to shifts in prey availability, which may be related either to ecosystem shifts or directly to climate change (Davis, 2020).

Although the overall abundance of marine mammals in the RA Study Area is highest from late spring to autumn, some species are present year-round (refer to Table 4.6). The species found in the RA Study Area throughout the year include several that are designated as being at risk under SARA or have been identified by COSEWIC as species in danger of disappearing from Canada. The RA Study Area also includes critical habitat for blue whale, North Atlantic right whale and northern bottlenose whale. Marine mammals are considered ecologically, economically, culturally and recreationally important to various groups, including government departments and agencies, Indigenous peoples, tourists and most residents of Nova Scotia.

Many of the larger species of marine mammals are already at risk from human activities in the marine environment, including vessel traffic, fishing activities, e.g., buoys, net and trap lines etc., noise and abandoned fishing gear. Activities associated with OSW developments could greatly increase the human presence and impact during pre-construction surveys, construction and project operations. Because relatively few species of mammals occur in the waters where OSW development has taken place elsewhere, there is not much that can be learned from those examples. This reinforces the need for an effective pre-commitment phase of research and monitoring.

4.3.5 Bats

Although mammals, bats are often considered together with birds (under the term ‘aerofauna’) because their flight ability means their use of and responses to the environment are similar to those of birds. An estimated 600,000 – 888,000 bats were killed at North American land-based wind farms in 2012, approximately 72% of which were *lasiurine* species (sometimes known as “tree bats” because of their roosting habits): silver-haired bat, hoary bat and eastern red bat. All three species have been designated as Endangered by COSEWIC (2023). Their carcases are among the most frequently found near land-based wind turbines. It has been suggested that bats are attracted to turbines because they are tall structures where they may roost, or that they forage near the turbines that are lit at night, possibly because the lights also attract insects, or as a mating aggregation site (USGS, 2016; Zimmerling and Francis, 2016; Good *et al.*, 2022; Guest *et al.*, 2022)

Bats are essentially land-based animals. Consequently, their activity in the RA Study Area is primarily in the nearshore environment. However, evidence from the United States and Europe indicates that larger species of bats have been recorded far from shore – as much as 817 km away – although most records along the Atlantic shore of the US were < 42 km from land (Peterson *et al.*, 2016).

There are a number of records of bats present at considerable distances from the NS shoreline – either ‘hanging up’ in the rigging of vessels during the daytime or arriving at distant islands – but for most species it is unclear if these incidents are part of controlled behaviour, such as when they are foraging, mating or on migration, or are accidental, as when driven away from shore by storms (Hayman, 1959; Peterson, 1970; McLaren, 1981, McLaren *et al.*, 2006; Broders *et al.*, 2003 and Doucette *et al.,* 2024).

Lucas and Hebda (2011) reported three species on Sable Island —silver-haired bat, hoary bat and eastern red bat — that were seen on several occasions during the summer months. These are medium- to large-bodied bats compared with other species in NS and have very wide distribution in North America (COSEWIC, 2023). There is no evidence of their breeding on Sable Island: sometimes their arrival there coincided with recent storms or strong winds, suggesting that their presence may have been inadvertent (Bleakney, 1965; McLaren *et al.*, 2006), but Doucette et al. (2024) consider that a southerly migration may in fact be occurring.

4.3.6 Birds

Within Atlantic Canada the coastal landscape supports a diverse waterfowl community of more than 30 species (DUC, 2023). Waterfowl use this area throughout the year, with significant numbers during staging, breeding and wintering. The region also supports birds important to the Atlantic Flyway, which is a major migratory pathway for birds along the eastern coast of North America from Greenland to South America. Important coastal species found in the study area include American Black Duck, Green-winged Teal, Ringed-necked Duck, mergansers, goldeneyes, scoters and eiders (DUC, 2023). Large fall and spring congregations of Common Eider, numbering more than 10,000 (approximately 2% of the total North American Common Eider population), forage in the coastal waters of the Scotian Shelf during the winter months before moving north to their summer breeding grounds. Some also breed on coastal islands in the RA Study Area (Tomlik *et al.*, 2023; DUC, 2024).

Marine birds, including petrels, cormorants, gannets, gulls, terns, auks, phalaropes, sea ducks and geese, loons and herons, are ubiquitous over the inshore Scotian Shelf, i.e., within 25 km of the coastline, at all times of year (Bundy *et al.*, 2024). During the spring, summer and fall, migrants from the South and North Atlantic use this area as refuge and feeding habitat. In the winter months, some inland birds also move to the coast, joined by large numbers of marine birds from Newfoundland, Arctic Canada, Greenland and northern Europe, which migrate south from breeding areas to overwinter (Bundy *et al.*, 2014; Stewart *et al.*, 2021). Consequently, there are numerous species that are potentially to be found within the RA Study Area: birds that utilize coastal waters for crucial life cycle stages, i.e., those that migrate from distant breeding grounds and stop over within the RA Study Area, as well as those that breed here and use offshore open waters as their primary foraging area. The longest journeys are those undertaken by great, sooty and Cory's shearwaters that breed in the South Atlantic during the southern hemisphere summer and feed in the RA Study Area during the northern hemisphere summer.

In existing OSW developments in Europe, the impact on marine birds, especially during migrations and feeding forays has led to concern about their ability to avoid contact with the turbines. Initial studies in Europe suggest that many species might be at little risk because the birds appear to avoid wind farms, but concerns remain regarding limitations in existing monitoring technologies (ADGC, 2024). The birds that are of greatest concern in relation to OSW development are obviously those that use the coastal shelf waters extensively. Tables 4.3 and 4.4 list some of the principal species in this region.

Table 4.3. Marine Birds Along the Nova Scotia Coast (Breeding)

Group	Habitat/Time of Year
Storm-petrels	
Leach's storm-petrel	Islands along Atlantic coast
Cormorants	
Great cormorant	Coastal and island colonies along eastern Cape Breton
Double-crested	Rocky shores along Atlantic coast
Herons	
Great blue heron	Coastal areas and on islands, some inland
Dabbling ducks	
Green-winged teal	Nest along Atlantic coast
Black duck	Common along coast in fall to spring, a few nest on coastal islands
Shorebirds	
Semipalmated plover	Beaches along Atlantic coast
Piping plover	Beaches in southwestern NS
Willet	Breeds along coast near saltmarshes; occurs on beaches during spring and fall migrations
Gulls and terns	
Herring gull	Large breeding colonies along coast; common in summer, some overwinter
Great black-backed gull	Common in breeding colonies along coast, some overwinter
Black-legged kittiwake	
Roseate tern	Islands off Cape Breton
Common tern	Coastal Islands
Arctic tern	Eastern and south shores
	Eastern and south shores
Alcids	
Razorbill	One breeding colony off Cape Breton and a few on southwest coast
	Coastal Islands; occurs on coast year round
Black guillemot	One breeding colony off Cape Breton and a few on southwest coast
Atlantic puffin	

Sources: Bundy *et al.*, 2014; modified from Breeze *et al.* 2002

Table 4.4. Birds Occurring Along the Nova Scotia Coast (Not Breeding)

Group	Habitat/Time of Year
Shearwaters	
Great, sooty and Cory's	Summer months
Loons and grebes	
Common loon	Breeds on lakes in summer but winters in coastal waters
Red-throated loon	In coastal areas during spring and fall migration
Pied-billed grebe	Estuaries and sheltered saltwater coves in winter
Horned grebe	Coastal areas during spring and fall migration
Red-necked grebe	Coastal areas during spring and fall migration
Geese	
Brant	Coastal areas in southwest NS during spring and fall migrations
Canada goose	Coastal areas in southwest NS during spring and fall migrations; large numbers overwinter at Port Joli and Cole Harbour
Dabbling Ducks	
Greater scaup	Coastal areas in southwest NS during spring and fall migrations
Harlequin duck	Migratory transient in fall and spring; some overwinter on southwest coast
Long-tailed duck	Common in winter along the coast
Black scoter	Common along the coast during fall and spring migration; uncommon in winter
Surf scoter	Common along the coast during fall and spring migration; common in winter
White winged scoter	Common along the coast during fall and spring migration; common in winter
Goldeneye	Common along the coast during fall and spring migration; common in winter
Bufflehead	Common along the coast during fall and spring migration; uncommon in winter
Shorebirds	
Black-bellied plover	Common along the coast during fall and spring migration; occasionally some overwinter near Cape Sable
Golden plover	Uncommon but occasionally numerous in fall migration; few in spring migration
Lesser yellowlegs	Uncommon during spring migration; more common in fall migration
Ruddy turnstone	Uncommon during spring migration; common in fall migration; occasionally overwinter near Louisbourg, and Cape Sable Island
Red knot	Uncommon during spring migration; common in fall migration; occasionally overwinter on southwest coast

Group	Habitat/Time of Year
Sanderling	Uncommon during spring migration; common in fall migration; occasionally overwinter on southwest coast
Semipalmated sandpiper	Uncommon during spring migration; more common in fall migration; small numbers on coast in summer
White-rumped sandpiper	Uncommon during spring migration; common in fall migration;
Pectoral sandpiper	Uncommon during spring migration; common in fall migration
Purple sandpiper	Common in some areas during winter on rocky shores
Dunlin	Uncommon during spring migration; common in fall migration; occasionally overwinter on south and eastern shores
Short-billed dowitcher	Uncommon during spring migration; common in fall migration;
Gulls and Terns	
Common black-headed gull	Common along coast in winter
Bonaparte's gull	Uncommon during spring migration, more common along South Shore during fall migration
Ring-billed gull	Common during spring and fall migration, some overwinter
Iceland gull	Fairly common in winter, Halifax and Sydney harbours

Sources: Bundy *et al.*, 2014; Breeze *et al.,* 2002.

Data provided to the Committee by Environment and Climate Change Canada (ECCC) in 2024 are based on densities estimated from periodic at-sea surveys in the Eastern Canada Seabirds at Sea Database (ECCC, 2022a). While the data are limited by the intermittent nature of the surveys, it is evident that there is considerable variation in density on a per species basis within the RA Study Area waters. Some species are low to absent in offshore areas, e.g., ring-billed gull, while other species such as storm petrels utilize the offshore area extensively. During winter, many species seem to congregate closer to shore in the southern portion of the RA Study Area, south of Yarmouth, NS. It should be noted that winter data are lacking for several species due to lack of surveying effort during this time period.

The Eastern Shore Islands situated along the southeast coast of central NS support breeding congregations of greater than 4,000 common eider duck. Harlequin duck are also found at this location in winter and other species frequent the area during spring migration, including thousands of scoters (white-winged, black and surf) and Leach's storm-petrel that breed on some of the islands (IBA Canada, 2024).

Many of these species forage at some distance offshore. Although the proposed 25 km buffer is designed in part to minimize the impact on these species, it is probable that many birds will exceed that distance. Ducks, scoters, shearwaters and others are well known to travel substantial distances to reach highly productive areas of the coastal ocean – notably upwelling sites — to forage, especially when

rearing young. The heights at which these birds fly is often poorly known; their vulnerability to OSW turbines therefore is not yet clear.

Vulnerability of birds during migration to OSW installations may be significantly different from vulnerability during feeding/foraging. Many species migrating north through the region in spring tend to stay close to land (Figure 4.8) as they adjust their northward movement according to the progress of warming temperatures. However, some shorebird species heading south to wintering grounds during the fall may fly further away from the shore, more directly over the RA Study Area (Figure 4.9). The limited information about the timing, frequency, abundance, flight height, foraging areas and reactions to OSW turbines of breeding and migratory birds needs to be remedied before permits to build are issued.

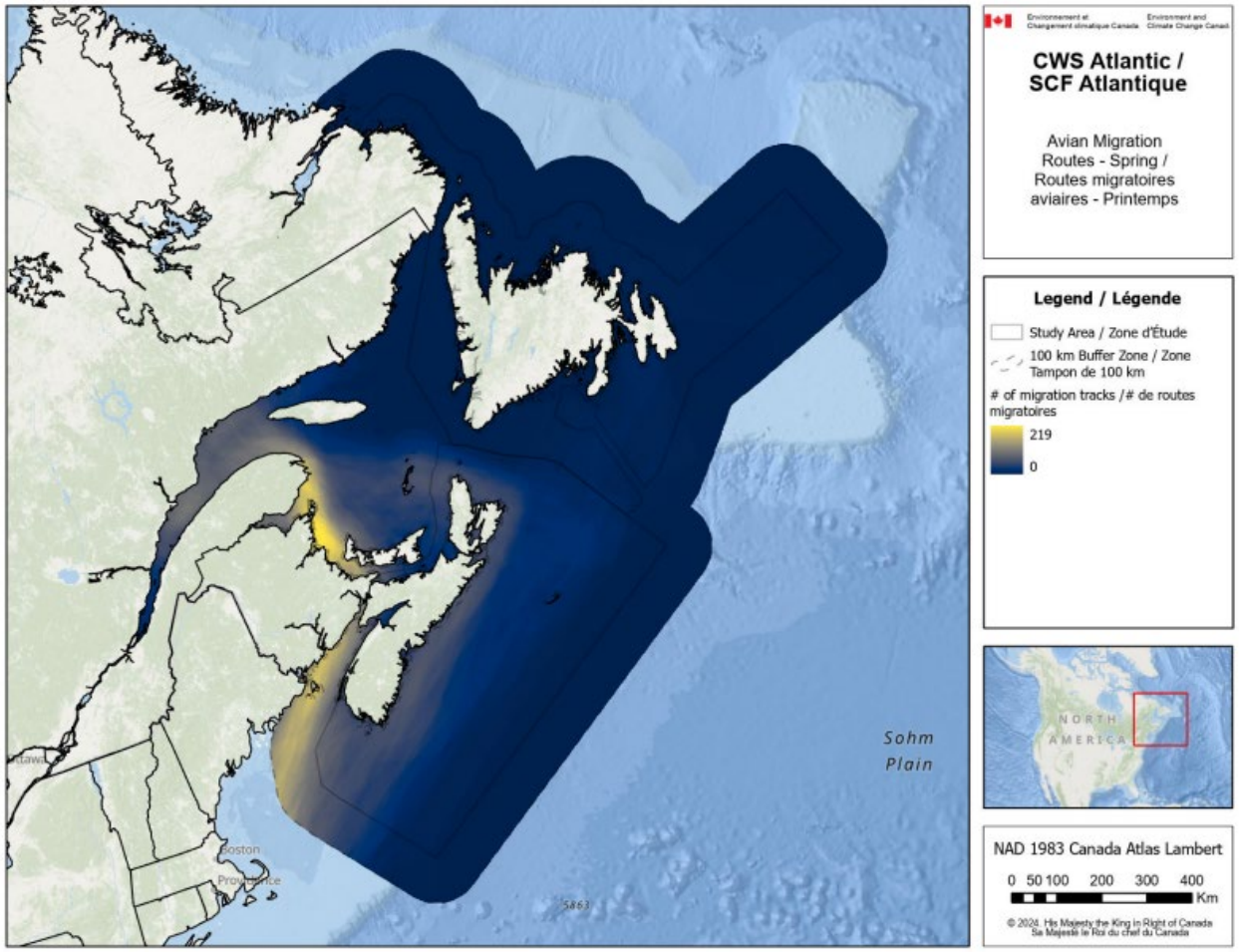


Figure 4.8. Avian Migration Routes – Spring

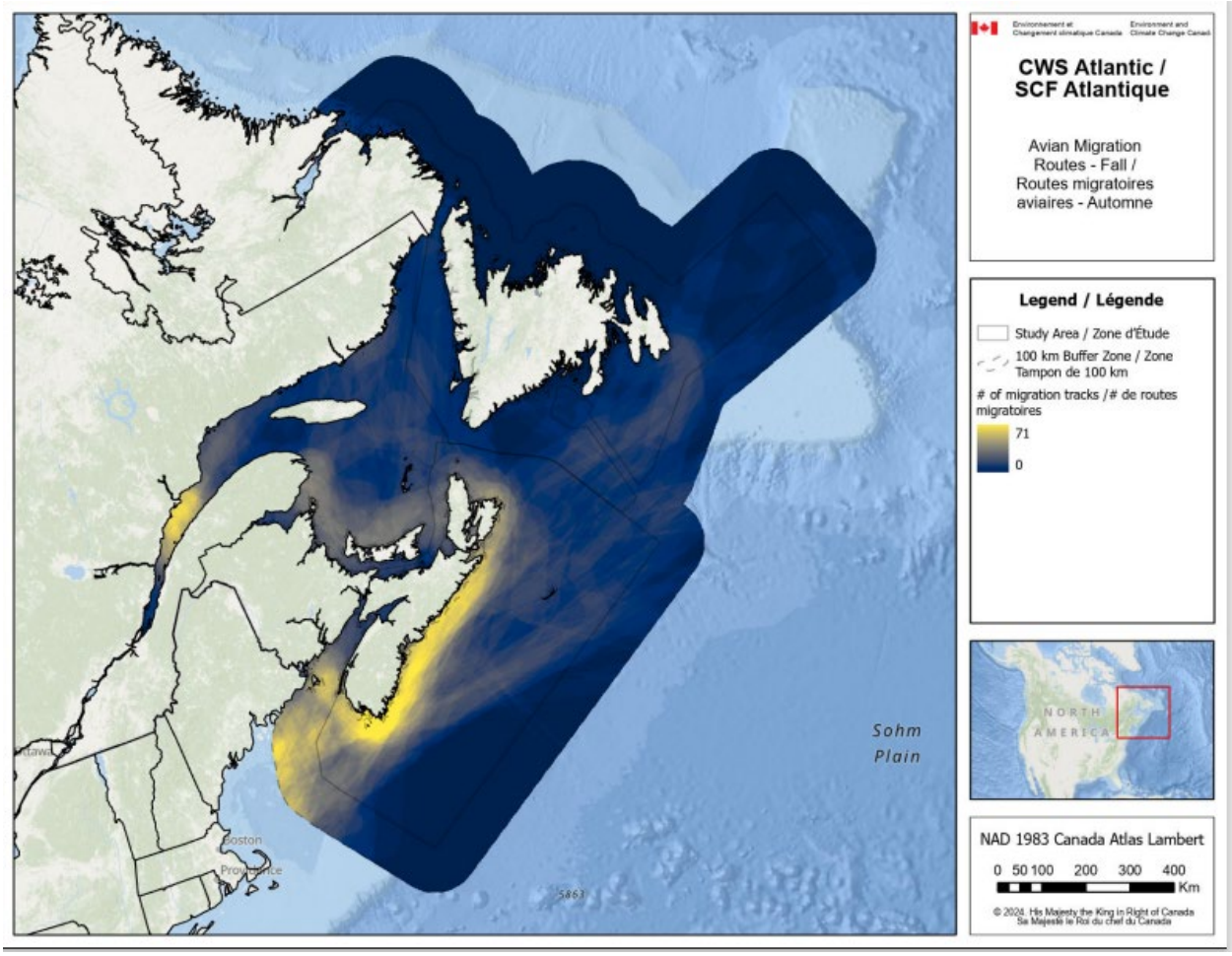


Figure 4.9. Avian Migration Routes – Fall

The breeding and migratory bird pattern mapping (above) was created by ECCC and presents movement models based on tracking data collected from birds moving through the offshore region of Atlantic Canada. Methods and bird species used to produce this mapping, as well as interpretation, limitations and assumptions can be accessed via the Registry. Additional shorebird movement track maps have also been compiled for eight species of shorebirds by the Shorebird Science and Conservation Collective, showing that several species (e.g. plovers, Hudsonian godwit; and whimbrel) have been tracked moving directly out to sea across the study area. This mapping and associated context report and data contributors are also provided via the Registry.

All OSW developments have the potential to adversely affect marine birds through collision mortality, disturbance and displacement. While mortality, occurring when flying birds and bats collide with wind turbines on land, is well documented, there is little evidence of mortality being caused at OSW farms in the North Sea. Collision is more likely if seabirds fail to avoid wind farms, which in the marine environment can happen because of fog, extreme winds etc. Disturbance, caused by structures or by human activity associated with wind farms, may also cause displacement if birds move away from wind farm locations (Furness *et al.*, 2013; Marques *et al.,* 2021). Displacement from foraging habitat is more

likely to occur if seabirds actively avoid wind farms but are unable to find alternate foraging habitat. Monitoring and follow-up studies at operating wind farm sites are needed to validate model predictions developed on birds utilizing the OSW farms (ECCC, 2024b).

4.3.7 Marine Turtles

Three species of sea turtles have been recorded on the Scotian Shelf and Slope frequently enough in recent years to indicate their regular migration into the area (Appendix 4.5). They are most abundant in the area during the summer months. The Atlantic leatherback sea turtle forages for jellyfish in the waters of the shelf during the summer and fall (Bleakney, 1965; James *et al.*, 2004, 2005, 2006a, 2006b; DFO, 2012; Archibald and James, 2016; Nordstrom *et al.*, 2019), migrating to warmer waters for the winter and nesting in beaches in the Caribbean and Gulf of Mexico (ALTRT, 2006). In Atlantic Canada, leatherbacks do not come ashore except, perhaps, when driven by storms. Their occurrence is associated with drifting stocks of jellyfish, (especially the moon and lion's mane jellyfish) possibly brought to the region in Gulf Stream rings (Bleakney, 1965; James *et al.,* 2005; James and Herman, 2001). The Scotian Shelf is thought to be the area of largest density of leatherback turtles in the whole Atlantic Ocean, even though they do not breed anywhere near this latitude (James *et al.*, 2006b). Their major predators in this region are thought to be large sharks (Muir, 2002).

The Atlantic leatherback is listed as Endangered and is protected under SARA (ECCC, 2020). Recent studies indicate that the leatherback, which is the largest known species of marine turtle, can tolerate very cold waters (James *et al.*, 2006a, 2006b). At present, there is no clear indicator of the number of turtles using these waters (DFO, 2020a), although increased tagging activities are expected to improve knowledge of their movements. Atlantic leatherback sea turtle important habitat is identified throughout the RA Study Area as indicated on Figure 4.11 (Section 4.4.5).

Immature loggerhead sea turtles occur fairly regularly at the edge of the Scotian Shelf and on the slope (Brazner and McMillan, 2008; DFO, 2020b). Loggerheads are vulnerable to both vessel and fishery interactions (Barco *et al.*, 2016) and to climate change (Witt *et al.*, 2010). The species was designated as Endangered in 2010 (COSEWIC, 2010b), in part because it has been estimated that ~1200 loggerhead sea turtles were taken yearly as by-catch in pelagic fisheries (Brazner and McMillan, 2008; Paul *et al.*, 2010). They migrate north to the edge of the Scotian Shelf during the summer months and return south for the winter.

Kemp's Ridley turtle has occasionally been reported in waters off Nova Scotia; however, it is generally found further south, and the Scotian Shelf has not been considered part of its regular foraging habitat (Marquez, 1995; TEWG, 2000). With increasing temperatures that assumption may have to be reassessed.

The occurrence of a fourth species, the green sea turtle, has been documented on the Scotian Shelf (James *et al.*, 2004). It is not expected to occur regularly in the area, although that might change as these waters warm in future.

Turtles are primarily threatened by human activities such as fishing – especially with nets and long-lines (DFO, 2020a, 2020b). They are not a major component in the North Sea, where OSW development is more advanced; it is not therefore possible to determine the potential effects of OSW developments on populations from research conducted there. This indicates a need for more intensive investigation in the RA Study Area if OSW development is to be considered.

4.3.8 Ecosystem Changes

The ecosystem of the RA Study Area has undergone significant changes over the last 50 years, primarily associated with human interventions including the overharvesting of groundfish, birds and mammals and climate change. While the management of the fisheries has become more effective in some ways, some species continue to be threatened, e.g., American eel and wolffish. As described above, there are numerous efforts to conserve threatened species and ecological features of the coastal waters of Canada, which may enable their continued existence.

More recently, increases in surface water temperatures have been accompanied by the appearance of more species that were previously found primarily in warmer waters further south (MacLean *et al.*, 2013; Gjerdrum *et al.*, 2018; Withers, 2021). These changes are expected to continue, although they may be masked by cyclical events such as the Atlantic El Niño-La Niña (Tuchen, 2024). This uncertainty makes it difficult to forecast the likely long term and cumulative effects of OSW development. One rarely recognized non-biological influence that affects fish and shellfish communities in the tidally dominated Bay of Fundy and Gulf of Maine is the 18.6-year long *nodal cycle* of the tides associated with a regular change in the relative movements of the Earth, Sun and Moon. This cycle affects the degree of vertical mixing in the water column, which in turn may influence the relative abundance of fish, shellfish and plankton productivity over a multi-year cycle (Cabilio *et al.*, 1987). Although less extreme than in the Bay of Fundy, tidal influences affect movements and mixing on the Scotian Shelf. Several instances in which abundance of fish species (as indicated by landings data) vary over ~20-year period might be related to nodal cycle variations, e.g., swordfish. Climate change, however, seems set to continue and may well accelerate, resulting in significant changes in the location, abundance and behaviour of many species, the introduction of new species from warmer waters, and the consequent trophic cascade that may arise from changes in predatory species. Development of large wind farms on the Scotian Shelf may add some challenges to the movements and behaviour of marine mammals, turtles, birds and fish because of vibrations or electromagnetic fields (EMFs) and could influence primary productivity as a result of changes in turbulent mixing of the water column. Such effects are likely to be minor in comparison with those caused by climate change. Nonetheless, our existing knowledge is still inadequate to assess in full the implications and potential consequences of OSW development in the region. A concentrated, coordinated effort to improve that knowledge is required.

4.4 Conservation Initiatives

Due to the growing concerns over the declines in diversity and abundance of many species, caused largely by human actions, there have been numerous initiatives suggested to identify and protect

existing species and ecosystems. These initiatives arise from international, national and local governments and non-government organizations. Many of them apply to the RA Study Area, especially those relating to Species at Risk and Canada's commitment to protect 30% of its coastal waters by 2025 (DFO, 2023b).

The variety of initiatives is substantial, ranging from Marine Protected Areas, which receive maximal protection under federal law, e.g., *Oceans Act*, to a great number of areas focussed on protection of specific species, such as fish, birds and mammals, or specific habitats, which have varying levels of protection.

4.4.1 Key Biodiversity Areas (KBAs)

A number of locations within the RA Study Area have been identified as very significant for marine waterfowl. Originally such areas were designated as Important Bird Areas (IBAs) or Migratory Bird Sanctuaries (MBSs) for those species, e.g., the Semipalmated Sandpiper or Piping Plover, that are dependent upon coastal habitats in NS during their migration, whether they breed here or not. Following an initiative by the International Union for Conservation of Nature, some of these areas have been renamed Key Biodiversity Areas (KBAs). These areas are important for wildlife and nature to survive and thrive and are found across land, freshwater and marine environments to support rare and threatened species and ecosystems, as well as natural processes (Birds Canada, 2024). In NS there are 19 KBAs, 10 of which occur in marine ecosystems (KBA Canada, 2024a) (Figure 4.10). Of these 10, eight are located adjacent to the RA Study Area (Figure 4.9; KBA Canada, 2024b). Except for the Sable Island site, all marine KBAs fall within the 25 km coastal buffer proposed in the Interim Report.

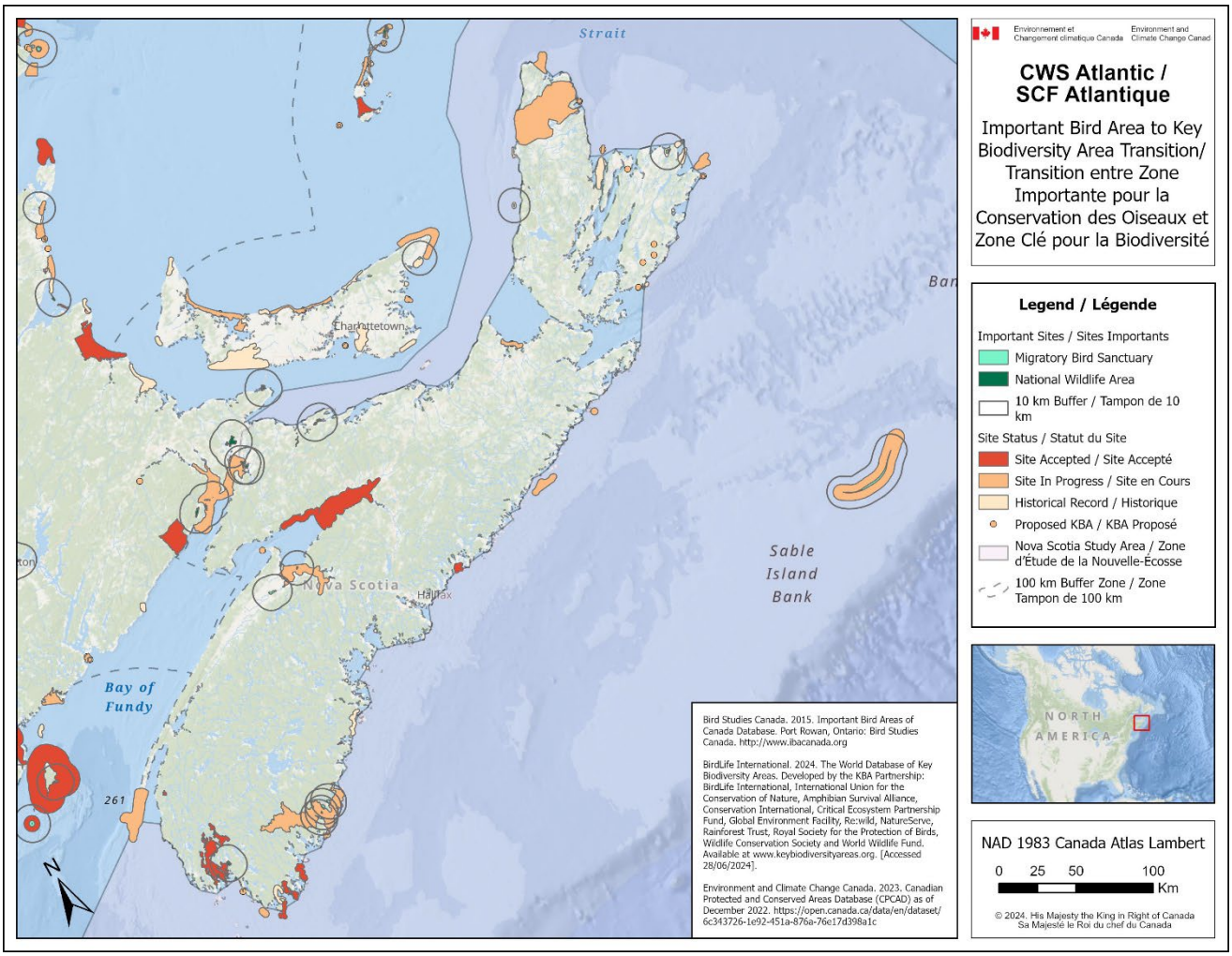


Figure 4.10. Key Biodiversity Areas (including MBAs, IBAs and NWAs)

Although many of these conservation areas appear at first sight to be remote from the region currently under consideration for OSW development, many of the birds occurring there are likely to move out to sea either to forage or during migration. This could bring them in close proximity to an OSW farm in the future. The species involved vary from small shorebirds, e.g., semipalmated sandpiper and purple sandpiper, to much larger marine-foraging species such as several gulls, roseate tern, northern gannet, great cormorant and razorbill. Their vulnerability to an offshore wind turbine varies according to their size, feeding behaviour and flight height when traversing water. For example, the shorebirds are, as their name implies, primarily associated with shallow, often intertidal waters and do not feed at the water surface. However, those that are on migration from the Arctic to Central and South America for the winter months traverse the RA Study Area on their way south, and depending upon the height at which they fly, might be at risk of encountering an operating turbine. Species like the northern gannet are plunge divers, that fly at turbine height before diving into the water.

A summary list of the IBAs and KBAs in NS is provided in Table 4.5 below. More extensive details of these sites, the significant species associated with them, and their location in relation to the RA Study Area are provided in Appendix 4.6.

Table 4.5. Important Bird Area to Key Biodiversity Area Transition in Nova Scotia

Name	Area (km^2)	State of Progress	Summary of Area
Basque Islands and Michaud Point	11.21	Historical Record	Supports large numbers of great cormorant, representing approximately 3.6% of the estimated North American population.
Big Glace Bay Lake	16.19	Historical Record	Supports approximately 1.3% of the estimated population of Canada geese from the Newfoundland and Labrador breeding population.
Bird Islands	10.89	Site in Progress	Supports approximately 9% of the estimated western Atlantic (North American) population of great cormorant, the largest concentration of black-legged kittiwake, razorbill and Atlantic puffin within Nova Scotia, and a few hundred nesting pairs of double-crested cormorant, black guillemot and Leach's storm-petrel.
Bon Portage Island	3.00	Site in Progress	Supports the largest known Leach's storm-petrel colony in the Maritimes: greater than 1% of the estimated western Atlantic population.
Brier Island and Offshore Waters	924.50	Site in Progress	One of the most important bird areas in the Maritimes due to the diversity of birds (331 species recorded in 2001).
Cape Breton Highlands National Park	956.48	Site in Progress	Supports between 2 and 8% of the estimated global population of Bicknell's thrush.
Cape North and Money Point	72.82	Site in Progress	Supports between 1.4 and 2.8% of the estimated Canadian population of Bicknell’s thrush and up to 1% of the global population of the species.
Copequid Bay (Bay of Fundy)	477.68	Site Accepted	Supports significant numbers of shorebirds including 50 to 95% of the world total of semipalmated sandpiper in the fall for staging before the southern migration.
Country Island Complex	16.35	Site in Progress	Supports approximately 37.5% of the estimated national population of roseate tern (Endangered – SARA), as well as Arctic and common tern and

Name	Area (km^2)	State of Progress	Summary of Area
			approximately 2% of the estimated Western Atlantic population of nesting Leach's storm-petrel.
Musquodoboit	28.54	Site Accepted	Supports huge congregations of the breeding population of Newfoundland and Labrador Canada geese (approx. 7%) as well as 1% of the global population of American black duck and semipalmated plover.
Eastern Cape Sable Island	33.62	Site Accepted	Supports a diversity of water and landbirds, e.g., loons, herons, egrets, cormorants, sea ducks, bay ducks, alcids and pelagic species. Supports estimated global population percentages of semipalmated sandpiper (7%), short-billed dowitcher (5%), semipalmated plover (1%), Canadian Atlantic population of piping plover (2%), Atlantic brant (6%) and 2% of all North American brant.
Eastern Shore Islands	269.06	Site in Progress	Supports over 2.5% of the estimated breeding congregations of the subspecies population of common eider (*spp. dresseri*) during large fall and spring congregations representing approximately 2% of the estimated North American population, and approximately 3.3% of the estimated eastern population of harlequin duck (Endangered – NS), and other waterfowl.
Grassy Island Complex	9.96	Historical Record	Supports important nesting sites of roseate tern (Endangered – SARA)
Harbour Rocks	3.34	Historical Record	Supports significant numbers of great cormorant, with over 2% of the estimated North American population nesting on the island.
Ingonish Island	5.66	Site in Progress	Supports great cormorant - approximately 2.2% of the estimated total North American population in 1992.
Margaree Island	8.13	Historical Record	Supports nesting and breeding sites for great cormorant, approximately 2.1% of the estimated North American population.

Name	Area (km^2)	State of Progress	Summary of Area
Northern Head and South Head	50.36	Historical Record	Supports approximately 6.7% of the estimated North American population of great cormorant.
Pomquet Beach Region	36.04	Site in Progress	Supports approximately 3% of the Canadian Atlantic population of piping plover.
Portnova Islands	4.78	Site in Progress	Supports a significant great cormorant colony comprising approximately 2.5% of the estimated North American population.
Rocks off Fourchu Head	1.39	Historical Record	Supports approximately 2% of the estimated North American population of great cormorant.
Sable Island, Nova Scotia	461.89	Site in Progress	Supports globally significant numbers of nesting colonial waterbirds, such as herring gulls (>1% of the estimated North American population), great black-backed gulls (>1% of the estimated North American population) and common terns (5% of the estimated North American population). Roseate tern (Endangered – SARA) nest on the island among larger colonies of common and Arctic tern.
Scatarie Island	67.65	Site in Progress	Supports approximately 1% of the estimated Canadian population of Bicknell's thrush, as well as large numbers of breeding Leach's storm-petrel pairs and southward-migrating whimbrel during the summer months.
Southern Bight, Minas Basin	221.92	Site in Progress	Supports significant numbers of shorebirds including 50 to 95% of the world total of semipalmated sandpiper in the fall for staging before the southern migration.
South Shore (Barrington Bay Sector)	42.06	Historical Record	Supports 2.6% of the estimated Atlantic Canada population of piping plover (Endangered – SARA).
South Shore (East Queens Co. Sector)	49.01	Historical Record	Supports over 1% of the estimated Atlantic Canada population of piping plover (Endangered – SARA), as well as thousands of migrating waterfowl (willet, sanderlings and harlequin duck).
South Shore (Port Joli sector)	435.61	Site in Progress	Supports the largest known Leach's storm-petrel colony in the Maritimes, greater than 1% of the

Name	Area (km^2)	State of Progress	Summary of Area
			estimated western Atlantic population.
St. Paul Island	20.27	Historical Record	Supports approximately 1% of the estimated Canadian population of Bicknell's thrush.
The Brothers	4.51	Site in Progress	Supports Canada's largest roseate tern (Endangered – SARA) population and approximately 1.5% of the estimated North American population.
The Capes	9.60	Historical Record	Supports 2.7% of the estimated total North American Great Cormorant population and a large colony of nesting pairs of black-legged kittiwake.

Sources: ECCC, 2024b; KBA Canada, 2024b.
Site Accepted = IBA has been accepted as KBA; Site in Progress = sites being converted from IBA to KBA; Historical Record = IBAs that will not be converted to KBAs; and Proposed KBA = candidate KBAs that are not yet accepted.

4.4.2 Migratory Bird Sanctuaries

MBSs are designated under the federal *Migratory Bird Sanctuary Regulations,* under the *Migratory Birds Convention Act* (1994), which describe the rules and prohibitions regarding the taking, injuring, destruction or molestation of migratory birds or their nests or eggs in the sanctuaries are in place.

Additional prohibited activities for Sable Island Migratory Bird Sanctuary are listed in the National Parks General Regulations, which includes operating an unmanned aerial vehicle (UAV or drone) over the National Park Reserve (National Parks General Regulations, 1978).

Table 4.6. Migratory Bird Sanctuaries in Nova Scotia

Name	Area (ha)	Summary of Area
Amherst Point	433	• Rich habitats including ponds, marshes, forests and old farm fields and sinkholes. • Supports a wide variety of migratory birds (stopover and resident), waterfowl and marsh birds. • Supports some rare birds such as gadwall and wood duck.
Big Glace Bay Lake	393	• Supports safe fall migration and nesting habitat for several key bird species, e.g., American black duck, Canada goose, common goldeneye, bufflehead, common tern, willet and piping plover (SARA listed species).

Name	Area (ha)	Summary of Area
Haley Lake	100	• Freshwater lake that comprises rocky ledges, granite boulders and gravelly substrate. • Important for Canada goose and black duck. • Site used for feeding, resting, preening and breeding waterfowl.
Kentville	200	• 100-hectare floodplain, grassy marsh, containing many small, shallow ponds and backwaters and the meandering Cornwallis River. • Migratory sanctuary for waterfowl including American black duck, blue-winged teal and green-winged teal.
Port L'Hebert	350	• In combination with nearby Port Joli and Sable River MBS, Port L'Hebert supports 4,000-5,000 Canada Geese each year. • Important resting, feeding and wintering area for American black duck as well as green-winged teal, northern pintail, common goldeneye, bufflehead, scaups, scoters and merganser.
Port Joli	280	• Supports important habitat for representative numbers of resting and breeding waterfowl, e.g., Canada goose, American black duck, common goldeneye, bufflehead, scaups, scoters and merganser.
Sable Island	2,350	• Supports important habitat for resting and breeding birds such as savannah sparrow (*ipswich* subspecies, SARA – Special Concern), great black-backed gull, herring gull, semipalmated plover, American black duck, blue-winged teal, red-breasted merganser, Artic tern, common tern, roseate tern, spotted sandpiper and least sandpiper.
Sable River	260	• The estuary includes shoals, rocks and islets, salt marsh and eelgrass. • Important migration site and utilized by several hundred Canada geese, American black duck and smaller numbers of green-winged teal and various other waterfowl species. • Canada geese overwinter at the site.
Sources: ECCC, 2024a, 2024c, 2024d, 2024e, 2024f, 2024g, 2024h, 2024i.		

According to the *Canada Wildlife Act*, National Wildlife Areas (NWA) are created and managed for the purposes of wildlife conservation, research and interpretation (Government of Canada, 2023).

Table 4.7. National Wildlife Areas within the RA Study Area

Name	Area (ha)	Summary of Area
Sea Wolf Island	54	• Sandstone bedrock formation with cliffs at the southern end with over 60 species of birds and 70 plant species. • Breeding habitat for great cormorant, great blue heron, great black-backed gull, herring gull, black guillemot and bald eagle. • Habitat for snowshoe hare, coyote, red fox, grey seal, as well as minke and fin whale.
Big Glace Bay Lake	393	*See Big Glace Bay Lake MBA Table 4.6 above*.
Source: ECCC, 2022b		

Additionally, the proposed Pemsik National Marine Conservation Area (NMCA) establishment process is underway and is part of a larger Indigenous-led vision for a conservation mosaic (Parks Canada, 2023). The Pemsik NMCA is located within the Scotian Shelf Marine Region and is located adjacent to Kejimkujik National Park Seaside, and extending 100 km off the coast (Parks Canada, 2023). There is also potential for another NMCA to be established in coastal areas off Cape Breton Highlands National Park (Parks Canada, 2023). Parks Canada recommends that both be excluded from areas where OSW development might occur (Parks Canada, 2023).

4.4.3 Marine Bird Colonies

Marine Bird Colony (MBC) maps were provided by ECCC and represent areas used by species to court, mate, lay and incubate eggs, and raise and feed chicks. These areas provide important habitat for many seabirds, shorebirds and waterfowl and are crucial for evaluating risks to birds transiting between nesting and feeding grounds.

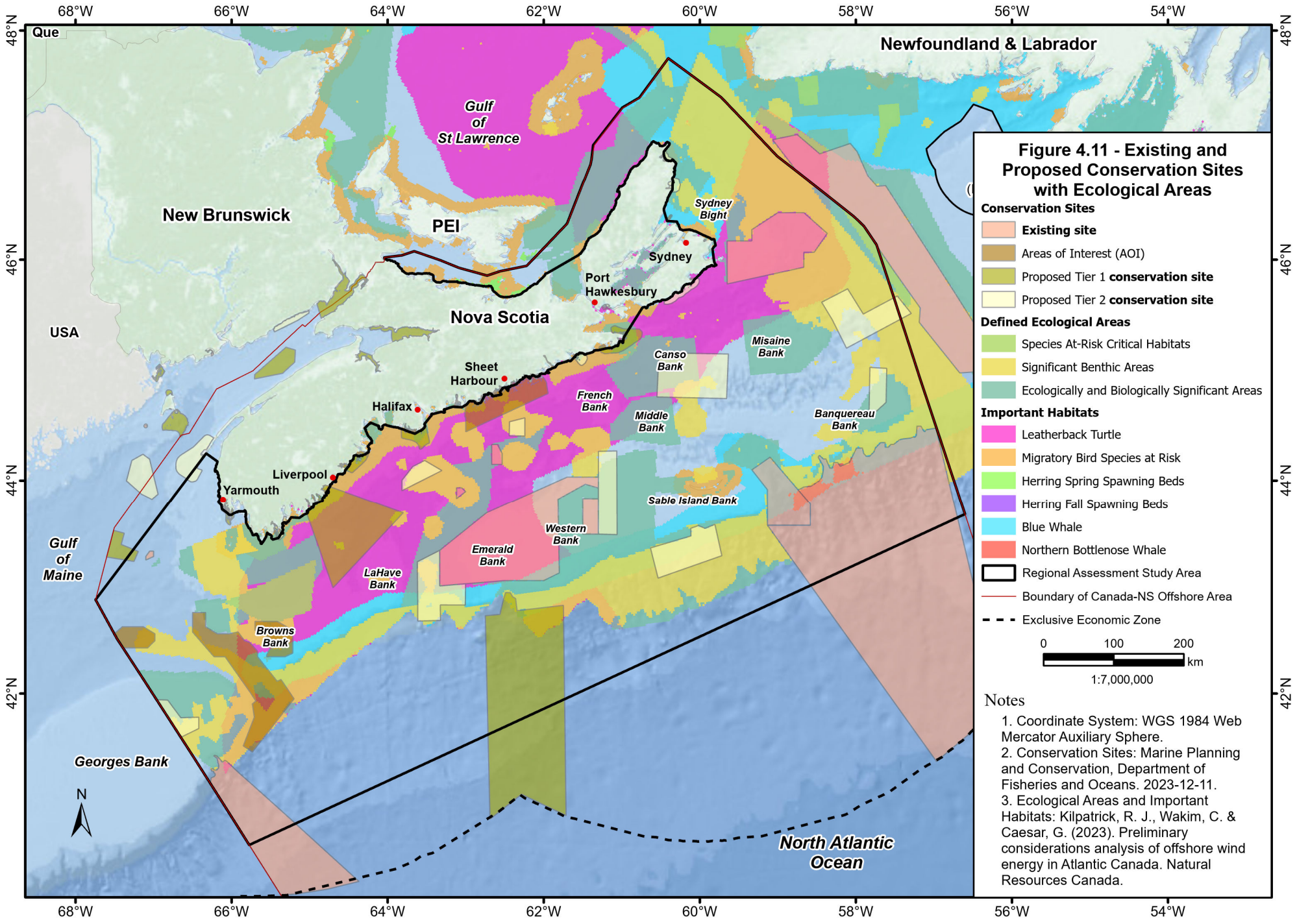
4.4.4 Sea Duck Key Habitat Sites

Sea duck key habitat sites are designated areas known as crucial importance to sea ducks, particularly during migration and breeding seasons (ECCC, 2024i). The mapping provided by ECCC included available survey data and expert knowledge for wintering common eider, buffered blocks of coastline and coastal islands that provide eastern harlequin duck habitat and expert knowledge of scoter and eider molting areas.

4.4.5 Protected and Special Areas

Several marine (offshore) and coastal areas in NS have been designated as protected under federal, provincial or other legislation or agreements due to their ecological, historical or socio-cultural characteristics and importance. Other areas, while not having legal protections, have been formally identified as being special or sensitive through other relevant processes and initiatives.

This section identifies and describes those special areas that are within or around the RA Study Area and are presented on Figure 4.11.


68°W
66°W
64°W
62°W
60°W
58°W
56°W
54°W
48°N
46°N
44°N
42°N
Que
Newfoundland & Labrador
Gulf of St Lawrence
New Brunswick
PEI
Sydney Bight
Sydney
Port Hawkesbury
Nova Scotia
USA
Misaine Bank
Canso Bank
Sheet Harbour
French Bank
Halifax
Middle Bank
Banquereau Bank
Liverpool
Yarmouth
Sable Island Bank
Western Bank
Emerald Bank
Gulf of Maine
LaHave Bank
Browns Bank
Georges Bank
N
North Atlantic Ocean
Figure 4.11 - Existing and Proposed Conservation Sites with Ecological Areas
Conservation Sites
Existing site
Areas of Interest (AOI)
Proposed Tier 1 conservation site
Proposed Tier 2 conservation site
Defined Ecological Areas
Species At-Risk Critical Habitats
Significant Benthic Areas
Ecologically and Biologically Significant Areas
Important Habitats
Leatherback Turtle
Migratory Bird Species at Risk
Herring Spring Spawning Beds
Herring Fall Spawning Beds
Blue Whale
Northern Bottlenose Whale
Regional Assessment Study Area
Boundary of Canada-NS Offshore Area
Exclusive Economic Zone
0
100
200
km
1:7,000,000
Notes
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere.
2. Conservation Sites: Marine Planning and Conservation, Department of Fisheries and Oceans. 2023-12-11.
3. Ecological Areas and Important Habitats: Kilpatrick, R. J., Wakim, C. & Caesar, G. (2023). Preliminary considerations analysis of offshore wind energy in Atlantic Canada. Natural Resources Canada.

Federally Designated Areas

In Canada, several pieces of legislation and other processes are used by federal departments and agencies to protect and conserve marine ecosystems. The following sections discuss Canada's management framework, and the measures used to identify and protect special areas in marine and coastal locations. A list of federal legislation allowing for the establishment of protected and otherwise special areas, along with the lead department or agency, is provided in Table 4.8.

Table 4.8. Federal Legislation and Associated Special Areas

Legislation	Type of Special Area	Lead Department / Agency	Purpose
Oceans Act, 1996, c.31	Marine Protected Areas	DFO	To conserve and protect fish, marine mammals and their habitats; unique areas; areas of high productivity or biological diversity.
Fisheries Act, 1985, c.43	Fisheries Closure Areas, Marine Refuges	DFO	To conserve and protect fish and fish habitat; and to manage fisheries (among other purposes).
Migratory Birds Convention Act, 1994, c. 22	Migratory Bird Sanctuary	ECCC	To conserve and protect habitat for migratory bird species.
Canada Wildlife Act, R.S., 1985, c.W-9	National Wildlife Area	ECCC	To conserve and protect habitat for a variety of wildlife, including migratory birds and species at risk.
Canada National Marine Conservation Areas Act, 2002, c. 18	National Marine Conservation Areas	Parks Canada	To conserve and protect representative examples of Canada's natural and cultural marine heritage and provide opportunities for public education and enjoyment.
Canada National Parks Act, 2000, c.32	National Park / National Park Reserve	Parks Canada	To protect representative examples of Canada's natural heritage for the benefit, education and enjoyment of Canadians.

Source: Government of Canada, 2024a.

In addition to the above list, DFO continues to develop a draft conservation network plan for the Scotian Shelf-Bay of Fundy Bioregion (DFO, 2023c). The latest draft reflects new science information on climate change, updated human-use activities (such as fisheries data), and feedback from consultations. The current dataset now includes the latest existing and proposed Tier 1 (higher priority for implementation and are among the sites that could be selected for advancement by 2030) and Tier 2 (important to create a representative conservation network but will not be considered for advancement by 2030) conservation sites. The boundaries for these sites however are preliminary and subject to change following ongoing public consultation (DFO, 2024b). This section identifies and describes those special areas that are within or around the RA Study Area and are presented on Figure 4.11.

Ecologically and Biologically Significant Areas

Ecologically and Biologically Significant Areas (EBSAs) are areas within Canada's oceans that have been identified through formal scientific assessments as having special biological or ecological significance when compared with the surrounding marine ecosystem (Government of Canada, 2024b). Their origins as a management tool are traced back to *Canada's Ocean Act,* and DFO has developed criteria for their establishment as part of its integrated ecosystem approach to management (DFO, 2018c). The goal of the EBSA process is to "facilitate provision of a greater-than-usual degree of risk aversion in management of activities in areas of especially high ecological and biological significance" (DFO, 2004). While most areas have some ecological function, the EBSA process seeks to identify areas that are considered "significant" and that if the area were to be disturbed the ecological consequences (in space, in time, or outward through the food web) would likely be greater than the effect of an equal disturbance of most other areas, although it is recognized that the nature of those consequences could differ greatly among specific cases (DFO, 2004).

On their own, EBSAs do not impose any legal restrictions on resource development or other human activities. They can, however, help to prioritize areas where such restrictions may be required to protect the integrity of a significant ecosystem or feature, (Hastings *et al.*, 2014), sometimes leading to a Marine Protected Area (MPA) designation.

To date, there are 18 EBSAs identified in the offshore component of the Scotian Shelf Bioregion (King *et al.*, 2016) and 47 EBSAs identified for the Atlantic coast inshore (Hastings *et al.*, 2014). Of the 47 inshore EBSAs identified, 38 are located either fully or partially within the RA Study Area. The offshore EBSAs have undergone further study and refinement since their initial identification, and their boundaries have been adjusted based on new data and analysis (King *et al.*, 2016).

Marine Protected Areas and Areas of Interest

The creation and establishment of MPAs in Canada is facilitated through the federal *Oceans Act*, with DFO administering the process of identifying, establishing and managing such areas.

The process for creating an MPA begins with the identification of Areas of Interest (AOI) within the different bioregions in Canada. This process is carried out by DFO, in consultation with other federal departments and scientific experts. The selected AOIs are subject to public review, and detailed

assessments for biological/ecological, socioeconomic and cultural factors undertaken. Once these analyses have been completed, a decision is made on whether to formally designate an MPA. Once an area has been designated, regulations are created that dictate what activities may or may not occur within the MPA. For the existing MPAs in Nova Scotia, prohibited activities include disturbing, damaging, destroying or removing living organisms or habitat; or depositing, discharging or dumping substances that may have the same result (DFO, 2023c, 2023d, 2023e, 2023f). Additional permissions or prohibitions for other activities are set out in the regulations specific to the area in question.

There are currently two MPAs: The Gully MPA; and St. Ann's Bank MPA, located within the RA Study Area (Table 4.9). The Gully MPA is located east of Sable Island National Park Reserve, on the edge of the Scotian Shelf (DFO, 2024c). The regulations for this MPA require that any activity carried out within its vicinity must not damage the ecosystem (*Oceans Act*, 1996). The St. Ann's Bank MPA is located east of Cape Breton and includes most of St. Ann's Bank, Scatarie Bank and a portion of the Laurentian Slope and Channel (Ford and Serdynska, 2013). St. Ann's Bank became an MPA under the *Oceans Act* in 2017; regulations include four management zones with varying levels of protection based on conservation objectives and ecological sensitivities (DFO, 2019a).

In addition to these two MPAs, there are two Areas of Interest (AOIs) located within the RA Study Area: Eastern Shore Islands AOI and Fundian Channel Browns-Bank AOI (Table 4.9). The Eastern Shore Islands AOI includes the nearshore waters surrounding the dense archipelago on the eastern shore of NS (DFO, 2023g). The site stretches from Clam Bay near Jeddore Harbour to Barren Island near Liscomb Point and extends approximately 25 km from the mainland into the Scotian Shelf bioregion (DFO, 2023g). The Fundian Channel Browns-Bank AOI includes two geographically separate components (DFO, 2023h): the western section is centred on Georges Basin while the larger eastern section encompasses the Fundian Channel (also known as the Northeast Channel) and part of Browns Bank (DFO, 2023h). A portion of the area is currently protected as a marine refuge, called the Northeast Channel Coral Conservation Area. Currently, DFO is working to establish a network of MPA areas within the Nova Scotian Shelf Bioregion, which could include additional areas within the RA Study Area (DFO, 2023c, 2023d).

Table 4.9. Marine Protected Areas and Areas of Interest in Nova Scotia

Name	Area (Kms^2)	Summary of Area
The Gully MPA	2,363	• The Gully is the largest underwater canyon in the western North Atlantic, home to the endangered Scotian Shelf population of Northern bottlenose whales and an important habitat for 15 other species of whales and dolphins. • In addition, plankton, a variety of fish species including sharks, tunas and swordfish, as well as seabirds, inhabit the surface waters, and halibut, skates, cusk and lanternfish can be found at depths as great as one kilometre. • The ocean floor supports crabs, sea pens, anemones, brittle stars,

Name	Area (Kms^2)	Summary of Area
		and approximately 30 species of cold-water corals.
St. Ann's Bank MPA	4,364	• St. Ann's Bank has the highest annual sea surface temperature range on the Scotian Shelf and provides important habitat for commercial and non-commercial species, e.g., Atlantic cod, redfish, white hake, witch flounder, and a variety of sponges, corals and sea pens. Scientific surveys have recorded more than 100 species in this area, including Endangered and Threatened marine species such as leatherback sea turtles, Atlantic wolffish, Atlantic cod, American plaice and redfish. • St. Ann's Bank MPA consists of four management zones and is part of an important migration corridor for fish and marine mammals, including whales, moving in and out of the Gulf of St. Lawrence and St. Lawrence Estuary.
Eastern Shore Islands AOI	2,000	• This area includes rich beds of eelgrass, kelp and salt marsh that provide important habitat for many marine species, including commercial species that use these habitats as juveniles. Estuaries associated with several rivers that drain into this site are considered important habitat for endangered Atlantic salmon. • This area provides important nesting and foraging grounds for many colonial seabirds and shorebirds. Many of the islands are protected through provincial and private conservation efforts, including current efforts by the NS Nature Trust's "100 Wild Islands Legacy Campaign".
Fundian Channel Browns-Bank AOI	7,200	• This area supports important oceanographic processes, diverse benthic habitats, several depleted species, e.g., groundfish, and deep-sea coral and sponge habitats. • The Northeast Channel portion of the area contains the densest known concentrations of large gorgonian corals in Atlantic Canada; the Browns Bank portion contains significant concentrations of sponges. • The channel is also the largest entrance to the Gulf of Maine from the open Atlantic Ocean and many species, e.g., basking sharks, use it as a migration corridor. • This Area of Interest includes Georges Basin and the Fundian Channel (also known as the Northeast Channel) and part of Browns Bank. • A portion of the area is currently protected as a marine refuge,

Name	Area (Kms^2)	Summary of Area
		called the Northeast Channel Coral Conservation Area.
Sources: DFO, 2019a, 2020b, 2023b, 2023c, 2023d, 2023g.		

Regulations restricting activities are similar among Marine Protected Areas (MPAs), while Areas of Interest (AOIs) do not have mandated regulations. Regulations for MPAs include prohibiting any activities that disturb, damage, destroy or remove living marine organisms or any part of their habitat, unless the activity is listed as an exception in the Regulations or approved by the Minister (DFO, 2017a, 2019a, 2020b).

Marine Refuges and Fisheries Closure Areas

The identification of Marine Refuges is another *Fisheries Act* initiative that DFO may employ to implement conservation measures. This includes closing areas to specific types of commercial or recreational fishing activity. These areas are designated to help Canada achieve its ocean protection commitments, including meeting Canada's conservation target of protecting 25% of our oceans by 2025 and 30% by 2030, as highlighted in the Fifth International Marine Protected Areas Congress (DFO, 2023b). Marine Refuges are considered by DFO as "Other Effective Area Based Conservation Measures", which are complementary to MPAs to help protect coastal and marine areas. The process for determining these areas uses five broad criteria (DFO, 2017b):

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

Once these areas are selected, they are implemented using management measures under the *Fisheries Act*, such as fishing licence conditions and variation orders. To date, DFO has designated six Marine Refuge Areas within the Scotian Shelf Bioregion; all are located wholly or partially within the RA Study Area. Except for the Corsair and Georges Canyons Conservation Areas (DFO, 2019b), (to the southwest

of the region), the Conservation Areas are listed in Table 4.10. Regulations in most of these areas either prohibit bottom contact fishing or have limitations on what type of fishing activity can occur to conserve the existing ecological / biological functions that the area provides to the marine and benthic communities it supports. This includes the conservation of corals and sponges, as well as fish and invertebrate species that are considered ecologically, socially or commercially important (DFO, 2017b; 2018a).

Table 4.10. Marine Refuges and Fisheries Closure Areas in Nova Scotia

Name	Area (kms^2)	Conservation Objective	Prohibited Activities
Eastern Canyons Conservation Area	43,976	Protects cold-water corals including significant areas of large gorgonian coral concentrations and deep-water frontier area.	All communal commercial and commercial bottom-contact fishing gear is prohibited except for bottom longline gear permitted within a small zone provided the fishing vessels have at-sea observers onboard.
Emerald Basin and Sambro Banks Sponge Conservation Areas (Two fisheries area closures)	260	Protects significant concentration of glass sponges (*Vazella pourtalesi).*	All commercial bottom-contact fishing gear. No human activities that are incompatible with the conservation of the ecological components of interest may occur or be foreseeable within the area.
Jordan Basin Conservation Area	49	Protects cold-water corals including significant densities of seacorn corals (*Primnoa resedaeformis*).	All commercial bottom-contact fishing gear. No human activities that are incompatible with the conservation of the ecological components of interest may occur or be foreseeable within the area.
Lophelia Coral Conservation Area	15	Protects only known *Lophelia pertusa* coral reef in Canadian Atlantic waters.	All commercial bottom-contact fishing gear. No human activities that are incompatible with the conservation of the ecological components of interest may

Name	Area (kms^2)	Conservation Objective	Prohibited Activities
			occur or be foreseeable within the area.
Northeast Channel Coral Conservation Area (restricted bottom fisheries zone)	391	Protects cold-water corals and includes high densities of intact octocorals.	All commercial bottom-contact fishing gear. No human activities that are incompatible with the conservation of the ecological components of interest may occur or be foreseeable within the area.
Western/Emerald Banks Conservation Area (restricted fisheries zone)	10,234	Supports productivity objectives for groundfish species of Aboriginal, commercial and/or recreational importance, particularly NAFO Division 4VW haddock. Manages the disturbance of benthic habitat that supports juvenile and adult haddock and other groundfish species.	All commercial and recreational fisheries using bottom-contact gear and/or gear known to interact with groundfish. No human activities that are incompatible with the conservation of the ecological components of interest may occur or be foreseeable within the area.
Scallop Buffer Zones (SFA 21, 22, 24)	5,835	These closures offer protection to other important species such as juvenile lobster, crab and others, and their habitats in the southern Gulf of St. Lawrence.	The ecological components of interest are effectively conserved through prohibition of scallop dragging. No human activities that are incompatible with the conservation of the ecological components of interest may occur or be foreseeable within the area.
Sources: DFO, 2019c, 2019d, 2019e, 2019f, 2019g; 2021; 2022a.			

In addition to the federal initiatives listed above, the province implements several conservation initiatives including Game Sanctuaries and Wildlife Management Areas. Although land-based, some of the species occurring in these may include animals that forage at sea and may therefore come into conflict with OSW turbines or activities.

4.4.6 Critical Habitat

Critical Habitat is defined under section 2 of SARA as the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' Critical Habitat in the recovery strategy or in an action plan for the species. In the marine environment this can include breeding grounds, feeding areas and migration routes for various species. Protection of Critical Habitat ensures that key ecosystems remain intact and resilient with the intent to prevent further population declines and long-term recovery of species at risk.

4.5 Commercial Fishing

Commercial fisheries within the RA Study Area are extremely important to both the regional and national economy. Of the nearly 200 fish species known to be present on the Scotian Shelf, more than 25 species are or were the focus of important commercial fisheries, representing some 50 distinct stocks. In addition, there are six invertebrate species, lobster, scallop, snow crab, shrimp, sea cucumber and whelk that are harvested commercially (MacLean *et al.*, 2013). The primary fish species that have been or continue to be exploited from the Scotian Shelf include the groundfish (cod, halibut, haddock, pollock, monkfish, skates and flounders) and several pelagic species (notably herring, Atlantic mackerel, dogfish, tunas, swordfish and several sharks). Several of these species have been reduced in population size sufficiently to warrant closure of some stocks, e.g., cod, haddock, pollock, plaice and wolffish; other species are ranked as 'of concern', e.g., mackerel, dogfish and haddock (MacLean *et al.*, 2013).

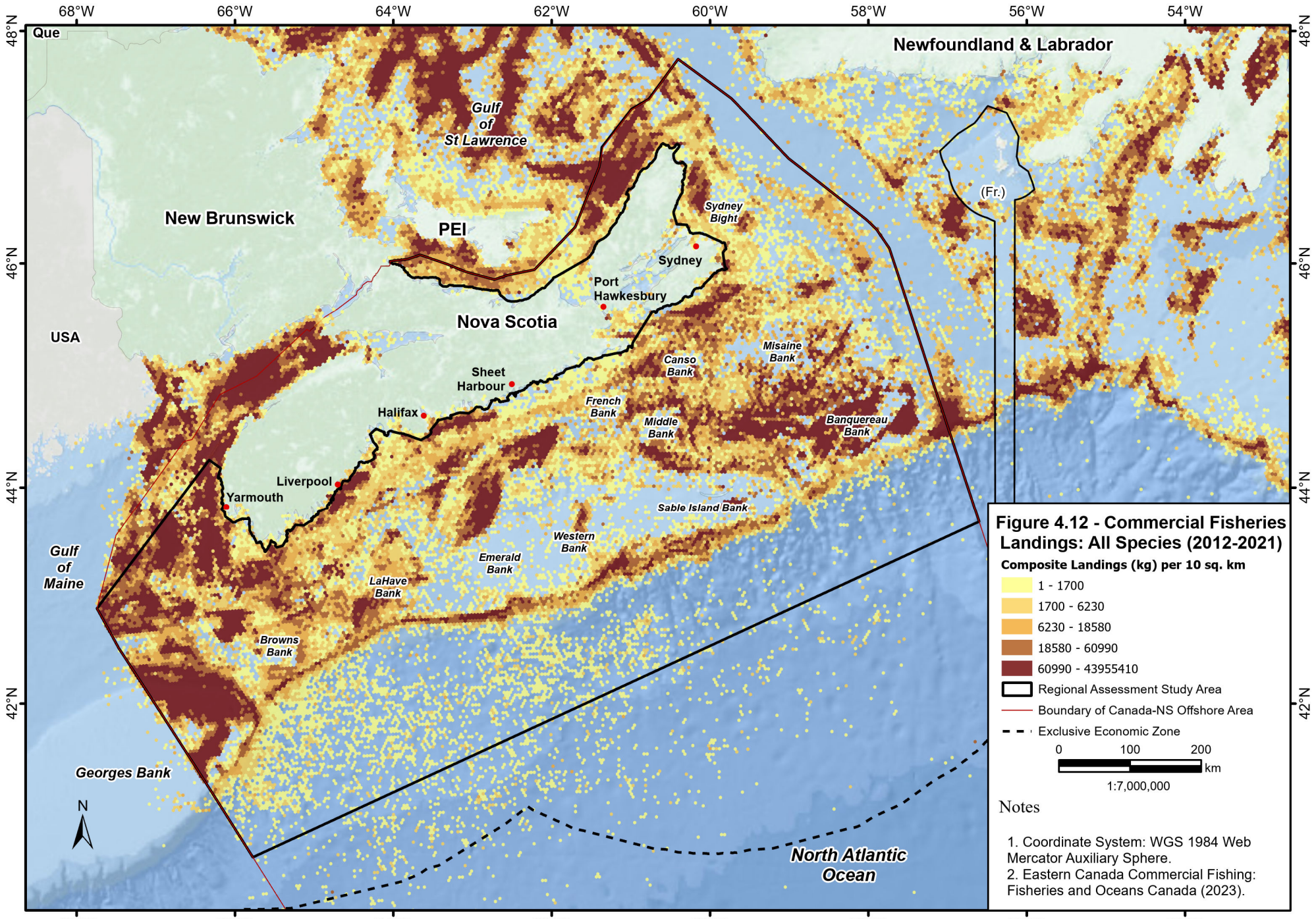
Several types of fishing gear are used within the RA Study Area. In some fisheries, one specific fixed gear type is used, such as crab pots or lobster traps. In other mobile fisheries, e.g., groundfish, many different gear types can be used, e.g., baited longline, gillnets, shrimp trawls, bottom trawls, dredge, handlines, harpoon and spear. In general, gear types can be classified into either fixed or mobile gear. Mobile and fixed gear harvesting are not always compatible and may have a high potential for gear conflict if fishing in the same area at the same time. For example, bottom otter trawls and bottom longlines or nets, or shrimp trawls, are incompatible with lobster or snow crab trap fisheries. More details about the species captured by each fishing technique are provided in Table 4.11.

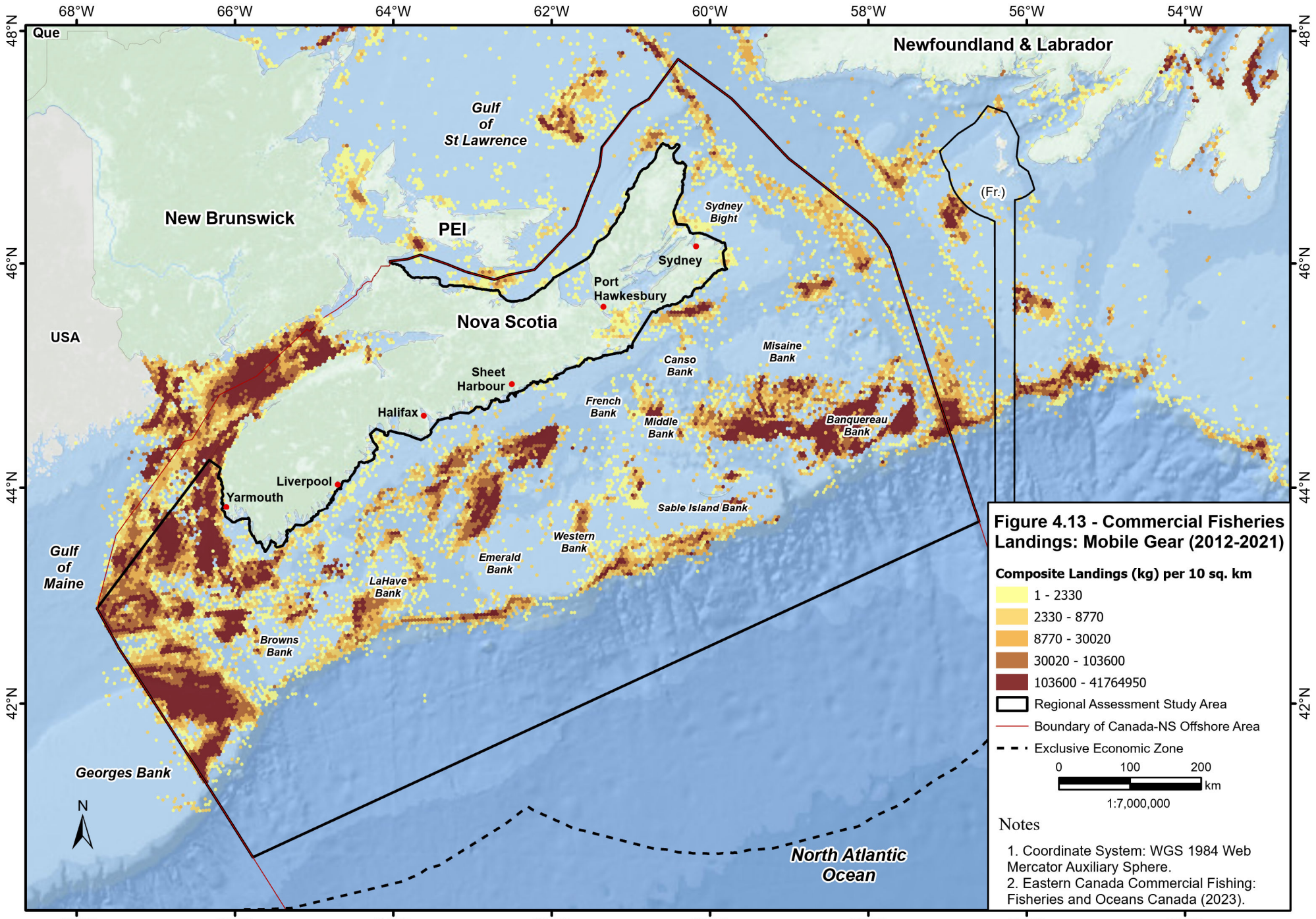
The area falls within 4 Northwest Atlantic Fisheries Organization (NAFO) fisheries management areas: 4X, 4W, 4Vs and 4Vn. Licenses for many species are issued with application to a specific NAFO area (NAFO, 2024) and managed through the establishment of the Total Allowable Catch (TAC) assigned to each license. In contrast, in the case of lobster, management involves limitations on the number and design of traps set by license holders rather than TAC; the results are recorded as totals landed within each Lobster Fishing Area (LFA), except for LFA 41 where a TAC is also applied (DFO, 2022b, 2022c, 2022d; 2023i).

It is difficult to summarize the commercial fisheries for several reasons:

1. the numerous techniques used to capture fish, depending upon the species' behaviour, distributions and movements;
2. some of the techniques used are specific in terms of the species captured, e.g., 'fixed gear' such as crab and lobster pots, whereas other mobile techniques (longlining and trawling) can capture a variety of species;
3. the locations within the RA Study Area where a specific fishing technique is deployed varies considerably: in some cases, such as the scallop and sea cucumber fisheries, the water depth and bottom conditions determine a relatively limited number of locations, whereas pelagic fish may be pursued by mobile gear (longlining, trawling) over many areas from the near shore to the edge of the Scotian Shelf;
4. the management of each fishery is often unique to each target species: e.g., in terms of the application of TACs (which is most common); limitations of gear design, numbers of traps (etc.); and seasons. Some fishing strategies such as those for scallop and sea cucumber are more akin to farming, where areas that are fished in one year are allowed to lie fallow for successive years to allow stocks to rebuild; and
5. changes in abundance, location and interactions of target species resulting from overfishing and/or climate change.

Fishing activities vary across the RA Study Area, reflecting the patterns of distribution of different highly valued species. Most of the lobster fishing has traditionally been conducted near to the NS coastline, although it appears to be changing as stocks are detected moving north and east. Groundfish harvesting by trawl or longline has taken place further offshore, while scallop, sea cucumber and whelks are associated with the tops or sides of banks, and snow crab is associated with the deeper channels. Longlining for larger pelagics such as the tunas, swordfish, sharks and halibut (etc.) tends to be most productive along the edges of the Shelf.


68°W
66°W
64°W
62°W
60°W
58°W
56°W
54°W
48°N
46°N
44°N
42°N
Que
Newfoundland & Labrador
Gulf of St Lawrence
New Brunswick
PEI
Sydney Bight
Sydney
Port Hawkesbury
Nova Scotia
USA
Misaine Bank
Canso Bank
Sheet Harbour
French Bank
Halifax
Middle Bank
Banquereau Bank
Liverpool
Yarmouth
Sable Island Bank
Western Bank
Gulf of Maine
Emerald Bank
LaHave Bank
Browns Bank
Georges Bank
North Atlantic Ocean
(Fr.)
N
Figure 4.12 - Commercial Fisheries Landings: All Species (2012-2021)
Composite Landings (kg) per 10 sq. km
1 - 1700
1700 - 6230
6230 - 18580
18580 - 60990
60990 - 43955410
Regional Assessment Study Area
Boundary of Canada-NS Offshore Area
Exclusive Economic Zone
0
100
200
km
1:7,000,000
Notes
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere.
2. Eastern Canada Commercial Fishing: Fisheries and Oceans Canada (2023).


68°W
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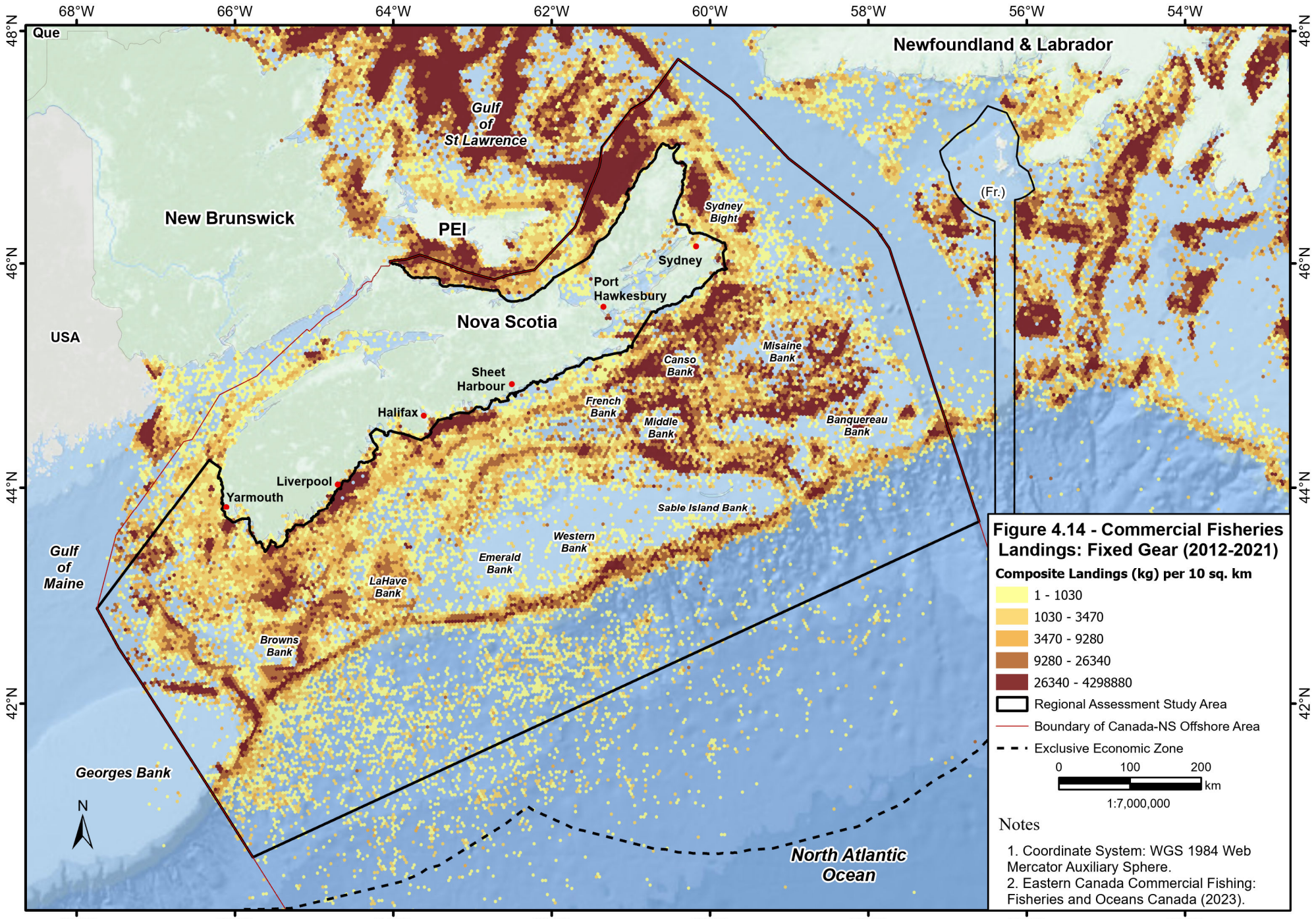
44°N
42°N
Que
Newfoundland & Labrador
Gulf of St Lawrence
New Brunswick
PEI
Sydney Bight
Sydney
Port Hawkesbury
Nova Scotia
USA
Misaine Bank
Canso Bank
Sheet Harbour
Halifax
French Bank
Middle Bank
Banquereau Bank
Liverpool
Yarmouth
Sable Island Bank
Western Bank
Emerald Bank
LaHave Bank
Gulf of Maine
Browns Bank
Georges Bank
North Atlantic Ocean
(Fr.)
N
Figure 4.13 - Commercial Fisheries Landings: Mobile Gear (2012-2021)
Composite Landings (kg) per 10 sq. km
1 - 2330
2330 - 8770
8770 - 30020
30020 - 103600
103600 - 41764950
Regional Assessment Study Area
Boundary of Canada-NS Offshore Area
Exclusive Economic Zone
0
100
200
km
1:7,000,000
Notes
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere.
2. Eastern Canada Commercial Fishing: Fisheries and Oceans Canada (2023).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Sydney Bight
Sydney
Port Hawkesbury
Nova Scotia
USA
Misaine Bank
Canso Bank
Sheet Harbour
French Bank
Halifax
Middle Bank
Banquereau Bank
Liverpool
Yarmouth
Sable Island Bank
Western Bank
Emerald Bank
LaHave Bank
Gulf of Maine
Browns Bank
Georges Bank
North Atlantic Ocean
(Fr.)
N
Figure 4.14 - Commercial Fisheries Landings: Fixed Gear (2012-2021)
Composite Landings (kg) per 10 sq. km
1 - 1030
1030 - 3470
3470 - 9280
9280 - 26340
26340 - 4298880
Regional Assessment Study Area
Boundary of Canada-NS Offshore Area
Exclusive Economic Zone
0
100
200
km
1:7,000,000
Notes
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere.
2. Eastern Canada Commercial Fishing: Fisheries and Oceans Canada (2023).

Table 4.11. Summary of Nova Scotia Fisheries (Maritime Region)

Main species	Technique(s)	# Licenses (Maritimes Region), 2022	Total Allowable Catch (tonnes)
Atlantic bluefin tuna	Longline surface (pelagic), bottom gillnets	153	2,350 t (2018-2020)
Clam (Arctic surf clam, quahog)	Dredge, diving	711	Quahog 12,387 t (2020); Arctic surf clams 20,943 t (2022)
Crab	Pot/trap, bottom trawling	331	8,449 t (N-ENS, S-ENS and 4X; 2022)
Groundfish (Cod, halibut, haddock, pollock, flounder, hake, sole, barracuda, mullet, rockfish, seabass, shad, sturgeon)	Bottom gillnets, drift nets, midwater trawls, longline bottom (groundfish)	2,074	For 2022 – 2023, TACs across these species ranged from 660 mt for Atlantic cod (4X5Y) to 16,500 t for winter flounder (4X).
Herring	Bottom gillnets, drift nets, Purse seine	1,499	8,000 t (2022)
Salmon	Bottom gillnets, drift nets, shore seine, grappling devices, e.g., harpoon and spear	0	0
Scallops	Bottom trawl, dredge, diving	270	5,005 t (2022)
Shortfin squid	Jiggers, handlines (SFA 17 –21), bottom and midwater trawls (4WX)	389	Directed fishery in the past, now mainly by-catch
Shrimp	Pot/trap, bottom trawl	51	2,300 t (SFA 13,14,15,16; 2022)
Swordfish	Bottom gillnets, drift nets, longline surface (pelagic),	852	734 t (2020)

Main species	Technique(s)	# Licenses (Maritimes Region), 2022	Total Allowable Catch (tonnes)
	grappling devices, e.g., harpoon and spear		
Whelk	Conical traps	Experimental fishery until Spring 2024	700 t (4VS)
Other (Oysters, mussels, sea urchins, slime eel/hagfish, sea cucumber, conch, whiting, red hake, dogfish, flounder, cod, turbot, lumpfish, blackback flounder, winter flounder, American plaice, white hake, sablefish, sharks)	Dredge, diving, bottom trawl, gillnets, pot/trap, bottom gillnets, drift nets, longline bottom (groundfish)	1,309	Sea cucumber 2,300 t (2022-23), hagfish 1,550 t (2023)

Sources: DFO, 2020c, 2020d, 2020e; 2022b, 2022c, 2022d, 2022e, 2022f, 2022g, 2022h, 2022i, 2022j, 2022k, 2022l, 2023j, 2024d; Perennia, 2023a, 2023b, 2023c; Rozalska and Coffen-Smout, 2020.

Total number of species licenses issued in Maritimes Region for NS in 2022 was 10,259.

With such a variety of fishing techniques being used in the RA Study Area, there is also a comparable variety of vessel sizes involved (Table 4.12; DFO, 2021, 2023j). These vessels require diverse harbour facilities for their maintenance and servicing. In addition, this varied fleet, together with its experienced crews, represents a distinct asset to facilitate future marine activities and to provide support for possible OSW development.

Table 4.12. Summary of Vessel Lengths in Nova Scotia (Maritimes Region) (2022)

<35’	35’ - 44’11”	45’-64’11”	65’-99’11”	>100’	Total
1,070	1,500	580	11	25	3,186

Sources: DFO, 2021, 2023j.

Gear conflicts are important when considering potential interactions with offshore wind operations and their infrastructural components. Fisheries using mobile gear such as a trawl or long lines could, for example, become entangled with the anchor lines of a floating OSW turbine. The Committee was advised that longlines, which may be many kilometres in length, cannot be effectively controlled, and

may drift considerable distances from the original target line. It thus becomes unlikely that such a technique could be used safely within a windfarm – even though the turbines may be > 3 km apart.

Pre-construction investigations, such as seismic surveys, could interact with surface level marker buoys for fixed gear, e.g., pots, as well as interacting with near surface longlines that may be set in the vicinity of the survey area.

As mentioned above, probably the most important cause of changes in fish stocks of the Scotian Shelf has been the overexploitation of the fisheries, particularly, but not only of groundfish, during the decades prior to the 1990s. These changes caused a significant ecosystem response, including increases in primary production and invertebrates, e.g., shrimp and crab, and reductions in the numbers of many long-lived groundfish species (Bundy, 2005; Choi *et al.*, 2005; Bernier *et al.*, 2018; Wood Canada Ltd., 2022). It was also associated with an increased abundance of some cold-water fish species including capelin and Greenland halibut (Wood Canada Ltd., 2022).

As groundfish stocks collapsed, the whole fishery complex changed from one dominated by fin fish to one based primarily upon shellfish – in landings, but also particularly in value (DFO, 2007, 2010; MacLean *et al.*, 2013). Commercial landings of pelagic fish, for example, declined from > 200,000 tonnes in the 1970s to < 60,000 tonnes in 2015, while invertebrate landings rose from <25,000 to ~100,000 tonnes in the same period (Bernier *et al.*, 2018, 2023). Despite regulatory actions intended to enable the recovery of previously important stocks, some have not recovered. In several cases, species that are adapted to cool water, e.g., Atlantic cod, might never recover if coastal waters continue to warm.

4.6 Socio-Economics

The potential to develop OSW to the benefit of Nova Scotians is dependent on many factors, but central to the discussion is the capacity and capability to accommodate this industry at the scale that has been posited, e.g., 5 GW as suggested by the province, or 15+ GW as has been articulated by others (Nicholson, 2023). However, it is important to consider and understand if the province has the labour force or skills necessary, and if the infrastructure, both physical (ports, roads etc.) and social (housing, education, medical etc.) can accommodate the demands that may be generated. Although the focus of this RA is principally concerned with the ecological consequences of potential OSW development, the TOR requires that the Committee focus on certain other components including Indigenous Communities, Activities, Interests and Rights; Visual Aesthetics; Physical and Cultural Heritage; Health; Communities and the Economy. The intent of this section is to provide sufficient data to enable the consideration of these factors in the balance of the report.

4.6.1 Demographic Profile

The population of NS is growing, and the rate has accelerated over the last five years. The average growth rate between 2002 and 2021 was 1.1% with no annual increase above 2.5%. Between 2021 and 2022, the population grew by 2.9% (Turner Drake *et al.*, 2022). As of July 1, 2023, the population of the province was estimated to be 1,058,694, an increase of 33,249 (+3.24%) over the 2022 estimate of

1,025,445. In absolute and percentage terms, Nova Scotia's population grew faster in this year than in any comparable period in either the modern data series which started in 1971, or in the historical records (1921-1971) (NS Economics and Statistics, 2024). Growth continues: as of April 2024, the population of NS was estimated to be 1,072,545, an increase of 13, 851 since July 2023. Although there has been growth in all parts of the province, the growth has been greatest in the Halifax Regional Municipality (HRM). As deaths outnumber births, this growth is attributable solely to international and inter-provincial migration.

The significant increase in international and inter-provincial migration has caused the median age of the provincial population to fall from 44.5 years as of July 2022 to 43.8 years as of July 2023. It has also contributed to a reversal in the decline of those in the younger age cohorts, particularly for those aged 0-14, 15-34 and 35-49. Although this represents an increase in the numbers of working age people in the province, the median age in NS remains the third highest in the country and significantly above the national median age of 40.6 years. As indicated in Table 4.13, the population in NS is older than the national population and over the past decade has become older despite the growth through immigration that has been accommodated.

Table 4.13. Population Estimates by Age

Year		Canada			Nova Scotia	
	0-14	15-64	65+	0-14	15-64	65+
2015	16.2%	67.7%	16.0%	14.2%	66.8%	18.9%
2020	16.0%	66.1%	17.9%	14.0%	64.8%	21.2%
2023	15.4%	65.7%	18.9%	13.7%	64.3%	22.1%

Source: Statistics Canada, 2024. Demographic estimates by age and gender, provinces and territories: Interactive dashboard.

Indigenous Population

The Mi'kmaq are the founding people of Nova Scotia. There are 13 Mi'kmaq communities in NS with populations ranging from approximately 300 in Annapolis Valley First Nation to over 4,700 in Eskasoni First Nation. Table 4.14 indicates that in 2024, there were 19,302 Mi'kmaq in the province, of which 11,180, or 58%, lived on reserve. 58% of the Indigenous population is affiliated with one of the five communities located on Cape Breton.

Table 4.14. Population of Indigenous Communities in Nova Scotia

Reserve	On Reserve		Off Reserve				
	Males	Females	Males	Females	Males	Females	Total
Membertou	502	467	340	334	842	801	1,643
Wagmatcook	345	348	104	133	449	481	930
Eskasoni	2,007	2,031	356	391	2,363	2,422	4,785
We'koqma'q	481	518	55	72	536	590	1,126
Potlotek	331	315	104	110	435	425	860
Paqtnkek	200	227	77	110	277	337	614
Pictou Landing	254	256	94	90	348	346	694
Millbrook	474	483	719	736	1,193	1,219	2,412
Glooscap	34	66	165	172	199	238	437
Sipekne'katik	638	726	800	903	1,438	1,629	3,067
Annapolis Valley	65	55	85	118	150	173	323
Bear River	50	70	134	139	184	209	393
Wasoqopa'q	111	126	874	907	985	1,033	2,018
Total	5,492	5,688			9,399	9,903	19,302

Source: Crown-Indigenous Relations and Northern Affairs Canada, First Nations Profiles, 2024.

It is challenging to obtain a reliable breakdown of age cohorts of the Mi'kmaq population in the province because Statistics Canada includes in their 2021 tabulation of the Indigenous population all who identify as First Nations, i.e., individuals from other nations living in Nova Scotia, Metis and Inuk (Statistics Canada, 2021). In general, it can be said that the Mi'kmaq population is younger than the non-Indigenous population: the average age is 37 years while that of the non-Indigenous population is 44.3; Indigenous children (aged 14 and younger) represent 20.8% of their population compared to 13.9% of the non-Indigenous population (Indigenous Services Canada, 2022). Given the age and population growth of Indigenous peoples, this is a community that could contribute significantly to the development of a new industry in Nova Scotia.

African Nova Scotian

The population in NS who self-identify as Black today includes both the African Nova Scotian population who have had a presence in NS since the early 1700s and a significant number of first- and second-generation immigrants. Historic Black immigration was mostly enslaved people; a second wave, often referred to as the Black Loyalists, followed the American Revolution in the later part of the 18th century. Most towns, such as Sydney, Truro and Windsor, accommodated distinct Black neighbourhoods, but there is also a history of Black rural communities such as Birchtown near Shelburne, across the province. Located just outside of Shelburne, Birchtown was the largest of the independent Black Loyalist settlements. The community was founded in 1783 with a population that swelled to between 1500 and 2000 people; almost half of the Black Loyalists in NS (Black Loyalists Digital Collections, n.d.). Over time

there has been substantive growth and change in the Black community in NS, and today Halifax is home to the majority, or 72.9% of the population. The observations that follow have been extracted from the African Nova Scotian Prosperity and Well-being Index (ANS Index), an impressive compilation of data compiled to describe the community, to identify indictors of change and to provide data that will facilitate action and support initiatives for community well-being:

- the provincial Black population in 2021 was 28,220, an increase of 5,475 or 28% since 2016;
- in 2021, 20.4% of the total were immigrants, and more than half had arrived since 2016;
- the unemployment rate for the Black population remains consistently higher than that for the population as a whole;
- Black Nova Scotians have the highest population share of adults (ages 25-64) with only a high school diploma;
- 31.8% of Black Nova Scotian adults (ages 25-64) hold a university degree; and
- 17.6% of Black Nova Scotians lived in poverty in 2020 – down from 35.1% in 2015.

This population is growing and is younger statistically than the population at large. The community is recognized and supported by African Nova Scotian Affairs, a division of the NS Department of Communities, Culture, Tourism and Heritage (CCTH) and is working with others to support economic development and entrepreneurship within their numbers. Severe challenges remain, but the ANS Index suggests that steps are being taken to address the challenges in a collaborative fashion. This is also a community that could contribute to the development of a new industry in Nova Scotia.

Minority and Vulnerable Groups

The TOR require the Committee to "consider the intersection of sex and gender with other identity factors and make recommendations on the manner in which future impact assessments should consider and address these factors". This is a challenging requirement in the short time allotted to a regional assessment because it requires thorough data collection and analyses, and critical reflection, of the complex ways in which gender interacts with other identity factors such as race, ethnicity, age, disability, sexual orientation and socioeconomic status. It involves examining how different systems and structures, historic and current, create and reinforce conditions of inequity and social exclusion and requires consideration of how individuals and communities with different backgrounds and origins participate in the labour force, the identification of obstacles to that participation and how an industry new to the province, such as the OSW industry, might better engage with and employ members of the identified groups. To inform the Committee's analyses for this RA, the Canadian Research Institute for the Advancement of Women (CRIAW) was engaged to conduct research and prepare a report (Fusco *et al.,* 2024) on their findings including challenges and recommendations associated with attaining enhanced equity in the industry. The Committee took the findings under advisement in the recommendations articulated in section 10.

As of 2023, based on census material, 50.5% of the provincial population was female; 49.5% was male. Almost the same number of women (247,100) as men (250,000) were working. Their employment patterns, however, were different: more women (57%) worked in the service producing sector and more

(22%) worked part-time as compared to 13% of males. Although women's participation in the labour force has risen, inequities, as the preceding figures suggest, persist. There can be many reasons for the differences including education, family responsibilities, where one lives in the province and associated access to employment opportunities. It is well documented, however, that fulltime employment is central to financial well-being which, in turn, is linked to the accumulation of financial assets and greater economic security (Spiteri *et al.*, 2024).

Table 4.15 identifies several vulnerable groups identified by the province as being of particular interest in relation to housing need, and the changes in their numbers that have occurred between 2016 and 2021. As the population increases, the number of people in each group will also increase, but not necessarily proportionately. For example, senior age groups will continue to rise faster than other age groups. If immigration continues, which may be necessary to address labour needs, the number of visible minorities will likely also rise.

Table 4.15. Summary Estimates of Vulnerable Groups in Nova Scotia

Vulnerable Group	2016	2021	2016-2021	Reference population
Total	923,560	969,380	+5%	Total population
Single persons	118,670	131,850	+11%	Population 15+
Young adults (18-25)	88,695	89,805	+1%	Total population
Seniors (65+)	183,820	215,325	+17%	Total population
Persons with disabilities		253,130		Population 15+
Newcomers	21,690	43,730	+102%	Total population
LGBTQ2+		33,305		Population 15+
Transgender and non-binary persons		3,940		Population 15+
Indigenous persons	51,495	52,430	+2%	Total population
African Nova Scotians		3,805		Total population
Visible minority	58,650	93,430	+59%	Total population
Veterans		15,390		Total population
Unhoused persons		1,759		By name list

Source: Adapted from Turner Drake *et al.*, 2022.

Demographic Growth

Statistics Canada regularly prepares population growth scenarios both for the country and for each province. In August 2022, it released projections based on the 2021 census data. This work estimated that the population of NS in the lowest scenario would be 1,006,300 (lower than the current population) in 2043 and, in the highest scenario, 1,236,300 by 2043; the latter would represent growth of 163,755 people, or 15.3% over a 19-year period, significantly lower than the growth that has taken place in the last five years. The direction of change predicted for the population of working age was mixed,

depending on the scenario, but in all scenarios, the population aged 65 or older grew. Similarly, all scenarios showed more deaths than births meaning that demographic growth in the province was dependent on international or inter-provincial migration (NS Economics and Statistics, 2024). Even if growth was to continue at close to the current rate, i.e., fuelled by continued international and interprovincial migration, it is unlikely that the Premier's stated goal of 2 million people in NS by 2060 would be achieved.

Given this background it will be important to recognize where growth is occurring, e.g., in Indigenous communities and in neighbourhoods with high levels of immigration, and to ensure that those currently in junior high in these areas are made aware of the industrial changes that are taking place, the opportunities that will be created and the skills training and education programs that are targeted and available. Given the growth in these populations and the age differential that exists with the provincial population at large, focussed education about the potential of the OSW industry is to be encouraged.

4.6.2 An Evolving Economy

The provincial economy was established on the attributes of its location and on its natural resources: fishery, forestry and mining were important catalysts for economic survival and growth. Circumstances, however, have changed, and in 2023 all employment gains were in the service sector where 17,400 jobs were generated. The distribution of employment between sectors may be changing, but the provincial economy remains diverse; the following sectors contribute to that diversity and to the provincial gross domestic product (GDP):

- agriculture and fisheries;
- tourism and hospitality;
- information technology;
- healthcare;
- manufacturing; and
- energy.

The higher education system in the province is important to the economy on many fronts; it attracts students and researchers from across Canada and internationally, and its graduates have fuelled growth not only in the above sectors, but in other niche markets including ocean technology. According to the Halifax Partnership, this sector accounts for about one third of the total research and development undertaken in Nova Scotia, supporting advances in ocean observation and monitoring, marine robotics, underwater acoustics and ocean data analysis. Key facilities include the Department of Oceanography at Dalhousie University and the Bedford Institute of Oceanography, Canada's largest centre for ocean research. Together they provide a large pool of innovation and expertise available to all marine users, including the OSW industry.

Another important initiative with respect to the practical application of marine research is the Centre for Ocean Ventures and Entrepreneurship (COVE), a collaborative business and research community in Dartmouth designed to test and commercialize marine technology. Not only has COVE facilitated the

commercialization of marine research, but it played a pivotal role in the establishment of Samqwane'jk, a venture to connect Indigenous businesses and ocean technology companies and to provide training programs in seamanship, marine modelling etc., to Indigenous participants. This outreach is important not only to the marine sector, but to the transference of knowledge across communities and the weaving together of Indigenous knowledge with western science and helps to ensure recruits are better prepared for the new economic opportunities that OSW development may bring.

While the provincial population is growing, the labour force confronts a declining and aging workforce because of low birth rates, the aging population and the outmigration of young workers (21FSP, 2024). Employment in NS grew at an annualized rate of only 0.6% over the five years to 2024, underperforming the national average of 1.5% (IBIS World, 2024). The challenges to substantial growth that may accompany a new industry are real. The province will need not only to invest in new training programs, but also in the skills needed to support general construction. Turner Drake, for example, extracted data from the Canadian System for Tracking Apprenticeship Qualifications and determined that by the end of this decade NS would experience a shortage of bricklayers, carpenters, mobile crane operators, power line technicians, roofers and pipefitters, essential skills in the construction sector (Turner Drake *et al.*, 2022).

Importance of the Fishery

In August 2024 in response to questions posed by the RA Committee, the NS Department of Fisheries and Aquaculture provided a synopsis of the importance of the fishery and seafood producers. In 2023, as Canada's number one seafood exporter, the provincial seafood industry contributed $2.5 billion to the provincial economy and employed approximately 19,000 people, many in rural, coastal communities. Upwards of 35% of employment in Digby, Yarmouth, Shelburne, Queens, Guysborough and Victoria counties is derived from the fishery. From 2008 - 2022, the growth in the industry (89%) has outpaced the growth of provincial output (21%). The industry is central to many coastal communities and is supportive not only of local commerce but is intertwined with economic activity of broader provincial relevance including transportation services, tourism and shipbuilding. There are, for example, some 65 companies (most family firms employing 10-200 employees) in communities around the province who provide maintenance services and new builds for the industry (Pisces, 2022).

DFO is cognizant of the importance of the fishery regionally, nationally and internationally. In June 2024, the Minister of Fisheries, Oceans and the Canadian Coast Guard at the H2O conference in Halifax announced the Blue Economy Regulatory Roadmap which outlines the actions that the federal government will take to support innovation and economic growth in Canada's oceans. This strategy does include support for marine renewable energy as an integral part of effectively managing the marine resource.

Indigenous Participation in the Economy

Over the past 20-30 years, Indigenous peoples participating in the economy have changed significantly. Unemployment rates have traditionally been higher, and participation rates lower in Indigenous

communities than those in the province at large, but there has been change. From the 2023 North American Indigenous Games (NAIG, 2023), hosted in Halifax, to the acquisition of a major interest in Clearwater Seafood and participation in several onshore wind farms, Mi'kmaq communities and businesses today contribute substantially to the regional economy. Until the release of a report prepared by the Atlantic Economic Council in July 2024 on behalf of the Atlantic Policy Congress of First Nations this contribution was difficult to assess because of a lack of readily available data on the Indigenous economy (Atlantic Economic Council, 2024). In 2021, Indigenous communities in the Atlantic provinces generated about 3% of the region's GDP and over 5% of the region's jobs; the equivalent figures for NS were 5% of the province's GDP and 8% of the province's jobs (Atlantic Economic Council, 2024). Wages and salaries earned by Indigenous workers are on average lower than those for non-Indigenous workers; in 2021 the gap was estimated to be 10%. Multiple factors contribute: differences in demographics, education, location (rural locations) and market access (access to internet and important infrastructure, including transportation) being key. Although the educational differential between Indigenous and non-Indigenous populations is closing, it still exists and is reflected in the wage differentials.

Statistics are one dimension, but equally important to the Committee has been the knowledge acquired through the engagement process. Indigenous communities in NS are increasingly taking account of both their own inherent values and the educational and business opportunities that are increasingly available to them. Each Indigenous community approaches the possible opportunities in a different way. The information boxes below are examples of action taken in three Mi'kmaw communities.

Membertou: In 1995, the community has 37 employees and was operating on a $4 million budget while dealing with a $1 million annual operating deficit. Change was necessary: education, determination, transparency and accountability were the lynch pins. The Membertou Corporate Office became the first Indigenous organization in the world to receive an ISO 9001 certification. This facilitated business partnerships with private industry in several sectors including engineering, mining, energy, construction, the commercial fishery and real estate. Today the community's operating budget exceeds $100 million and the number of employees ins nearly 60– which includes both community and non-community members.

Eskasoni: with a population of approximately 5,200, Eskasoni is the largest Indigenous community in Nova Scotia. Over the last 15 years, the Chief and Council have proactively taken steps to improve both its economic development strategy and investment portfolio. This has resulted in investment in 9 new Joint Venture companies that have provided both employment and revenue streams; examples include: storage facilities for frozen fish products and onshore wind developments. The community has built a long-term care facility, expanded the health centre and is planning a new multi-purpose high school. It is a community that is open for business.

Glooscap: Since the establishment in 2012 of Glooscap Ventures, the economic arm of Glooscap First Nation, the community has established strategic partnerships with several sectors including retail, the fisheries, renewable energy and consulting. Employment has grown from less than 30 to over 80 and today the community generates the highest per capita own source revenue of any Mi'kmaq community and has transitioned from financial uncertainty to a robust multi-million-dollar operating budget. Economic growth has been grounded in the Indigenous principle of seven generation thinking, ensuring that decisions benefit the community far into the future.

How Mi'kmaw communities individually, and collectively, approach participation in the OSW industry will also vary. In the engagement sessions, while many raised legitimate questions about the potential of adverse consequences to the fisheries from OSW activities, there was genuine interest in, and many questions asked about, the OSW industry and the economic opportunities that the industry might create for their communities. Several communities have invested in onshore wind developments, and many have trained as technicians to service that industry; this is a good segue into OSW development.

The Mi'kmaq were the first to harvest the waters off Nova Scotia. Today, because of the 1999 Supreme Court's Marshall rulings[24], Indigenous communities in the province are now actively involved in the commercial fishery (Wein, 2022). The Canadian census reported 350 Indigenous individuals employed in fish harvesting in 2001. By 2016, this number had expanded to 1,370, an increase of 291% (Wein, 2022). Their participation continues to expand: in 2020, 50% of Clearwater Seafoods was acquired by Premium

[24] The Marshall decision is a landmark decision in Canada that affirmed First Nations' treaty right to fish, hunt, and gather in pursuit of a moderate livelihood. On September 17, 1999, the Supreme Court affirmed the hunting, fishing and gathering rights promised to Indigenous peoples in the Peace and Friendship Treaties of 1760 and 1761 followed by a second decision in November 1999, in which the Court clarified important elements of the decision that emphasized that the treaty rights could only be limited for conservation reasons or other compelling and substantial public objectives.

Brand Holdings and a Mi'kmaq First Nations Coalition - a legal entity formed specifically for First Nations to invest in Clearwater. The investment represents the largest investment in the seafood industry by any Indigenous group in Canada. Increasing Indigenous involvement in the commercial fishery brings benefit to Indigenous communities across the province and parallels their ongoing involvement in the social and ceremonial, food and moderate livelihood fisheries.

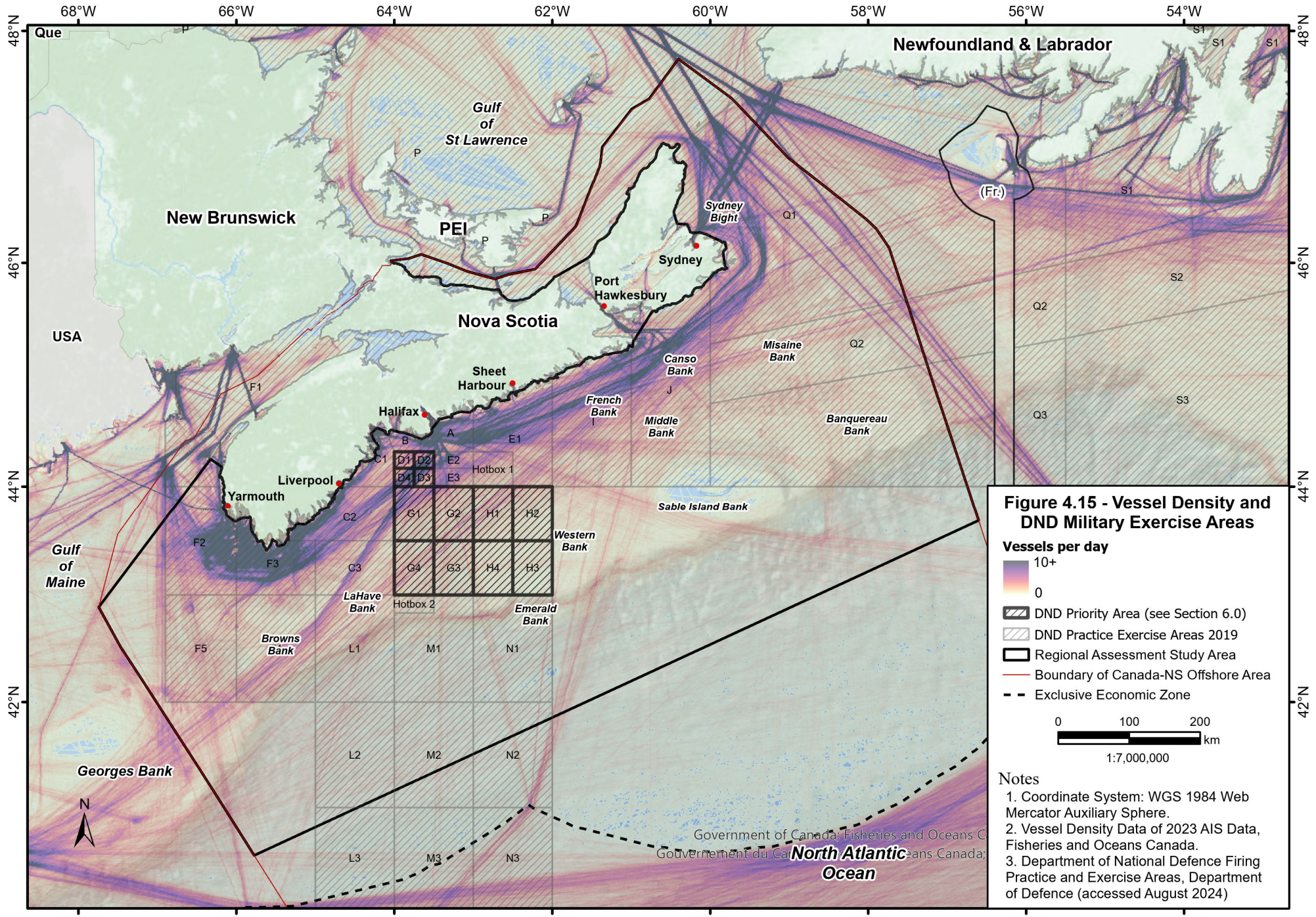
4.6.3 Other Users of Marine Waters

Commercial Shipping

Commercial shipping traffic off the coast of NS includes cargo vessels, tankers, ferries, cruise ships, fishing vessels, tugs and towing vessels and other vessels dedicated to a specific sector such as offshore oil and gas or vessels delivering components for the OSW industry. Breeze *et al.* (2005) have divided the RA Study Area into four main zones of use:

- global shipping lanes between North America and Europe, the Mediterranean and other regions, i.e., the “great circle route”;
- international and domestic shipping along the coast of NS bound to and from the US, Gulf of St. Lawrence and Newfoundland;
- shipping lanes through the Cabot Strait linking trans-Atlantic traffic to the St Lawrence Seaway and the Great Lakes; and
- traffic associated with the major ports in the RA Study Area: Halifax, Port Hawkesbury and Sydney.

The three densest aggregations of vessel traffic are off the coast in the southwest of the province, around Halifax harbour and the southern portion of the eastern shore and off the coast of northern Cape Breton. Fishing vessels use ports all along the coast from Yarmouth to Sydney and use the waters throughout the RA Study Area. Yarmouth and the smaller ports of the southwest are home to a significant portion of the fleet. Other commercial vessel traffic use more defined corridors as depicted in Figure 4.15 and as referenced above.


68°W
66°W
64°W
62°W
60°W
58°W
56°W
54°W
48°N
46°N
44°N
42°N
Que
Newfoundland & Labrador
Gulf of St Lawrence
New Brunswick
PEI
Nova Scotia
USA
Sydney Bight
Sydney
Port Hawkesbury
Sheet Harbour
Halifax
Liverpool
Yarmouth
Misaine Bank
Canso Bank
French Bank
Middle Bank
Banquereau Bank
Sable Island Bank
Western Bank
Emerald Bank
LaHave Bank
Browns Bank
Georges Bank
Gulf of Maine
Hotbox 1
Hotbox 2
(Fr.)
North Atlantic Ocean
N
Figure 4.15 - Vessel Density and DND Military Exercise Areas
Vessels per day
10+
0
DND Priority Area (see Section 6.0)
DND Practice Exercise Areas 2019
Regional Assessment Study Area
Boundary of Canada-NS Offshore Area
Exclusive Economic Zone
0
100
200
km
1:7,000,000
Notes
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere.
2. Vessel Density Data of 2023 AIS Data, Fisheries and Oceans Canada.
3. Department of National Defence Firing Practice and Exercise Areas, Department of Defence (accessed August 2024)

Marine Atlantic operates two ferry services to Newfoundland from North Sydney: an annual service to Port Aux Basques and a seasonal service to Argentia. In addition, there are shipping movements across the RA Study Area depicting the shipping linkages to Europe and beyond. These routings are reflective both of significant investment and of the role that commercial shipping plays both in the national and regional economy. The national economic impact of marine shipping is equal to approximately 1.8% of the Canadian economy or about $30 billion (Council of Canadian Academies, 2017; updated 2024). This is not distributed equally across the country and will change in response to global forces including the development of the OSW industry and climate change. The consequences of the latter, as ice retreats in the arctic and shipping to serve northern communities and for military purposes becomes year-round, could have consequences for ports on the east coast.

Military Presence

Halifax is Canada's east coast naval base and home port to the Royal Canadian Navy - Atlantic Fleet. Canadian Forces Base Halifax provides administrative, logistics, information technology, executive services and port operations and emergency services to personnel and units with the Maritime Forces Atlantic formation and additional units at home and abroad. The Base supports approximately 11,000 Canadian Armed Forces members and civilian employees of the Department of National Defence (DND) and is an important contributor to the economy of the city and surrounding region. The Navy conducts military training, on occasion with allied ships, in the waters off NS in areas defined as Maritime Local Operating Areas (MARLOAs). MARLOAs are established military exercise areas and, as such, are published both on the nautical charts and in the Canadian Annual Notices to Mariners. DNDs priority MARLOAs are identified on Figure 4.15 and discussed further in section 6.

In response to questions posed by the Committee, DND provided information on the location of known naval and merchant marine shipwrecks, which may contain explosive munitions and underwater munitions dump sites; collectively these are known as UXO Legacy Sites. There are Legacy Sites located between Emerald Bank and Sydney Bight and the coast which would need to be considered in the routing of electricity transmission cables to shore from any proposed OSW development in the area.

4.6.4 Infrastructure

Ports

As indicated in section 3.3.1.2, ports, and the facilities and services that are provided, are essential to the build-out of the OSW industry. Table 4.16 provides a high-level description of the principal wharfs and associated facilities in NS; some, with the necessary investment, could provide the dockside support required by the industry.

Table 4.16. Port Facilities in the RA Study Area

Location and Wharf Facility	Infrastructure Available	Readiness/Necessary Upgrades
Digby Harbour	The dock structures in Digby Harbour are those of a small crafts harbour and are not suitable for handling the components of an OSW project. This harbour is totally committed to the fishing industry.	If berthage was available, it could be used by OSW supply vessels.
Halifax Harbour	Woodside Marine Terminal: This facility is owned by the Government of NS and administered by Invest Nova Scotia. It has two main berthing areas: the Woodside Wharf which is 230 m in length and the Exxon Mobil Wharf, 65 m in length. The terminal is a multi-use marine facility servicing many clients. There is limited marshalling space available.	There are conceptual plans to link the existing wharfs and to create additional marshalling area. This facility has handled OSW components including monopiles and transition pieces for projects in the US northeast. These were largely handled ship-to-ship due to limited dock space. This wharfage is no longer available as it has been fully leased to Irving for approximately two years (2024-26). It could be available at the end of the lease period.
Liverpool (Port Mersey Commercial Port)	The wharf is located on the site of the former Bowater Mersey Pulp and Paper Mill. The berth is 152.2 m in length and has a 7.3 m draft. A storage shed occupies a large portion of the dock surface.	There is considerable back-up marshalling area, but to fully service the OSW industry, a new purpose built, high weight bearing wharf and deeper draft would be required.
Sheet Harbour	The main marginal wharf is 152.2 m in length with concrete caissons. The draft at the wharf face is 13.75 m. There is a large, accessible marshalling yard.	A considerable portion of the marshalling area is used for existing operations, including wood fibre operations, an aggregate shipping business and a ship dismantling operation. The port has handled major offshore wind components, primarily monopiles and transition pieces, and has demonstrated that it can handle these efficiently. The dock could be expanded to the south with a fit-for-purpose berth for the OSW industry and associated marshalling area. Conceptual plans have been developed.

Location and Wharf Facility	Infrastructure Available	Readiness/Necessary Upgrades
Shelburne	The existing infrastructure consists of a relatively long finger pier with a T-section at its head. It is primarily used as a fishing wharf: smaller fishing vessels dock along the finger pier; larger vessels with deeper draft moor on the outside of the T-section.	The T-section has the length and the draft to accommodate OSW vessels, but there is insufficient back-up land to marshal components. There is a plan to infill the western side of the finger pier to the shoreline. This would create more marshalling area. To accommodate the OSW industry, the T-section would have to be further analyzed and subsequently reinforced to achieve the required bearing capacity to handle large OSW components.
Strait of Canso	Bearhead Hydrogen Facility: there are plans to build a purpose designed wharf to export green hydrogen and ammonia.	The purpose built Bearhead wharf would not be suitable for OSW components.
	McNally Marine Terminal, Port Hawkesbury: the capacity of the existing terminal has been expanded by the purchase of the adjacent Georgia Pacific Terminal.	With the purchase of the Georgia Pacific Terminal, McNally has obtained a significant amount of land and an important water lot. Upgrades in this location to handle OSW components would include the building a new wharf on the Georgia Pacific site to the specifications necessary to handle OSW components. The option also exists to construct a graving dock (dry dock) in this location to enable the construction of floating OSW structures.
	Melford Terminal: originally this site on the western side of the Strait of Canso was proposed as a container terminal. Now a portion is being considered as a marshalling facility for OSW.	The first phase would involve the construction of a purpose built 1,000 ft wharf. Permitting is in place; land is available and conceptual design is underway.
	Mulgrave Marine Terminal: the existing structure is old and has been modified several times. To accommodate the movement of OSW components at the present, a baily	The existing facilities have limited capacity to handle major components associated with the OSW industry, but the terminal is preparing to handle smaller components, such as anchors, cables and chains. The terminal could also be used for ship-to-ship

Location and Wharf Facility	Infrastructure Available	Readiness/Necessary Upgrades
	bridge is used to access the highway. Marshalling space is limited.	transfers of larger components and as a berth for supply vessels.
	Port Hawkesbury Paper: the existing wharf is used to import kaolin for the supercalender paper procedure.	Designs are being prepared to rehabilitate this facility, but to accommodate the needs of the paper plant, not for OSW purposes.
	Statia Terminals Dock: this facility consists of two berths: a large supertanker dock to accommodate the delivery of petroleum products and an inner berth to load out product on smaller vessels.	Neither of the existing berths are suitable for the OSW industry.
Sydney	Atlantic Canada Bulk Terminal: formerly the Sydney Steel dock, the facility, a marginal dock on the east side of Sydney harbour, has capacity to service the OSW industry.	The facility is currently receiving monopiles and transition pieces. The monopiles have been offloaded over the caisson portion of the dock using structured steel bridging to spread the load. The dock would require to be reinforced to better accommodate the large onshore cranes needed to offload large pieces.
	NovaPorte: this is a new initiative on the west side of Sydney Harbour.	Most of the infill necessary for a large laydown area has been completed. Permitting is in place for a new dock structure and conceptual engineering for a purpose designed transhipment terminal for the OSW industry is underway. NovaPorte could also be a location considered for a graving dock.
	Sydport Industrial Park: several old wharfs, constructed in the early 1950s, would need to be replaced. There is space for marshalling.	The existing wharfs would have to be removed, and purpose-built wharfs designed and constructed to enable usage by the OSW industry.
	International Coal Pier: Currently used as an export coal terminal, this facility should become available for other purposes in five years.	To convert from the handling of coal to handling other materials would require the removal of the ship loader and a large portion of the elevated rail loop to provide adequate storage area. The harbour would

Location and Wharf Facility	Infrastructure Available	Readiness/Necessary Upgrades
		require infill out to the dolphins (man-made berthing or mooring structures).
	Sydney Marine Terminal: the main structure, known as the Liberty Dock, is new and is used primarily for cruise vessels.	The liberty dock could be used for ship-to-ship transhipment of OSW components but is unlikely to be repurposed.

Source: DMDE Engineering, 2024.

In summary, depending on foundation type and likely scale of the industry, further study and engineering need to be undertaken before strategic decisions are made on the optimal locations for port investment. What seems clear is that the current port capability is inadequate to support the development of the industry at virtually any scale, and that significant investment is going to be required to ensure that NS effectively participates from an economic development standpoint (refer to section 8).

Preliminary observations based on work commissioned by the Committee to provide current infrastructure opportunities and challenges for the future of the OSW industry in the province are:

- the current wharf space in southwest Nova Scotia, e.g., in Yarmouth, Digby and Shelburne, is designed for and dedicated to the fishing sector. Each of these ports could handle offshore service and supply vessels if berthage was available, but the primary focus and usage of the facilities would not change;
- in Shelburne, consideration is being given to infilling to the west of the finger pier to develop more marshalling area, but, if the aim is to accommodate the larger OSW vessels, further engineering is required to ensure that the wharf itself has the necessary bearing capacity to accommodate the weights involved;
- the Bowater site in Liverpool offers potential, but both dredging and a new purpose-built wharf would be necessary to accommodate the larger vessels associated with the development of the OSW industry;
- the Woodside Marine Terminal in Halifax has the capacity to serve the OSW industry, particularly if the plans for its expansion are executed;
- Sheet Harbour offers potential for a purpose-built OSW wharf and additional marshalling area;
- both the McNally Marine Terminal and the Melford Terminal in the Strait of Canso provide sites that could accommodate a purpose-built wharf to the specifications required by the industry. In addition, the McNally site provides a possible location for a graving dock. The Mulgrave Marine Terminal, also in the Strait of Canso, does not have the capacity to handle the major OSW components, but could accommodate handling smaller components such as anchors, chains etc.; and

- in Sydney, *NovaPorte* could accommodate a purpose designed wharf, and there is already a large marshalling area at this location. A graving dock could also be developed. At the Sydport Industrial Park the existing wharfs would need to be removed, and a purpose-built wharf designed and constructed. The exiting wharf at the Atlantic Canada Bulk Terminal would have to be reinforced to bring it up to spec to bear the weight of the necessary cranes.

Existing Electrical Distribution System

The Nova Scotia Power (NSP) transmission system was designed to deliver energy from coal-fired generation stations, located primarily at, or in proximity to, producing mines. Over time the energy demand has moved from the industrial mining locations, e.g., Sydney and New Glasgow, to Halifax, which is now the main load centre and the fastest electrical load growing area in the province. NS has a stated objective to generate 80% of electricity from renewables and to phase out the use of coal in generation by 2030 (NRR, 2021), but it is not as simple as replacing one with the other. Neither wind nor solar energy is constant; both are intermittent "non-dispatchable" sources of supply and require immediately available "dispatchable" on demand supports to ensure the stability of the provincial grid. The base situation is complex, and, to date, no full transmission planning study has been conducted (Scott *et al.*, 2024.) The province is considering the following as steps towards meeting their 2030 commitments:

- recent RFP for 600 MW of land-based wind power;
- an additional 150 MW of battery storage; and
- commitment to the development of a 2nd 345 kv AC transmission line, i.e., a new intertie line, from Onslow, NS, to Salisbury, NB, with the capacity to move approximately 400 MW of power.

The new intertie line in the first instance provides security of supply to NS when the wind isn't generating power and there is no thermal generation available. The proposed transmission line will increase integration between the two provincial grids, a step towards allowing for expansion into a regional interconnection via further transmission beyond Salisbury. To meet the targets for 2030, additional investment is necessary. It has been suggested that up to 1500 MW of additional onshore wind generation is required on the system, i.e., beyond the 600 MW mentioned above, and the installation of 150-900 MW of fast acting natural gas or oil turbines (NSP, 2023).

The transmission link across the Strait of Canso from Cape Breton to the mainland is a weak link in the provincial grid and a factor limiting additional generation in Cape Breton. The development of one or both proposed hydrogen plants in the Strait area may provide an opportunity to mitigate some of this risk as the demand for electrical load created will be counter to the present flow of energy to Halifax. If, as planned, the proposed hydrogen plants develop power from onshore wind farms on the mainland, this power could be replaced by energy generated from OSW, e.g., from Sydney Bight, and fed into the Cape Breton grid; the power from the mainland windfarms could then be redirected to the load required in Halifax. This would mitigate the need for additional transmission capacity at the crossing of the Strait of Canso.

As stated by the Clean Electricity Solutions Task Force "the transformation of the energy system will not be simple. There are no quick or easy solutions. It will take time, careful planning and considerable investment in energy infrastructure to replace coal fired generation, strengthen our ability to integrate renewable resources and establish transmission upgrades" (Scott *et al.*, 2024). There is some capacity in the grid to accommodate power from another source, such as offshore wind, but it is limited. A recent Net Zero Atlantic (NZA) sponsored RFP entitled 'Atlantic Canada Offshore Wind Integration and Transmission Study' identifies its objective as:

> "…to develop a comprehensive report that provides federal and provincial policymakers, electricity grid operators, regulatory bodies, research institutions, and other stakeholders with the information necessary to deepen their understanding of the options and their impacts resulting from the integration of large-scale OSW projects with capacities of 1GW or more into the Atlantic Canadian electricity grid. The study will identify potential pathways, constraints, and investments needed, with an emphasis on technical impacts of OSW integration on the Atlantic Canadian electricity grid (NZA, 2024)."

The new provincial *More Access to Energy Act* provides for an Independent Energy System Operator to be in place by late 2025 to manage the operations of the electricity system including the connection of renewable energy projects into the grid (NRR, 2024). Any substantial offshore generation to be accommodated will necessitate the identification of new markets and/or the development of the Atlantic Loop.

Roads, Rail and Air

OSW projects will, as indicated above, be serviced from one or more of the marine wharves and major project components will be delivered to site by sea, either directly or via a coastal terminal. Smaller components of the supply chain may come from industrial centres in other parts of Canada or the US and arrive in NS by rail or by road. CN's rail network connects Halifax via Truro to the rest of Canada and to the US. In 2023, CN acquired a stake in the Cape Breton and Central NS Railway which has active track operating between Truro and the Strait of Canso. The rail connection between the latter and Sydney is not currently in operation though proposals have been mooted to upgrade and reinstate it.

The highway system is more comprehensive. The 100 series highways connect the communities and the wharves, with the exception of Sheet Harbour, that may service the OSW industry. These are:

- Highway 104 (part of the Trans-Canada Highway) from the New Brunswick border to the Strait of Canso and Port Hawkesbury;
- Highway 105 (part of the Trans-Canada Highway) from Port Hawkesbury to Sydney;
- Highway 102 from Halifax to Truro; and
- Highway 103 from Halifax to Yarmouth serving Liverpool and Shelburne.

Highway 102 between Halifax and Truro and Highway 104 between Truro and the New Brunswick border (west) and Truro and Antigonish (east) are twinned. Significant portions of the other routes referenced are also twinned enabling good communications across the province. Further twinning,

bridge improvements, enhanced intersections and other maintenance are planned for each of the identified highways (Government of Nova Scotia, 2023). Sheet Harbour is served by Route 374 which connects to Highway 104 at Antigonish and by Route 7 to Halifax.

The hub for national and international air communications is Halifax Stanfield International Airport. Sydney is served by the J.A. Douglas McCurdy Airport, and there are smaller airports, either municipally or privately operated in several communities including Yarmouth and Port Hawkesbury. Halifax Stanfield is also the principal heliport serving the offshore though there are pads in several locations across the province.

The provincial rail, road and air infrastructure may not play such a pivotal role in the development of the OSW industry as the ports and electricity grid, but this infrastructure is important and will be essential to the movement not only of necessary supply chain components, but to the movement of labour.

Social Infrastructure

There is regular commentary that NS in 2024 is confronting a crisis in the capacity of its social infrastructure, i.e., its housing pool, its medical resources and its educational facilities. There is an acute shortage of affordable housing not just in HRM, but across the province (Turner Drake *et al.*, 2022). As of June 2024, more than 16% of Nova Scotians did not have a family doctor and emergency facilities were reducing hours because of staff shortages. Schools are overcrowded in part due to recent population growth. It is not the intent of the RA to undertake a close examination of these topics, but if a new industry is to be accommodated, it is imperative that due consideration be given by the responsible authorities, federal, provincial and municipal, to address the pressures that would be placed on the already compromised social infrastructure and to plan and invest accordingly. If the labour needs of a new OSW industry are to be met by attracting further immigration, either from other provinces or internationally, investment in housing, the health system and education is of equal importance to investment in ports or the grid.

4.6.5 Social Costs of Carbon on Air Quality and Public Health

Air pollution is the largest environmental risk factor to human health. The impacts include increased incidences of stroke, heart disease and acute respiratory diseases, and the aggravation of health issues such as asthma and diabetes. These impacts result in increased hospitalizations, emergency room visits and premature deaths (Health Canada, 2024). Although Canada has relatively good air quality when compared internationally, above background air pollution in 2018, including air pollution from human activities in North America, contributed to 17,400 premature deaths across the country. Higher death burdens were estimated in the most populated or polluted regions of the country, namely Ontario, Quebec, British Columbia and Alberta. The monetized value of all health impacts is estimated by Health Canada to be $146 billion per year. NS may not be as urbanized or polluted as areas to the west, but as referenced in section 1.2, the province remains highly dependent on coal and other fossil fuels to generate electricity. Emissions from the plants at Point Aconi, Point Tupper and Trenton contribute to

GHGs and therefore to climate change and to air pollution locally and provincially. These emissions aggravate health conditions in vulnerable local populations and add cost to provincial health services.

4.6.6 Tourism, Recreation and Heritage

As indicated above, tourism is an economic driver not only in HRM, but in rural and coastal communities throughout the province. It generates both investment and employment and is often viewed favourably compared to other development initiatives such as mining or gas drilling (Foster and Main, 2019). It is also believed by some to provide more economic security as it cannot be outsourced and is inherently tied to local infrastructure. Furthermore, in coastal communities where there is reliance on seasonal patterns of employment, such as exists in the fishery, it is thought that tourism can provide an additional source of income, e.g., fishers can operate ecotourism businesses in the summer months at the end of their fishing season (Oncescu and Robertson, 2010; VanIderstine, 2019). Although Halifax is a major draw, the accessible coastline, coastal communities, national parks and heritage sites, marine wildlife and a newfound culinary reputation are the focus of many visitors to the province (Qatalyst, 2023; Tourism NS, 2018). Among these, natural areas and historical sites tend to be the principal drivers, with a third of those planning to visit the province citing these as the main reasons for their visit (Tourism NS, 2022). In addition to the designated parks and historic sites, visitors wander the side roads exploring the smaller harbours and lesser-known beaches (Ragan *et al.*, 2022); the provincial coastline is a major draw.

There are two National Parks in Nova Scotia: the Cape Breton Highlands National Park and the Kejimkujik National Park and Seaside Adjunct (Parks Canada, 2024): the former covers an area of 950 km^2 in Cape Breton extending across the northern peninsula from coast to coast, providing many expansive ocean views: the Kejimkujik Seaside Adjunct is a protected coastal wilderness area in southwest NS providing views of the Atlantic Shoreline. In addition, the province manages 121 provincial parks across the province of which 60% are located on or near the coast. National Historic sites and UNESCO sites, many of which are located on or near the coast add further evidence of the importance of the coast to visitors and residents. People are attracted to the water and to the wildlife, but they also seek escape from urban intensity, noise and light. Parks Canada recommended a minimum protective buffer of 45 km around the entire Cape Breton Highlands National Park and a buffer of 25 km around the Fortress of Louisbourg National Historic Site (Parks Canada, 2023). Resorts and cottages throughout the province have served families and visitors for generations, and investment continues. One responder to the Interim Report, a foreign investor on the eastern shore, expressed relief that a significant coastal buffer had been recommended.

Tourism and marine recreational activities are seasonally determined, i.e., between June and October (Tourism NS, 2018). Sailing, motor cruising, whale watching and other planned coastal ecotourism activities such as organized sea kayaking, seabird tours and whale watching are important to the economy of many communities along the Atlantic coast from Sydney to Yarmouth. Much of the activity takes place within the major bays, within several kilometers from shore and within access to the harbours and marinas. The NS Department of Communities, Culture, Tourism and Heritage (CCTH) in

response to questions from the Committee recommended that OSW development areas should be a minimum of 25 km offshore to minimize impacts on these activities (NS CCTH, 2024).

CCTH, as the provincial archaeology regulator, pursuant to the *Special Places Protection Act,* has the responsibility for heritage and archaeological sites within the RA Study Area and in coastal waters. It has been pointed out to the Committee that several of the submerged banks were above sea level 13,000 years ago. A possible outcome of OSW development might be the finding of Pleistocene or younger aged terrestrial animal fossils during subsurface excavations. There is also the possibility of disturbance to archeologically valued shore sites when required infrastructure, such as cables, is being developed. CCTH is also responsible for shipwrecks and has identified the known shipwrecks within the RA Study Area. All such circumstances require adherence to established protocols with respect to reporting and conservation. CCTH is always willing to work with developers as they proceed through planning and preconstruction studies and into construction and operations.

4.6.7 Other Factors Raised

Visibility and Aesthetics

The visibility and visual impact of an OSW farm have been raised in many jurisdictions as issues of public concern; this is particularly true as the coastal landscape often lends itself to panoramic and long-distance views. Viewed from historic sites, national and provincial parks, beaches and other recreational areas (hiking trails, golf courses etc.), coastal homes and cottages and from commercial sites such as hotels and resorts, turbines can, for some, be considered a visual intrusion. As indicated in section 3.1.3, OSW turbines are large, and getting larger, and the "synchronized sweeping of the massive blades during the day and the synchronized flashing of the lighting at night contribute to the facilities' visibility over very long distances" (Sullivan *et al.*, 2012). Several factors influence visibility on the one hand and impact on the other.

Visibility is influenced by the number, size and arrangement of the turbines, the weather and sky conditions, sea state, time of day and sun angle and the elevation of the viewer. If the turbines can be seen, the impact will be influenced by viewer sensitivity and perspective and what he/she is doing, e.g., cycling for pleasure or driving to work, enjoying a historic site or working at a wharf – the situations are infinite. As turbines increase in size, they will be visible at greater distances qualified only by weather conditions such as rain and fog. Sullivan *et al.* concluded that "even small offshore wind facilities of a few dozen turbines can be seen easily at distances exceeding 25 km and that moderately sized facilities of 100 turbines are easily seen at distances of 35 km or even farther, depending on weather and lighting conditions (Sullivan *et al.*, 2012).

Although some variables can be quantified in both simulated exercises and modelled when details of a specific project are known, some variables are highly subjective and cannot be quantified. Short of siting turbines far enough from the shoreline that they would be fully obscured from land by the curvature of the earth, there is no mitigation that would fully satisfy all viewers. In one research initiative, turbines 187 m above sea level would need to be approximately 55 km offshore to be invisible to a viewer at

water level and further for a viewer at an elevated position (NYSERDA, 2017). This distance is obviously not warranted to avoid all infrequent visual impacts. The same study, based on weather observations off Long Island, indicated that the most visible conditions occur during less than 10% of daylight hours during a typical year. This is a simulated figure - important factors, including sun angle and sea spray, were not considered. The former can heighten visibility for short periods of time particularly in the early morning and at sunset while the later can serve to scatter and diffuse light thus reducing the effective visibility range. NYSERDA's analysis concluded that during most of the year the turbines would not be visible at 30 km to the casual observer. Weather conditions off NS are not necessarily comparable to those off Long Island, but it should be noted that the waters of the RA Study Area are among the foggiest in the world, particularly from May to September (Canavan *et al.*, n.d.), the summer months when residents and visitors frequent coastal destinations in the greatest numbers.

Night lighting is an important factor and as indicted by Sullivan *et al.* can result in turbines being seen at great distances. NYSERDA in the simulations undertaken off the coast of Long Island, assumed the use of an Aircraft Detection Lighting System (ADLS). Based on the frequency of night flights offshore New York, it was estimated that aircraft warning light activation would occur "during 0.03% to 0.08% of available annual nighttime hours, or approximately 72-201 minutes per year" (NYSERDA, 2017). The conclusion was that aircraft warning lighting would not be of concern to onshore viewers if ADLS was employed. Such systems are, as of this year, mandatory in Germany.

The challenge always will be to balance the need to protect local interests and values while responding to the need to embrace investment in renewable energy technologies.

Food Security

As referenced above, the fisheries are important economically, but the product, whether lobster destined for the US or sea cucumbers destined for Asia, is also important as a source of food. Food security was raised as a topic of concern during the engagement sessions, perhaps reflective of the fact that food security and nutrition stand as Goal 2 of the United Nations Sustainable Development Goals (UN, 2015). Agriculture and the fisheries are being impacted by global warming, and governments, including international agencies, are cognizant that these primary sectors of the world's economy are increasingly under threat. At the same time, the consumption of seafood per capita is on the rise. Between 1962 and 2021, the consumption of aquatic animal foods rose by 483%, an annual growth rate of 3% (NS Fisheries and Aquaculture, 2024). The demand for fish and other aquatic products globally is expected to continue to increase and perhaps double by 2050 (Vaughan, 2021). This expectation puts pressure on fishing practices and may result in increased levels of fish farming, including fish farming within and in proximity to OSW developments. It also expands existing markets for marine produce for the provincial industry, creates markets for species not traditionally harvested and potentially puts increasing pressure on the aquatic ecosystem. It does underpin the significance of the fishing sector, provincially, nationally and internationally.

There is another facet to the importance of fish and seafood that is of relevance to NS - its significance to the Indigenous populations of Nova Scotia. The economic importance of fisheries to Indigenous

communities has been referenced above. Fish and seafood are important economically but are also significant culturally. It has been stated that “Food security and food sovereignty are inexorably linked for Indigenous Peoples because the harvest of TF (traditional food) is a key element in the achievement of both these constructs” (Batel *et al.*, 2021). This was reflected in many of the conversations the Committee had during engagement with Indigenous peoples and communities. Reference, for example, was made to the cultural significance of both American eel and Atlantic salmon, and to the need to protect the habitat and migratory routes of these species.

5.0 Impact Producing Factors and Mitigation

Under the TOR, the Committee has been asked to "identify and consider the potential *positive* and *adverse* effects of future OSW activities in the Study Area." This includes consideration of "any cumulative effects" and to "identify and consider the effect to which OSW development activities hinder or contribute to the federal and provincial governments' ability to meet environmental obligations and commitments in respect to climate change." As indicated in section 1.2, both the federal and provincial governments have established targets to achieve net zero GHG emissions by 2050. OSW development on the Scotian Shelf would assist in the attainment of the legislative targets and government policy objectives. The extent of the contribution will be largely determined by infrastructure and labour constraints and timely decisions around approaches to, and investment in, capacity building.

Although the number of OSW projects is growing exponentially in various parts of the world, there are no projects currently under development in the RA Study Area. It is a new industry for Canada and careful consideration must be given to potential effects, i.e., impact producing factors (IPFs), and mitigative measures that will allow both the industry and individual projects to evolve sustainably. The following sections identify the IPFs generally associated with OSW projects and the Valued Components (VCs) that may be potentially impacted in one or more phases of development: preconstruction, construction, operations and maintenance, and decommissioning. In broad terms, the IPFs can be separated into two categories: safety and the environment, and socio-economic, the latter including health, community and the economy.

No discussion of impact producing factors, avoidance and mitigation would be complete without a reference to the significant regulatory effort that has been undertaken since The *Canadian Energy Regulator Act* (CER Act) came into force in 2019, including the recent passage of the "mirror" Accord Amendment legislation by the federal (Bill C-49)[25] and provincial (Bill 471)[26] governments. Once these Acts are proclaimed in force, the CNSOPB will assume the role of the Canada-Nova Scotia Offshore Energy Regulator (CNSOER) within the new joint management structure for projects in NS.[27] The regulatory process was referenced in section 1.3 in the context of the overall industry development timelines, but without further detail. The discussion that follows is intended to provide context and to reference how the OSW industry will be regulated to ensure that the primary goals of safe operations and environmental protection are achieved.

[25] Bill C-49 received Royal Assent on October 3, 2024; https://www.canada.ca/en/natural-resources-canada/news/2024/10/government-of-canada-passes-legislation-to-seize-the-enormous-economic-opportunity-offshore-wind-presents-for-nova-scotia-and-newfoundland-and-labr.html

[26] 'Advancing Nova Scotia Opportunities Act' received Royal Assent on September 20, 2024.

[27] For a comprehensive discussion of the process undertaken, see https://canadagazette.gc.ca/rp-pr/p1/2024/2024-02-24/html/reg2-eng.html

5.1 The Pathway to Offshore Wind Regulations

Following the coming into force of the *CER Act* in 2019, NRCan commenced development of draft Offshore Renewable Energy Regulations (ORERs)[28] focused on safe operations and protection of the marine environment. The CNSOPB was an active participant in the process, anticipating its pending role as the CNSOER. Many of the questions and comments brought forward to the Committee through its engagement process sought clarity on OSW project authorizations, how safety would be addressed in project design and operations management, and how protection of the environment would be prioritized, all topics addressed in the ORERs. The ORERs are extensive, cover all phases of project development and are expected to become law by the end of 2024.

While the *CER Act* establishes the CER as the life cycle regulator for offshore renewable energy in Canada's federally regulated offshore areas, Bill C-49 provides that within the RA Study Area the CNSOER will serve in this role and administer regulations substantially similar to the ORERs; the NS regulations will be established under the amended Accord Acts following their coming into force. The reader is directed to the helpful summary of the ORER goals and objectives and the draft wording of the regulatory text to gain a detailed understanding of what will be taken into consideration throughout the various authorization processes once a project has been approved following a federal impact assessment.[29] The regulatory framework is robust. It is designed to promote the identification, avoidance and mitigation of risk and ensure appropriate mitigation of impacts.

5.2 The Role of the Offshore Energy Regulator

Notwithstanding the detailed OSW regulatory framework referenced above, the importance of the role of the CNSOER to ensure that the goals of safety and environmental protection are actually achieved cannot be overstated. Regulations are often "goal seeking": they do not and should not attempt to anticipate and prescribe everything. Safety cultures and operator commitment to environmental protection are facilitated by, but not created through, regulations or safety and environmental management plans. Much is left to the judgment and discretion of those charged with the day-to-day responsibility for the industry, the assessment and approval of work authorizations and the supervision of the activities that follow. While no regulatory or management scheme is perfect, and acknowledging the differences between oil and gas (O&G) and OSW activities, it is fair to say that the overall safety and environmental performance achieved by the NS O&G industry has been positive; by extension much credit is due to the work and watchful eye of the CNSOPB. That work spans 30 years including the drilling of over 200 wells (exploration, delineation and production wells), and three production projects which have all been successfully abandoned. A great deal of that experience is directly transferable to OSW.

[28]The text of the draft regulations can be found at https://canadagazette.gc.ca/rp-pr/p1/2024/2024-02-24/html/reg2-eng.html. They were published in the Canada Gazette Part 1 for public comment in February, 2024, expected to come into force later this year.
[29] For a comprehensive discussion of the process undertaken, see https://canadagazette.gc.ca/rp-pr/p1/2024/2024-02-24/html/reg2-eng.html

The Committee applauds the extension of the O&G management framework to the OSW industry, something which has precedent in other jurisdictions. The CNSOER is positioned as the single window (contact) through which the OSW industry will interface with the myriad of federal and provincial government departments who have regulatory jurisdiction over aspects of the project's activities, e.g., shipping, and fisheries.[30] The operator must designate a Facility Manager who is responsible for the safety and operations of the project.[31] It is the role of the regulator to confirm that activities will comply with the applicable legislation before permitting any offshore work. The breadth of the role can be gleaned by considering the types of documents an operator has to submit throughout the various permitting processes:

- detailed description of the activities;
- the various documents associated with an Environmental Assessment under the *IAA;*
- Environmental Protection Plan(s) including the identification of incident and pollution prevention measures;
- Oil Spill Response Plan;
- Waste Management Plan;
- Occupational Health and Safety Policy;
- Safety plan and suite of technical operational safety related documents;
- Comprehensive Security Plan (physical and cyber);
- Medical care plan;
- Training plan;
- Severe weather plans;
- Incident Management (reporting, investigation, tracking, trends) and Emergency Response Plans where applicants must provide details about emergency preparedness and response methods to manage a potential incident. This includes:
    a. Incident classification (in consideration of risk and consequence)
    b. Incident management teams (based on the classification)
    c. Local, regional and global resources and response teams
    d. Internal and external notification procedures
    e. Incident response structure, command post and communication
    f. Roles and responsibilities of incident management team
    g. Training and competencies
    h. Exercises and drills
- proof of an established Workplace Committee; and
- Certificate of Fitness from an approved third-party certifying authority (to ensure vessels and equipment are fit for purpose).

In its role as the oil and gas regulator, the CNSOPB has entered into Memoranda of Understanding (MOU) with various government departments and agencies, e.g., DFO, ECCC and Transport Canada, to ensure effective coordination among those that have some regulatory role relevant to the marine

[30] See Bill C-49, s.170.2
[31] See Bill C-49, s.188

environment. This enables the regulator to leverage the vast expertise that exists within the public sector before making regulatory decisions.

One of the conundrums in successfully regulating an industry is that the development of standards lags behind industry experience, because the documentation of proven experience is the last step in the development of proven practices (NREL, 2013). Industry knowledge acquired through experience and consultation needs to be captured on an ongoing basis to either fill in gaps or enhance the utility of regulations as part of the adaptive management process, and it is expected that the CNSOER will establish a series of detailed "best practice" guidance materials.[32] Many other jurisdictions have established guidance materials for the OSW industry reflecting their current understanding of best practices,[33] which can serve as examples for the development of guidance material for OSW in NS. Both the work of updating existing CNSOPB MOUs and operating procedures that will streamline the effectiveness of the CNSOER, and the development of guidance documents that draw on best practices developed in jurisdictions with operating wind farms, are essential to achieving conflict avoidance among marine users and success in the areas of safety and environmental management. The CNSOER needs to be supported with the resources required to do this work.

In the areas of health, social and economic impacts, the recently published federal guidance under the *IAA* is instructive in providing details of the proponent's obligations as part of the impact assessment process that determines whether, and on what conditions, an OSW project receives approval to proceed into the Offshore Energy Regulator (OER) permitting phase. Subjects that get vetted at this stage include the project's expected impacts on physical and social infrastructure such as the need for portside facilities and the demand for labour, community services, housing, medical facilities, emergency services and educational/training; the operator must also describe the project's potential impact on the fisheries and to Indigenous and other communities.

5.3 Indigenous Knowledge, Two-Eyed Seeing (Etuaptmumk) and Adaptive Management

Identifying, mitigating and monitoring potential impacts, as discussed in detail above, requires the integration of Indigenous knowledge, experience and ways of knowing. Netukulimk is an essential concept to the Mi'kmaw because it embraces the sustainable use of natural resources while maintaining balance with the physical, emotional, cognitive, social and spiritual relationships a person has with the

[32] Bill 471, s.74 which establishes (amended section 180AA) the Regulators authority to issue guidelines and interpretation notes.

[33] See for examples, Final-Summary-Report-for-BMP-Workshop-BOEM-2018-015-(1).pdf; Regulatory Framework and Guidelines | Bureau of Ocean Energy Management (boem.gov); Guideline for Information Requirements for a Renewable Energy SAP (boem.gov); Pitre.pdf (cailaw.org); Fishing/Offshore Wind Mitigation Measures Development Workshops | Bureau of Ocean Energy Management (boem.gov)

world around them, including the physical features of the land, the rhythms and cycles and patterns of Wskitqamu (Mother Earth) and all her living beings and nonliving things.

Two-Eyed Seeing (Etuaptmumk), the integration of Indigenous and western knowledge systems, is a concept that offers opportunities for advancements in community resiliency and environmental stewardship, while empowering Indigenous Peoples (Leonard *et al*., 2022). Elder Murdena Marshall was passionately firm in saying that Indigenous Knowledge/Traditional Knowledge "was never meant to be static and stay in the past; rather, it must be brought into the present so that everything becomes meaningful in our lives and in our communities" (Bartlett Marshalls, 2012). A presentation to the Committee on Two-Eyed Seeing (Etuaptmumk) included a discussion around the Seven Sacred Teachings and the importance of considering the concept of Seven Generations – a philosophy of the Mi'kmaq people that ensures that decisions today are made with both current and future generations in mind. It is particularly applicable to decisions related to the development of a new industry such as OSW and the Committee has endeavoured to keep these concepts and approaches in mind through its analysis of IPFs, valued components and mitigation presented in this section.

5.4 Climate Change and Investment

Climate change is arguably the IPF of our time. In response, action is being taken internationally, nationally and provincially to combat both the underlying causes and consequences including initiatives to reduce GHG emissions entering the atmosphere. Nova Scotia's current objective of 5 GW of OSW leases by 2030 supports its net zero GHG 2050 emission target, in a sense a response to the overarching IPF of climate change.

Climate change will influence project design and has the potential to affect operational resiliency and effectiveness. As weather patterns continue to shift, affecting sea levels and storm intensity and frequency, OSW infrastructure and the technologies used in operations and monitoring, must be robust and adaptable to ensure that OSW developments remain safe and functional. The evolving challenges must be considered in the context of adaptive management and performance-based regulations (see section 7).

Investment and financial commitment from governments will play a pivotal role in the successful development of the OSW industry in NS and are required to ensure long-term profitability and scalability of the industry. Government policy and strategy begins with an articulation of its aspirations for the industry but must quickly shift its focus to ensure that the necessary investment is in place to encourage and accommodate the desired outcomes. In many respects, an increase in employment and expenditures can be expected to have positive economic impacts, e.g., direct and indirect local employment, an increase in expenditures on goods and services from local businesses and the generation of tax revenues for all levels of government. However, the industry is new, and the infrastructure required for the attainment of current development objectives is inadequate, becoming increasingly inadequate with increasing scale. With the support of consultants, the Committee has undertaken an initial appraisal and overview of the opportunities and challenges that may be encountered as OSW projects are planned and developed. The results of this work are provided in

sections 8 and 10 and highlight the Committee's belief that development of OSW in NS is properly considered as a regional/national rather than a provincial initiative.

5.5 Overview of Impact Producing Factors from Offshore Wind Development Phases

IPFs identify the cause-and-effect relationships between actions, e.g., a specific action associated with the life cycle of an OSW project, and relevant physical, biological, socio-economic or cultural valued components (VCs) (Figure 5.1). They define the way(s) in which an action or activity affects a given valued component. It is to be expected that multiple IPFs may affect the same valued component. Each IPF has the potential to impact different VCs throughout the stages of an OSW project development.

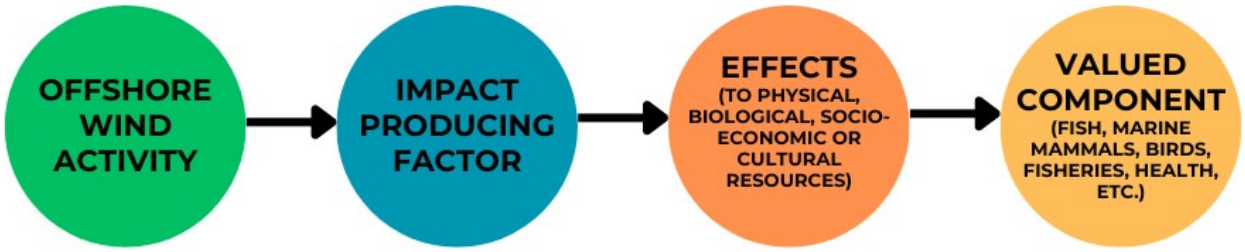


Figure 5.1. Pathway of Effects Associated with IPFs Caused by OSW Activities and Phases

Based on typical OSW project components and activities as described in section 3, the Committee identified and considered the following key potential IPFs:

- Atmospheric emissions
- Artificial lighting
- Vessel activity
- Noise and vibrations
- Exclusion zones
- Seabed disturbance
- Electrification of subsea power cables
- Presence of infrastructure
- Movement of turbine blades
- Waste handling and management
- Accidents and malfunctions

Table 5.1 identifies specific activities associated with an OSW project and resulting potential IPFs. The following sections provide a description for each IPF.

Table 5.1. Impact Producing Factors of Offshore Wind Development Phases

Activity	Impact Producing Factors										
	Atmospheric emissions	Artificial lighting	Vessel ad equipment activity	Noise and vibrations	Exclusion zones	Seabed disturbance	Electrification of subsea cables	Presence of infrastructure	Movement of turbines	Waste handling and management	Accidents and malfunctions
Planning and Development											
Marine vessel and equipment use	X	X		X						X	X
Site surveying and investigation work			X	X	X	X				X	X
Construction and Installation											
Installation of wind turbines and foundations/anchors	X		X	X	X	X		X		X	X
Installation of cables/cable protection	X		X	X	X	X		X		X	X
Marine vessel and equipment use	X	X	X	X						X	X
Operations and Maintenance											
Presence and operation of wind turbines		X		X	X			X	X	X	X
Presence of subsea infrastructure							X	X		X	X
Marine vessel and equipment use	X	X	X	X						X	X
Decommissioning, Repowering and Abandonment											
Marine vessel and equipment use	X	X	X	X						X	X
Removal of subsea infrastructure	X		X	X	X	X		X		X	X

5.5.1 Atmospheric Emissions

Atmospheric emissions are defined as gaseous or particulate pollutant substances emitted into the atmosphere by human and natural activities which can cause health and environmental problems such as acid rain, air quality degradation and global warming/climate change.

Air emissions associated with OSW originate from vessel and equipment activities during the construction, maintenance and decommissioning of OSW projects (Corio, 2022; Bang *et al*., n.d.) with increased traffic occurring during construction and installation (BOEM, 2023). Vessel activities include tugboats, cable and turbine installation vessels, helicopters, survey vessels and other construction and support activities (Corio, 2022; NYSERDA 2017e, 2018). The major air contaminants are nitrogen oxides, sulfur dioxide, particulate matter, carbon dioxide and methane (ICCT, 2020; NYSERDA, 2018).

A noted benefit of wind energy development is the displacement of fossil-fuel based sources of energy that will, in turn, lead to reductions in GHG emissions and air contaminant emissions into the atmosphere (Browning and Lenox, 2020). Fossil fuel displacement through development of OSW will contribute to helping Canada and the Province of Nova Scotia meet their environmental obligations and commitments in respect to climate change (section 1.1). Overall, air contaminant emissions from OSW development are expected to be less than those from conventional power generation (US EPA, n.d.).

5.5.2 Artificial Lighting

Artificial lighting associated with OSW projects will include temporary construction lighting, vessel lights, navigational lighting for mariners, aviation obstruction lighting (used to enhance the visibility of structures or fixed obstacles which may conflict with the safe navigation of aircraft), and work/safety lighting for maintenance and operations during nighttime hours (BOEM, 2013; Krijgsveld *et al.*, 2011).

The FAA recommends voluntary marking or lighting, or both, of a meteorological tower less than 200 feet (ft) in height above the sea surface to promote the safety of low-level aviation operations and to enhance the conspicuity of these towers. Depending on the type of meteorological tower, the use of spherical marker balls may enhance conspicuity of these typically skeletal structures (BOEM, 2021). Marking lights should be visible to the mariner from all directions in the horizontal plane (IALA, 2021). When lighting is deemed necessary, medium intensity flashing white (Type A), flashing red (Type B) or fixed red (Type C) lights must be used. The perimeter of an OSW project must be defined with a maximum determined distance and lights should be positioned on the nacelle so that they are visible from all directions.

5.5.3 Vessel Activity

Vessel activity related to an OSW project includes vessels used for survey work, turbine component transfer, cable burial, crew transfer and turbine installation. The number and category of vessels used depends largely on environmental conditions, distance of the project from shore, project size and other factors (CleanPower, 2021). Vessel activity will take place along specific routes between ports, or between ports and the project (NYSERDA, 2022a); it will be greater during construction and installation.

Vessel discharges to the water can occur both as a result of normal operations or through incidents and accidents. Discharges could include bilge water, ballast water (used for stabilization), deck drainage,

gray/black water, fire suppression system test water, chain locker water, exhaust gas scrubber effluent, condensate and seawater cooling system effluent (BOEM, 2023).

5.5.4 Noise and Vibrations

Sound travels efficiently in the ocean, about 4 - 5 times faster than it does in air (NOAA, 2022). Underwater sound can be generated by biological, physical and anthropogenic sources. Unwanted sound sources, such as those from OSW development, are referred to as "noise" (SEER, 2021). There are four primary sources of underwater noise generated by OSW projects and associated activities (NYSERDA, 2019):

1. geophysical surveys to assess the ocean bottom at a prospective development site during the site assessment phase;
2. turbine operation;
3. construction activities, such as installation of turbine foundations into the seabed; and
4. vessel and air traffic.

During construction, the driving of foundation piles into the sediment generates a significant amount of noise for certain foundation types (SEER, 2021). Noise levels that can cause auditory injury to marine species are likely to occur in relatively close range to the pile driving. The intensity of noise produced reduces at greater distances from the source (due to spreading) (SEER, 2021). Vessel operations during the OSW construction phase generate varying levels of underwater noise depending on the type of vessel and by the method of station keeping, e.g., dynamic positioning or mooring system (SEER, 2021). The risk to marine life from underwater noise during other phases of OSW development, e.g., site surveys, operations and maintenance, is lower than during the construction phase (SEER, 2021). Overall, underwater sound levels (both particle motion and sound pressure) and detection distances vary substantially by site and depend on factors such as substrate characteristics, depth, pile diameter, size of impact hammer and how they are measured (Mooney *et al*., 2020). Further monitoring is needed to address research needs and gaps to better understand the impacts of underwater noise on different marine species (SEER, 2021).

Vibrations caused by OSW turbines may affect some marine species that live in, on, or close to the substrate, e.g., the seabed (Popper *et al.*, 2022). Activities such as pile driving and sound energy entering the substrate through the water from intense sources, e.g., seismic air guns, can initiate vibrations by direct contact of a sound source with the substrate (Popper *et al.*, 2022). Additionally, vibrations can cause sound pressure and particle motion to emanate from the substrate back into the water column (Hawkins *et al.*, 2021; Popper *et al.*, 2022). Many marine species rely on sound for communication, foraging, and avoiding hazardous situations. Hearing sensitivity varies greatly between species, and anthropogenic noise is often recognised as detrimental to many forms of marine life.

Throughout the construction and operation of an OSW farm, vessels and helicopters will be used to move personnel and supplies from shore bases to the turbine locations and from offshore substations or accommodation vessels to turbine locations. Their use will be greatest during construction activities, e.g., pile-driving and cable installation. Transmission of sound from the helicopters used into the marine environment is related primarily to the altitude of the helicopter and the sea surface conditions.

5.5.5 Exclusion Zones

Exclusion zones, or “navigational safety zones” can be either temporary (during construction) or permanent (during operations and maintenance). They are established to restrict vessel movements within certain distances of construction, installation or operations of OSW components, including individual turbines, cables and substations to reduce the risk of vessel collision (between vessels) or allision (collision between a boat and a stationary object, e.g., a wind turbine) (FLOWW, 2014; BOEM, 2019). In addition to navigational safety, exclusion zones may be imposed for certain fisheries to protect buried and floating cables and anchor/mooring lines.

5.5.6 Seabed Disturbance

Seabed disturbances are associated mainly with construction activities, including seafloor preparation, dredging and the creation of scour protection around turbine bases, cable burying, foundation installation and vessel anchoring (see section 3.2.2). The construction of an OSW project often includes dredging or excavation works for levelling the seafloor at the foundation locations, for pre-trenching part of the cable route to assure sufficient burial depth during the lifetime of the project, for the creation of foundation pits (in case of gravity-based foundations) and to cross navigation channels with the electrical cables (Vanden Eede *et al*., 2014).

Foundation installation and cable laying that require major bottom disturbance, e.g., by dredging, typically create the largest installation-related suspended sediment levels and sedimentation effects on benthic communities (ICF, 2020). Depending on the foundation type, the materials used and the sediment type present, the placement of new structures can temporarily or permanently alter the benthic habitat directly beneath and in the vicinity of fixed-bottom turbines (Maxwell *et al*., 2022).

In the case of floating OSW turbines, anchors are installed on the seafloor. While some mooring designs use a taut cable that does not contact the seafloor, other designs (conventional catenary moorings) drape through the water column and there is potential to interact with the seafloor (Maxwell *et al*., 2022).

Depending on the strength of ocean currents, waves and the sediment type present, the seafloor surrounding a fixed-bottom turbine foundation may be subject to scouring. The resultant depressions and pits on the seafloor can affect the stability of turbine foundations and potentially alter benthic habitat (NYSERDA, 2017e). Scour protection (rocks, mats or other hard surfaces) is installed around the bases of fixed-bottom turbines and along subsea cables when the conditions are considered conducive to scouring (NYSERDA, 2021b).

5.5.7 Electrification of Subsea Power Cables

Subsea power cables are used at OSW projects to connect individual turbines (array cables) and to transmit power back to shore (export cables). Whenever possible, power cables associated with OSW projects are buried in the seabed or protected with a concrete mattress or other coverings to minimize any accidental damage. In the case of floating OSW projects in deeper waters, array cables are left to float in the water column at a designated depth, facilitated by floaters and buoys.

Electromagnetic fields (EMFs) are created by the electrification of subsea power cables. They are the invisible magnetic forces which surround the electrical equipment and power cables and are strongest close to the source (Health Canada, 2024). Most electric field emissions are virtually eliminated before being released into the surrounding environment because the array and transmission cables used are shielded, buried and grounded, a process that helps to equalize voltage between connected equipment. Subsea power cables carry either AC (alternating current), or DC (direct current) power, and both systems produce magnetic fields. DC power cables, often used to transport the aggregated power output from the turbines to shore, can carry higher power levels and can therefore generate stronger magnetic fields than AC power cables.

5.5.8 Presence of Infrastructure

The infrastructure footprints and configurations of fixed and floating technologies are slightly different, but both include turbine towers, foundations, cables, substations etc. (see Figure 3.1 in section 3.1.2).

OSW turbine foundations may provide habitat for epifaunal organisms along a depth gradient, attracting fish and other species (SEER, 2022b) (Figure 5.2). Artificial reef effects have been documented at OSW projects, as well as at offshore oil and gas platforms; these are known to attract certain fish and invertebrate species and to provide hard vertical and horizontal substrate habitats (SEER, 2022b; Degraer *et al*., 2020).

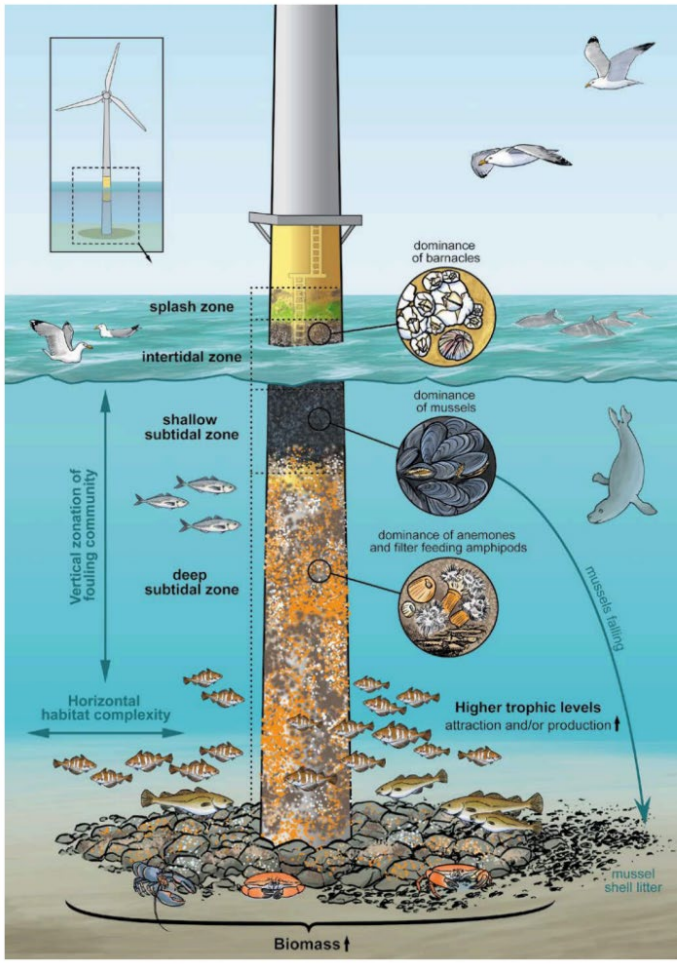


Figure 5.2. Illustration of a Turbine Foundation Providing Habitat Illustration by Hendrick Gheerardyn (Degraer *et al*., 2020)

According to SEER (2022b), floating OSW farms are still a relatively nascent technology and less is known about their potential effects on fish and shellfish (SEER, 2022b). Based on the technology type, they may have a less direct effect on fish species and habitats because of the limited vertical profile of the floating foundation and smaller footprint associated with mooring and anchoring (SEER, 2022b).

When decommissioning an OSW project and removing foundational structures including rock scour protection from the project site, substrate habitats are removed and reef-like resources for different benthic species are lost (Demuytere *et al.*, 2024; Hall *et al.*, 2020; Jalili *et al.*, 2024). The removal of this habitat not only affects the colonial species directly attached to the infrastructure, but also other predatory species that depend on these colonial species for food (Abramic *et al.*, 2022). The environmental impacts caused by artificial reef removal depend heavily on the local context. For example, if a species at risk became associated with an OSW structure, the removal of the artificial reef would further increase the vulnerability of that species (Hall *et al.*, 2020). Additionally, the biodiversity generated around an artificial reef can spill over into surrounding areas (Danovaro *et al.*, 2024);

removing these reef structures could therefore not only reduce biodiversity in the immediate area, but in adjacent habitats (Hall *et al.*, 2020).

5.5.9 Movement of Turbine Blades

When wind flows across the turbine blade, the air pressure on the downstream side decreases while that on the upstream side increases. The difference across the two sides of the blade creates both lift and drag; when the force of the lift is stronger than the drag, this causes the rotor to spin (US DoE, n. d.). On the upstream side of the turbine, the pressure increases because of backflow, forcing more of the air to pass to the side of the turbine and increase speed (Myers and Meneveau, 2011; Hou *et al*., 2019). This effect varies according to the distance between the turbines and their layout. The complex interactions of blades with the surrounding wind dictates the aerodynamic performance of the wind turbines (Asim *et al*., 2022).

High winds, periods of reduced visibility, or distractions may influence a bird's ability to react at a micro-scale to a moving turbine blade (Willmott *et al.,* 2013). Vulnerability of marine birds to OSW turbines has been examined extensively at sites in the North Sea. In general, evidence suggests that marine birds are less vulnerable to direct contact with turbine blades than originally thought, even during migration (Dahlström, 2023). Monitoring of migratory species passing through OSW farms in Denmark (Christensen *et al.,* 2006) and Scotland (AOWFL, 2023), for example, seems to indicate that the majority of individuals avoid the farm by maneuvering around it when weather conditions permit (AOWFL, 2023; Christensen *et al.,* 2006). They may, however, be affected by being displaced from previous feeding grounds (Garthe *et al*., 2023).

The increased speeds and turbulence associated with wind blowing through a wind farm can have significant effects on surface mixing of the water column in the vicinity and downstream of the turbines, and hence on the local biological productivity. This needs to be evaluated for each wind farm design and site. It is an effect that might be difficult to distinguish from changes in vertical mixing caused by climate change, and hence needs to be studied more thoroughly.

Shadow flicker is an effect of pulsating light and shadow caused by the sun as it shines through rotating wind turbine blades (USDoE, 2024; Haac *et al*., 2022). Intensity of shadow flicker diminishes with increasing distance from a wind turbine and is less noticeable the farther away from the turbine (Haac *et al*., 2022). Witnessing shadow flicker from OSW farms is a relatively rare occurrence, as it requires the angle of the sun to be at a specific angle in a certain location, which only occurs a few hours each year (USDoE, 2024).

Unlike birds, bats rarely collide with stationary infrastructure, e.g., turbine towers, substation platforms and non-spinning blades, but may be at risk of collision with spinning turbine blades (Boonman, 2018). The principal cause(s) of bat mortality at turbines is/are still unclear, but since mortality appears to involve primarily tree bat species (*lasiurine* bats) or bats in migration during the spring and fall, there are hypotheses that they are either mistaking the turbine as a roosting or mating symbol, or not using sonar for positional information. Because of the electromagnetic fields at turbines, bats may also not be able

to recognize the direction or speed of rotating wind turbine blades, or they may become disoriented (Stantec, 2023). Feathering of blades during high bat activity periods is therefore being adopted increasingly to mitigate impacts on bats (Richardson *et al.,* 2021; Huang *et al.,* 2024).

5.5.10 Waste Handling and Management

Possible sources of wastes associated with an OSW project include discharges of wastewater, artificial scour protection materials, combustion emissions from vessel operations, dredge material (from infrastructure installation including export cables) disposal, direct chemical emissions and spills during accidents and malfunctions (Kirchgeorg *et al*., 2018).

Additional sources of wastes relate to the types of materials removed at the end of an OSW project lifecycle. Many of these materials are either recycled or are discarded, depending on the materials' condition and the recycling systems and programs available (Hall *et al*., 2020).

The *Canadian Environmental Protection Act* (1999) (CEPA) prohibits the disposal of a substance at sea within Canadian jurisdiction and by Canadian ships in international waters and waters under foreign jurisdiction, unless the disposal is done under a permit issued by the ECCC Disposal at Sea Program (ECCC, 2019). The only materials authorized under Section 5 of the Regulations are natural organic materials such as fish waste, uncontaminated dredge spoils, some classes of man-made materials associated with aircraft, vessels etc., and some bulky, uncontaminated materials consisting primarily of iron, concrete or steel (ECCC, 2019).

Offshore infrastructure uses anti-fouling paints and anti-corrosives; galvanic anodes may emit substantial amounts of metals; and organic coatings may release organic substances from weathering or leaching (BOEM, 2023; Kirchgeorg *et al*., 2018).

It is expected that many of the larger vessels required for the construction and installation of OSW turbines would come from abroad thereby increasing the risk of accidental releases of invasive species that may be present in ballast and/or bilge water.

5.5.11 Accidents and Malfunctions

Accidents and malfunctions at OSW projects are varied and can be unpredictable. In the event of an accidental event, the nature of subsequent impacts will depend on factors such as quantity of contaminants released, location of event, time of year and environmental conditions among others (Gunter, 2014; BOEM, 2023). The size and scale of the wind farm, including the infrastructure to support it, will determine the type and volume of chemicals, discharges and materials stored on site and would be factored into determining the magnitude of potential impacts (BOEM, 2023).

Types of accidents and malfunctions that could occur at an OSW project include fires, personal injuries and fatalities, chemical leaching and spills, subsea cable failures and malfunctions, blade failures and malfunctions and vessel collisions. From a personal injury perspective, the Committee notes the significant number of personnel transfers expected in support of the ongoing operations and maintenance of turbines. It is suggested that this represents an order of magnitude safety risk greater as

compared to O&G operations and is something that CNSOER must address when considering risk mitigation in work authorizations, e.g., heave compensated transfer platforms and operating procedures that define acceptable weather conditions.

Lightning strikes, ice formation, hurricanes and other weather events can also lead to turbine damage and malfunctions. The number of failures in OSW components has been small, but as turbine size has increased, there has been a slight increase in turbine blade failures (Bushard, 2024). Turbine blades are typically made of fibreglass materials which are difficult to recycle and have strong negative environmental effects (Spini and Bettini, 2024). Recently, one of the turbine blades in the Vineyard Wind Farm collapsed unexpectedly and turbine parts washed up on Nantucket Island shores in the Eastern US (Bushard, 2024).

5.6 Overview of Valued Components

VCs are the environmental, social, cultural and economic conditions that are important to the community at large.

The Committee has considered the following VCs as identified in the TOR:

- atmospheric environment;
- fish and fish habitat;
- marine mammals and sea turtles;
- aerofauna (birds, bats and insects);
- fisheries;
- other ocean users;
- physical and cultural heritage; and
- health, community and economy.

This list is generally understood to be the VCs associated with OWS development, to be supplemented as required by the characteristics of a specific site.

Table 5.2 combines the IPFs from Table 1 with the VC's assessed.

Table 5.2. Potential Impacts of Offshore Wind Development

	Valued Component							
	Atmospheric environment	Fish and fish habitat	Marine mammals and sea turtles	Aerofauna	Fisheries	Other ocean users	Physical and cultural heritage	Health, community, and economy
Impact Producing Factor								
Atmospheric emissions	X			X			X	X
Artificial lighting		X	X	X	X	X	X	X
Vessel and equipment activity	X	X	X	X	X	X	X	X
Noise and vibrations		X	X	X	X	X	X	X
Exclusion zones					X	X	X	X
Seabed disturbance		X	X	X	X		X	X
Electrification of subsea power cables		X	X		X	X	X	X
Presence of infrastructure		X	X	X	X	X	X	X
Movement of turbine blades		X	X	X	X	X	X	X
Waste handling and management		X	X	X	X	X	X	X
Accidents and malfunctions	X	X	X	X	X	X	X	X

Subsequent tables identify the potential effects and appropriate mitigation and monitoring for each impacted VC. In compiling this information, the Committee has received considerable support from various agencies and departments, including the following:

- Environment and Climate Change Canada Advice Response (including Canadian Wildlife Service);
- Department of Fisheries and Oceans Canada Advice Response;
- NS Department of Fisheries and Aquaculture Advice Response;
- NS Communities, Culture, Tourism and Heritage Advice Response;
- Transport Canada Advice Response;
- Health Canada Advice Response;
- Indigenous Services Canada Advice Response;
- Natural Resources Canada Advice Response; and
- Parks Canada Feedback on Interim Report.

While this information has been helpful and appreciated, and the Committee has also learned much through its own jurisdictional scans and research efforts, it has not independently examined in detail all applicable legislation (including standards adopted through international conventions) or best practice guidelines from other jurisdictions that may be relevant to an assessment of IPFs, mitigation and monitoring. As discussed above in section 5.2, the Committee recognizes the need for best practice guidelines in the Nova Scotia context and the value they could bring to inform proponents on expectations with respect to project specific mitigation and monitoring, supplemented as required by information obtained through the project environmental assessment. The RA is not evaluating a project. It is hoped that the following information will be taken into consideration by the OER as one source of information that can inform the development of appropriate best practice guidance.

5.6.1 Atmospheric Environment

Overall, OSW generation produces less emissions than most alternative electricity generation methods (US DoE, 2024), and where fossil fuel sources of electricity are replaced by OSW development, there is a net GHG reduction (Government of Nova Scotia, 2024). Quantifying GHG emissions produced by the construction, operations and decommissioning of OSW power is challenging for a number of reasons. No project specific data exist for Canada. Many project specific factors influence GHG emitting outcomes including water depth, distance from shore, type of platform (floating or fixed), the size of the turbines, the number of turbines and the number and types of vessels used. The activities giving rise to GHG emissions are associated with the combustion of fossil fuels for vessel operation for the various activities including the transportation of components, seabed preparation, foundation installation, cable laying, wind turbine installation, sub-station installation, crew transportation, inspection and maintenance of equipment and the removal of infrastructure during decommissioning.

GHG emissions and criteria air contaminants (CACs)[34] associated with OSW development are generally short-term:

- weeks to months over a period of a few years for site assessment surveys;
- approximately eight months for 1-3 years for construction and installation;
- weeks to months each year for inspection and maintenance activities over the operating life of the project; and
- approximately eight months for a period of 1-3 years for decommissioning.

It is acknowledged that accidents and malfunctions, e.g., fire, may have adverse environmental effects on the atmospheric environment.

Table 5.3 presents IPFs, potential effects, mitigation and monitoring for the VC: atmospheric environment.

[34] The six most common air pollutants are called “criteria” air pollutants and include carbon monoxide, lead, ground-level ozone, particulate matter, nitrogen dioxide, and sulfur dioxide.

Table 5.3. Atmospheric Environment – Effects, Mitigation and Monitoring Measures

Impact Producing Factor	Potential Effects	Key Mitigation and Monitoring Measures
• Air emissions • Vessel and equipment activity • Accidents and Malfunctions	• Increase in air pollutants and GHG emissions associated with combustion of fossil fuels and, potentially from accidental releases associated with chemical spills and fires	• Development of air contaminant emission inventories and report to the national registry as appropriate (O&M) • Select vessels with engines designed to reduce air pollution, e.g., hybrid electric or fully electric crew transfer vessel, to the extent practicable (SA) • Adherence to air quality guidelines, using high-quality fuel that contains low sulfur levels, and ensure that emissions control technologies for marine vessels and backup generators are properly maintained and installed (CI, O&M) • Limit engine idling time (CI, O&M) • Consider climate change and GHG guidance presented in the Government of Canada's 'Strategic Assessment of Climate Change'[1] and related Technical Guides (O&M) • Consider establishing a lifecycle GHG output/MW installed generating capacity to establish a benchmark for the Atlantic Canada region against which to measure future project performance (O&M) • Use monitoring systems that detect early signs of system malfunctions (O&M) • Develop contingency and emergency response plans, and work with emergency response partners in exercise simulations to improve emergency response performance and reduce response times (O&M)

1. The *Strategic Assessment of Climate Change* considers the extent of which designated projects hinder or contribute to the Government of Canada's ability to meet its commitments in respect of climate change and will enable consistent, predictable, efficient and transparent consideration of climate change throughout federal impact assessments.

Note: SA = Site Assessment, CI= Construction and Installation, O&M = Operations and Maintenance, RD = Repowering and/or Decommissioning
Sources: Adekanmbi *et al*., 2024; Bang *et al*., n.d.; BOEM 2022b; BOEM, 2023; Browning and Lenox, 2020; Corio, 2022; ICCT, 2020; IMO n.d.; Kirchgeorg *et al*., 2018; NYSERDA 2017e; NYSERDA, 2018; Raadal *et al*., 2014; Stantec, 2023; US EPA, n.d.

For more information, see Environment and Climate Change Canada Advice Response (iaac-aeic.gc.ca); Health Canada Advice Response (iaac-aeic.gc.ca); Transport Canada Advice Response (iaac-aeic.gc.ca) available on the Registry.

5.6.2 Fish and Fish Habitat, Marine Mammals and Sea Turtles

Frequent concerns raised during the RA engagement process over potential impacts to these VCs are listed below:

- noise and vibrations associated with site assessment surveys, e.g., sonar and high resolution geophysical / seismic surveys;
- the potential for entanglements with mooring lines and cables;
- collisions because of increased vessel traffic;
- EMF emissions from subsea power cables;
- physical habitat disturbance;
- disrupted migration routes;
- accidents and malfunctions; and
- inappropriate waste management.

Table 5.4 presents IPFs, potential effects, mitigation and monitoring measures for the VCs: fish and fish habitat, marine mammals (cetaceans (whales) and pinnipeds (seals)) and sea turtles.

Table 5.4. Fish and Fish Habitat, Marine Mammals and Sea Turtles – Effects, Mitigation and Monitoring Measures

Impact Producing Factor	Potential Effects	Key Mitigation and Monitoring Measures

• Artificial lighting
• Vessel and equipment activity
• Noise and vibration
• Seabed disturbance and resuspension of sediment
• Electrification of subsea power cables
• Presence of infrastructure
• Movement of turbine blades
• Waste handling and management
• Accidents and malfunctions
	• Changes in habitat quality/quantity and biological diversity, e.g., reef effect, turbulence in the air above the sea caused by turbine blades affecting mixing processes and biological productivity of downwind surface waters, etc.
	• Physical and psychological injury or mortality due to underwater noise and vibration, electrification of subsea cables, e.g., EMF and heat, entanglement, and vessel collisions
	• Behavioural changes, e.g., avoidance, displacement, attraction
		• Baseline surveys to identify critical habitats, seasonal species distributions and monitoring protocols (SA)
		• Avoidance of sensitive seafloor habitat for cable-laying and anchoring, e.g., through pre-construction site surveys (SA)
		• Minimization of sediment disturbance and alteration during cable-laying, e.g., horizontal directional drilling, jet cable embedment and remotely operated vehicles (CI)
		• Where appropriate, ensure dredge materials are tested and disposed of under ECCC ocean dumping permits
		• Underwater noise and vibration mitigation: (SA, CI, O&M)
		  ○ Quieting technologies, e.g., bubble curtains, hydro sound dampers
		  ○ Time of year restrictions, e.g., during migration or breeding / spawning seasons
		  ○ Exclusion buffer zones during pile driving activities
		  ○ Soft start / gradual ramp up for pile driving
		• Follow Canada's Ocean Noise Strategy *(under development)* to collaboratively better understand and manage ocean noise (CI, O&M, RD)
		• Vessel speed restrictions and guideline development around operating limitations (wind, wave height) (SA, CI, O&M)
		• Marine mammal and sea turtle monitoring to reduce potential for vessel collision, e.g., passive acoustic monitoring (SA, CI, O&M)
		• Conduct hearing sensitivity studies for selected species, including detection of particle motion, vibration, and sound pressure
		• Reduction of EMF emissions, e.g., cable selection and burial, protective scour protection layers (SA)
		• Timing of cable-laying to avoid sensitive periods (spawning and migration) (SA, CI)
		• Select lighting that minimizes impacts to marine species (SA, CI, O&M, RD)

Impact Producing Factor	Potential Effects	Key Mitigation and Monitoring Measures
		• Monitoring of moorings for entanglement of marine debris, e.g., passive technologies (O&M) • Pre-installation seabed assessment surveys to determine sensitive habitat locations (P) • Avoidance of sensitive seafloor habitat, e.g., eelgrass beds, coral and sponge hotspots, archaeological resources and contaminated areas for cable-laying and anchoring (P) • Reduce overall footprint of turbine matrix and cable array (P) • Minimize seafloor disturbance and alteration during construction activities (C) • Monitor project footprint, e.g., turbine locations and cable path, to determine potential changes to benthic community structure and behaviour during the life of the project (O) • Follow up on the research undertaken by NSP with respect to EMF impacts associated with the NL link to NS (O&M) • Monitor and evaluate impacts of reef effects on fish and fish habitat over the long-term (CI, O&M, RD) • Employ partial decommissioning of offshore structures in situ, e.g., leaving the scour protection layer, to minimize the disruption of benthic habitat created since the time of installation for the conservation of local hard-bottom dwelling species and benthic biodiversity (RD) • Minimize the use of anti-fouling paint on subtidal surfaces to encourage species' colonization on the structures (CI, O&M)
Note: SA = Site Assessment, CI= Construction and Installation, OM = Operations and Maintenance, RD = Repowering and/or Decommissioning **Sources**: Bat *et al*., 2013; BOEM, 2021, 2023, 2024; Bourgeois *et al*., 2009; Byrne Ó Cléirigh Ltd., 2000; Castellote *et al*., 2007, 2012; Cresci *et al*., 2019; Copping *et al*., 2016; Copping and Hemery, 2020; CSA, 2021; Degraer *et al*., 2020; Depledge *et al*., 2010; DFO, 2000, 2004; Di Iorio and Clark, 2010; Erbe *et al*., 2015, 2019; Farrugia *et al*., 2010; Gill *et al*., 2020; Gill and Desender, 2020; Gill and Taylor, 2002; Glass *et al*., 2008; Harsanyi *et al*., 2022; Holt *et al*., 2009; Hou *et al*., 2019; Hutchinson *et al*., 2018, 2020; ICES, 2021; ICF, 2020; Kaldellis *et al*., 2016; Koschinski *et al*., 2003; Fine and Lenhardt, 1983; Longcore and Rich, 2010; Lüdeke, 2017; Mavraki, 2020; Maxwell *et al*., 2022; McCauley *et al*., 2000; Mooney *et al*., 2020; Moore *et al*., 2013; Moray East Offshore Windfarm, 2019; Murphy *et al*., 2012; Myers and Meneveau, 2011; NJDEP, 2010; Nowacek *et al*., 2007; NMFS, 2016; NRC, 2003; NYSERDA, 2017e; NYSERDA, 2017f; NYSERDA, 2017g; NYSERDA, 2017h; NYSERDA, 2021b; O'Hara and Wilcox, 1990; Orr *et al*., 2013; Parks *et al*., 2007; Popper *et al*., 2014; Risch *et al*., 2012; Scott *et al*., 2018; SEER, 2021, 2022B; Southall *et al*.,		

Impact Producing Factor	Potential Effects	Key Mitigation and Monitoring Measures
2007; Stantec, 2023; Stone and Tasker, 2006; Svendsen *et al*., 2022; Tang and Kilpatrick, 2021; Taormina *et al*., 2020; Tricas and Gill, 2011; Tyack, 2008; Wang *et al*., 2023; Weilgart, 2007b; Weir, 2008; Wilber *et al*., 2018; Wright *et al*., 2007a, 2007b, 2011. For more information, see Department of Fisheries and Oceans Canada Advice Response (iaac-aeic.gc.ca), NS Department of Fisheries and Aquaculture Advice Response (iaac-aeic.gc.ca), Health Canada Advice Response (iaac-aeic.gc.ca) available on the Registry.		

5.6.3 Aerofauna

The operations and maintenance phase of OSW development pose the greatest potential threat to aerofauna (birds, bats and insects) including collision with moving turbine blades and displacement due to avoidance of turbines. The presence of infrastructure and activity can also attract birds and bats to roost on structures and vessels. Attraction to new foraging habitats created by underwater structures may also lead to displacement from flight/migratory corridors and foraging areas while artificial lighting can cause disorientation at night or attraction to turbines during inclement weather events.

Other IPFs include the presence of vessels and equipment, noise and vibrations, seabed disturbance, waste handling and accidents and malfunctions, all of which have the potential to affect aerofauna in ways similar to the impacts to all VCs discussed in this chapter, i.e., changes in behaviour.

Table 5.5 presents IPFs, potential effects, mitigation and monitoring for the VC: aerofauna (birds, bats, and insects).

Table 5.5. Aerofauna – Effects, Mitigation and Monitoring Measures

Impact Producing Factor	Potential Effects	Key Mitigation and Monitoring Measures
• Atmospheric emissions • Artificial lighting • Vessel and equipment activity • Noise and vibrations • Seabed disturbance • Presence of infrastructure • Movement of turbine blades • Waste handling and management • Accidents and malfunctions	• Physical or psychological injury or mortality due to collision, e.g., vessels and infrastructure, seabed disturbance, noise and vibrations • Behavioural changes, e.g., avoidance, displacement, attraction, foraging	• Undertake baseline data collection and collision and displacement vulnerability modelling to inform siting with an objective to avoid or reduce interactions (SA) • Site turbines to avoid important areas, minimize development footprint and displacement effects (SA) • Design turbines to minimize potential for perching/roosting (SA) • In combination with detection technologies, implement curtailment procedures to change rotor speeds or halt turbine rotors during high-risk periods, e.g., high fog events, storms, foraging, breeding, etc. (O&M) • Use bird/bat deterrent technology and designs, e.g., sound and visual cues, feathering of blades (O&M) • Minimize lighting to meet aviation obstruction lighting requirements (CI, O&M) • Undertake post-construction monitoring of bird/bat activity (cameras, radar, strike indicators) (O&M) • Follow Canada's Ocean Noise Strategy (*under development*) to collaboratively better understand and manage ocean noise (CI, O&M) • Application of the model developed by Canadian Wildlife Service (CWS) and integration of high-quality data collection to improve its predictive value

Note: SA = Site Assessment, CI= Construction and Installation, O&M = Operations and Maintenance, RD = Repowering and/or Decommissioning
Sources: Allison *et al*., 2018, 2019; Arnett *et al.*, 2008; BOEM, 2021; Boonman, 2018; Desholm and Kalhert, 2005; Dehnhard *et al*., 2019; Dierschke *et al*., 2016; Dowling *et al*., 2017; Drewitt and Langston, 2006; Fox and Petersen, 2019; Furness *et al*., 2013; Gartman *et al*., 2016a, 2016b; Gjerdrum *et al*., 2021; Goodale and Milman, 2019; Guest *et al*., 2022; Hüppop *et al*., 2016; Jarrett *et al*., 2018; Kahlert *et al*., 2004; Kaldellis *et al*., 2016; Kerlinger and Curry, 2002; Kerlinger *et al*., 2010; Kondili, 2022; Kragefky, 2014; Lavers *et al*., 2009; Larsen and Laubek, 2005; Leemans and Collier, 2022; Masden *et al*., 2010; Mendel *et al*., 2019; MMO, 2018; Mockrin and Gravenmier, 2012; Montevecchi, 2006; NatureScot, 2020; ORJIP, 2022; Ortega-Izquierdo, 2020; Pelletier *et al*., 2013; Petersen *et al*., 2006; Pettersson, 2005; Rebke *et al*., 2019; Ronconi *et al*., 2015; Schwemmer *et al*., 2011; SEER, 2022a; Skov *et al*., 2018; Solick and Newman, 2021; Stantec, 2016a and b; Stantec, 2023; True *et al*., 2023; USDoE, 2012; Voigt *et al*., 2018; Weller and Baldwin, 2012; Willmott *et al*., 2013.

For more information, see Environment and Climate Change Canada Advice Response (iaac-aeic.gc.ca) available on the Registry.

5.6.4 Fisheries

The IPFs and potential consequences to fisheries have been the subject of study and debate. The Committee appreciates the engagement effort of numerous fisheries organizations and individual fishers in helping to define the issues in a Nova Scotian context. One of the much-discussed impact pathways is 'exclusion'; where a temporary or permanent loss of access may occur resulting in some form of economic loss. In its most recent submission to the Committee, the NSFAEE made it clear that fishermen want to keep fishing, and that compensation should be viewed as a "last resort" (NSFAEE, 2024b) to be considered only once every effort to avoid or mitigate has been exhausted. In keeping with this general approach, the Committee prefers to treat the topic of economic loss through exclusion separately, as a consequence of an inability to avoid or mitigate, rather than mitigation per se. The IPF of "exclusion" remains in Table 5.6, but the issue of compensation is addressed elsewhere (section 10).

The presence of infrastructure, e.g., turbines, array cables, substations, scour protection and export cables can lead to increased potential for collision risk and gear loss in the vicinity to OSW projects. Similarly, and as noted previously, the presence of this infrastructure may also impact fish and fish habitat, i.e., habitat alteration and disturbance to migration patterns, reef effects, and decrease biological diversity which may present associated indirect impacts to fisheries. Indirect impacts to fisheries may also result from the introduction of noise from site assessment, construction and installation activities, the potential introduction of invasive species, waste handling activities and accidents and malfunctions. Table 5.6 presents IPFs, potential effects, mitigation and monitoring for the VC: fisheries.

Table 5.6 presents IPFs, potential effects, mitigation and monitoring for the VC: fisheries.

Table 5.6. Fisheries – Effects, Mitigation and Monitoring Measures

Impact Producing Factor	Potential Effects	Key Mitigation and Monitoring Measures
• Artificial lighting • Vessel and equipment activity • Noise and vibrations • Exclusion • Seabed disturbance • Electrification of subsea power cables • Presence of infrastructure • Movement of turbine blades • Waste handling and management • Accidents and malfunctions	• Loss of access to fishing grounds • Gear loss or damage • Changes in fisheries resources • Disruption in vessel navigation • Increased risk of collision, allision, and vessel/infrastructure damage	• Engage early with fishing interests in the project design phase to facilitate the establishment of successful co-location/co-existence opportunities and clear protocols for fishing access and operations (SA) • Provide training to fishers, including access to fishing simulation within OSW farms to support co-location activities (SA, O&M) • Consider performing field tests for maneuverability and operation of various gear types in and around OSW project area (SA, O&M) • Minimize issues associated with scour protection (minimize footprint, avoidance of important fishing habitats) and cable-laying (sufficient burial depth) (SA) • Provide navigational aids/upgrades to fishers (cell-phone coverage, fog signals, AIS technology, radar, obstruction charts) (SA) • Early consultation and ongoing communication with fishing industry on construction, operation and decommissioning activities and safety measures (SA, CI, O&M, RD) • Plan the installation of infrastructure during time windows to avoid disruptions to important habitat and fishing activities (CI) • Undertake post-construction monitoring, e.g., safety threats, cable burial etc. (O&M) • Consider compensation plans/agreements for loss of access (SA, CI, O&M) • Collect adequate information in the project planning stage on long-term trends in the levels of different types of fishing activities to allow a distinction to be made between effects from OSW versus effects from climate change (SA, CI, O&M, RD)
Note: SA = Site Assessment, CI= Construction and Installation, O&M = Operations and Maintenance, RD = Repowering and/or Decommissioning **Sources**: Bat *et al*., 2013; Bates, 2024; BOEM, 2020a, 2020b, 2020c; 2021, 2022a, 2022b; Bonsu *et al*., 2024; Boyce *et al.*, 2023a, 2023b; FLOWW, 2014, 2015; Gkonis and Psaraftis, n.d.; Gray *et al*., 2016; Hooper *et al*., 2015; Mackinson *et al*., 2006; Methratta *et al*., 2020; National Environment Research Council, 2016; Moray Offshore Wind Farm East Ltd, 2022; NYSERDA, 2017h, 2022b; Roach *et al*., 2022; Schupp *et al.*, 2019, 2021; Steins *et al*., 2021; Stelzenmüller *et al.*, 2016, 2021; Thomsen *et al*., 2006; Van Hoey *et al*., 2021.		

Impact Producing Factor	Potential Effects	Key Mitigation and Monitoring Measures
For more information, see Department of Fisheries and Oceans Canada Advice Response (iaac-aeic.gc.ca); Health Canada Advice Response (iaac-aeic.gc.ca); Transport Canada Advice Response (iaac-aeic.gc.ca); NS Department of Fisheries and Aquaculture Advice Response (iaac-aeic.gc.ca) available on the Registry.		

5.6.5 Other Ocean and Airspace Users

Other Ocean and Airspace Users covers all other potential users that may interact with an OSW development. Potential effects are similar to those for the fisheries, e.g., presence of infrastructure and increased vessel activity could increase collision potential. Development and the establishment of exclusions zones could also impact other ocean users including those involved in commercial shipping, national defense, ocean monitoring programs and tourism and recreation activities. These issues would have to be addressed at the project level. The coastal buffer provides effective mitigation for a significant proportion of commercial and recreation vessel traffic. Turbine presence and moving turbine blades may present radar communication interference and aviation obstruction. From a sub-surface perspective, consideration would have to be given to the presence of array and export cables. Waste handling, accidents and malfunctions (and the subsequent remedial actions) may also impact the activities of other users.

Table 5.7 presents IPFs, potential effects, mitigation and monitoring measures for the VC: Other Ocean and Airspace Users.

Table 5.7. Other Ocean Users – Effects, Mitigation and Monitoring Measures

Impact Producing Factor	Potential Effects	Key Mitigation and Monitoring Measures
• Artificial lighting • Vessel and equipment activity • Noise and vibrations • Exclusion • Electrification of subsea power cables • Presence of infrastructure • Movement of turbine blades • Waste handling and management • Accidents and malfunctions	• Disruption to aviation and vessel navigation • Increased risk of collision, allision, and vessel/infrastructure damage • Rerouting • Conflicts with space	• Aviation and vessel navigation mitigation: o Undertake pre-installation navigational safety risk assessment to identify issues with siting and design (SA) o Communicate with aviation and marine users to determine navigation safety issues (SA, CI, O&M) o Design turbine siting and farm layout to minimize physical obstructions and radar interference (SA) o Install authorized navigational lighting (CI, O&M) o Incorporate latest technology, e.g., stealth treatment of turbines, artificial detection lighting system (SA) • Reduction in collision, allision and vessel/infrastructure damage: o Undertake risk-based models to determine appropriate set-back distances for vessels and infrastructure (SA) o Undertake pre-installation cable burial risk assessment to identify risk to vessels and extent of any required exclusion zone setbacks (SA) o Communicate to ocean users of cable-laying activities and creation of safety zones (CI, O&M) o Undertake pre-installation cable route and landing site assessments to identify potential cable corridors (SA) o Minimize interactions with existing subsea cables/pipelines and OSW cable installation, e.g., avoidance or removal of existing subsea infrastructure, installation of cable-crossings and cable protection systems (SA, CI) o Undertake post-construction monitoring to maintain safe cable burial depth (O&M) • Rerouting and conflicts with space mitigation:

		○ Consult with stakeholders and establish permanent traffic management measures to minimize rerouting impacts to vessels (SA) ○ Consult and coordinate with local municipalities and tourism stakeholders to minimize conflicts during peak tourist seasons and coastal events (SA, CI, O&M) ○ Locate to avoid existing and proposed mineral extraction areas (SA) Consult with regulators to minimize conflicts with scientific research and surveys and military operating/training operations (SA)

Note: SA = Site Assessment, CI= Construction and Installation, O&M = Operations and Maintenance, RD = Repowering and/or Decommissioning

Sources: BIS, 2008; BOEM, 2013, 2021, 2022b; European MSP Platform, 2022; Hattam *et al*., 2015; Ling *et al*. 2013; Marico Marine Group, 2007, 2008; MCA, 2016; Mehdi *et al*., 2018; Musial *et al*., 2020; NYSERDA 2017a, 2017b, 2017c, 2017e, 2018, 2021a; Rawson and Rogers, 2015; Stantec, 2023; Tsai and Lin, 2021; Vandermolen and Nordman, 2012; Wetra Lights n.d.; Zhen *et al*., 2022.

For more information, see Health Canada Advice Response (iaac-aeic.gc.ca), Transport Canada Advice Response (iaac-aeic.gc.ca) available on the Registry.

5.6.6 Physical and Cultural Heritage

Potential impacts to physical and cultural heritage are possible through all phases of OSW development. Seabed disturbance, vessel and equipment activity and accidents and malfunctions are IPFs that have potential to interact negatively with structures and sites of known/unknown historical, archaeological or paleontological significance, e.g., shipwrecks, and Mi'kmaq archaeological sites. Potential interaction with protected or special areas, including areas that are spiritually or culturally important to the Mi'kmaq, require consideration; these areas can occur in coastal areas where transmission cables come ashore as well as in locations further from shore. As indicated in section 4.6.6, the provincial archaeological regulator at CCTH is an important resource regarding heritage and archaeological sites, including Mi'kmaq sites and the locations of known shipwrecks.

Potential impacts may result in either a change to the physical area or to structures within it, or in the way a site is used or accessed. For example, physical sites in the marine environment, such as shipwrecks, could be altered or destroyed by OSW activities if not properly identified and avoided during project works. Likewise, valued sites or historical/archaeological features in coastal areas could be defaced or destroyed by the construction of onshore infrastructure, e.g., cable landing sites, port infrastructure and onshore substations, actions which could potentially reduce their real or perceived historical and cultural value. In addition, view planes from coastal areas of cultural importance could be negatively impacted by OSW project infrastructure.

Table 5.8 presents IPFs, potential effects, mitigation and monitoring for the VC: Physical and Cultural Heritage.

Table 5.8. Physical and Cultural Heritage – Effects, Mitigation and Monitoring Measures

Impact Producing Factor	Potential Effects	Key Mitigation and Monitoring Measures

• Atmospheric emissions
• Artificial lighting
• Vessel and equipment activity
• Noise and vibrations
• Exclusion
• Seabed disturbance
• Electrification of subsea power cables
• Presence of infrastructure
• Movement of turbine blades
• Waste handling and management
• Accidents and malfunctions
	• Flashing lights from turbines at night may disturb or degrade visitor experiences at physical and cultural heritage sites, e.g., national parks
	• Visual impacts to coastal communities
	• Potential for interaction, e.g., collision, with structures, sites or artefacts, e.g., shipwrecks, of historical, archaeological, paleontological or architectural significance, i.e. through collisions, propellor wash etc.
	• Potential negative effects of noise, including displacement or avoidance, on culturally important marine species
	• Seabed disturbance may lead to the discovery or uncovering of archaeological artefacts during subsurface excavation
	• EMF could affect fish species of cultural importance to the Mi'kmaq, e.g., *Kataq* (American Eel) and *Wipitamekw* (shark)
	• Potential for sediment displacement during construction activities resulting in erosion of archaeological features, e.g., shipwrecks.
	• Discharge and waste may lead to degradation of culturally important sites including coastal areas that may receive debris
		• The recommended coastal buffer will minimise any impact from offshore lighting to the onshore visitor experience (SA, CI, O&M)
		• Engage with coastal municipalities, Mi'kmaq Communities, CCTH and local experts regarding sites of historical or cultural significance to (SA, CI, O&M):
		  ○ Identify and categorize sites
		  ○ Inform the development and implementation of the necessary protocols for site assessment, construction and installation phases of all proposed works including cable routes
		  ○ Monitor identified sites to assess impacts over times
		• Report any discovery of new sites (SA, CI, O&M)
		• Avoid unnecessary lighting that may impact shoreline activities and cultural practices (CI, O&M)

Impact Producing Factor	Potential Effects	Key Mitigation and Monitoring Measures
	• Potential for spills/chemical releases to adversely impact culturally important sites and archaeological features	

Note: SA = Site Assessment, CI= Construction and Installation, O&M = Operations and Maintenance, RD = Repowering and/or Decommissioning
Sources: BOEM, 2020b, 2021, 2022a; Defingou *et al*., 2019; Dong and Lang, 2022; Firestone *et al*., 2015; Gee, 2010; Glasson *et al*., 2022; Gusatu *et al*., 2020; Haggett, 2011; Hattam *et al*., 2015; Huntington *et al*., 2015; Kaldellis *et al*., 2016; Karanikas *et al*., 2021; Kim and Chung, 2019; Ladenburg, 2010; Maslov *et al*., 2017; NYSERDA, 2017a, 2017b, 2018; Rees *et al*., 2019; Sullivan *et al*., 2013; Trandafir *et al*., 2020.

For more information, see NS Communities, Culture, Tourism and Heritage Advice Response (iaac-aeic.gc.ca); Transport Canada Advice Response (iaac-aeic.gc.ca); Health Canada Advice Response (iaac-aeic.gc.ca); Indigenous Services Canada Advice Response (iaac-aeic.gc.ca) available on the Registry.

5.6.7 Health, Community and Economy

The TOR requires consideration of potential impacts to Health, Community and Economy. It is, however, a VC with several dimensions. There are effects generated by the IPFs identified, and there are broader consequences associated with the investments required, both by the developer and by other parties, in the project components, services and infrastructure necessary to support the new industry. Table 5.9 identifies the proximate effects of the identified IPFs. Effects occur during the site assessment, construction and installation, operations and maintenance and decommissioning phases and are related to IPFs associated with physical activities such as noise and vibrations, increased vessel and equipment use, seabed disturbances, accidents and malfunctions and waste handling; all factors that relate to potential health issues for workers at sea.

IPFs of relevance during the operations and maintenance phases include the presence of infrastructure (visual impacts), artificial lighting (visual impacts), movement of turbine blades (shadow flicker) and atmospheric emissions. If OSW development occurs in one or more of the recommended PDAs, shadow flicker and visual impact, are likely only of concern to workers at sea as the proposed 25 km buffer will serve to protect coastal residents from these IPFs. This needs to be confirmed in a project impact assessment. Although there are uncertainties regarding the extent of offsetting GHG emissions expected from OSW development, it is broadly accepted that OSW will have an overall positive effect on atmospheric emissions. The 'carbon payback' period, i.e., the length of time it takes for a turbine to produce enough clean electricity to make up for the carbon pollution generated during its lifecycle is estimated at between 5 and 12 months (Alsaleh and Sattler, 2019; Australian Government, 2024; Peach, 2001). Considering that OSW turbines generate clean energy for decades, the net societal benefits are significant.

The broader consequences of the investment that may result from OSW development are introduced in section 5.7 and explored further in section 8. The reader is also referred to the comprehensive Health, Social, and Economic Guidance prepared by the Impact Assessment Agency and the Environmental Assessment guidelines prepared by the Government of Nova Scotia as valuable resources to understand how this VC is scoped and assessed for a project.

Table 5.9 presents IPFs, potential effects, mitigation and monitoring measures for the VC: Health, Community and Economy

Table 5.9. Health, Community and Economy – Effects, Mitigation and Monitoring Measures

Impact Producing Factor	Potential Effects	Key Mitigation and Monitoring Measures
• Atmospheric emissions • Artificial lighting • Vessel and equipment activity • Noise and vibrations • Exclusion • Seabed disturbance • Electrification of subsea power cables • Presence of infrastructure • Movement of turbine blades • Waste handling and management • Accident and malfunctions	• Offsetting of GHG emissions is a positive impact which can improve human and climate health • Potential for user conflicts through increased use of ports • Seabed and shoreline disturbance from OSW construction activities may impact human health through the release and mobilize of contaminants, including arsenic, heavy metals, oil, organotin, polychlorinated biphenyls (PCBs) and pesticides • Potential adverse impacts from noise and equipment activity and from EMF on culturally and economically important marine species, e.g., Atlantic lobster, Atlantic salmon, *Kataq* (American eel), and *Wipitamekw* (shark), which could directly or indirectly affect harvesting activities, performance of ceremonies and have consequences on the mental health of communities • Potential for decreased tourism which will impact the economy of NS • Potential for increased tourism opportunities which could have positive outcomes for NS • Potential for shadow flicker to impact those working near and around OSW	• Engage with coastal communities to understand shoreline locations that are culturally important and might be affected by offshore lighting, noise and vibrations as well as exclusion zones during CI; consider alteration to timing and/or planned activity location as appropriate (SA, CI, O&M) • Design turbine layout and the subsequent lighting plan to minimize visual effects (CI, O&M) • Prepare port infrastructure for increased vessel traffic (SA, CI, O&M) • Engage coastal communities at the outset of planning to identify the locations of cultural practices and areas of importance that might be affected seabed disturbance (SA, CI, O&M) • Site projects away from sensitive habitats such as areas with high densities of corals, sponges or eelgrass beds (SA, CI, O&M) • Avoid areas that may contain contaminants and minimize seafloor disturbance during construction (CI) • Select export cable routes based on avoidance of sensitive areas and areas that are heavily fished (SA, CI, O&M) • Promote recovery within the intertidal zone, e.g., material displaced from cable burial used as backfill to reduce the potential for sediment remobilization and to enable recovery of benthic organisms (CI, O&M) • Cover cables with scour protection where burial is not possible, or if burial would impact sensitive habitats (SA, CI, O&M)

Impact Producing Factor	Potential Effects	Key Mitigation and Monitoring Measures
	project sites that might cause headaches, dizziness, fatigue, and nausea etc. • Harsh environmental conditions can lead to the degradation of the toxic chemicals used to fabricate turbines, which could affect human health, e.g., contamination of fish and associated food systems • Chemical spills or marine debris from OSW vessels and equipment may impact human health if contaminated fish or other marine species are consumed	• Develop a community consultation plan, including for the site assessment phase, and engage with communities to inform people of what might be expected, i.e., how the viewscape might change (SA, CI, O&M) • Promote understanding of the positive aspects of OSW – this can be achieved by visitor centres, boat tours to view the OSW project, informational pamphlets about the OSW etc. (SA, CI, O&M) • Develop and implement safety management systems, environmental protection plans, pollution, contingency and emergency response plans (SA, CI, O&M)

Note: SA = Site Assessment, CI= Construction and Installation, O&M = Operations and Maintenance, RD = Repowering and/or Decommissioning

Sources: Adekanmbi *et al*., 2024; BOEM, 2021; Buonocore *et al*., 2016; Dai *et al*., 2013; Dethleff *et al*., 2016; Glasson *et al*., 2022; Hattam *et al*., 2015; Health Canada, 2023; ICF, 2020; Karanikas *et al*., 2021; Kaldellis *et al*. 2016; Krueger *et al.*, 2011; Maxwell *et al*. 2022; Mette *et al*., 2018; Musial *et al*., 2020; NYSERDA, 2017j, 2021a; Orr *et al*., 2013; Price and Figueira, 2017; Ren *et al*, 2021; Scheu *et al*., 2018; Speilmann *et al.*, 2021; Stantec 2023; Trandafir *et al*. 2020; USDI, 2013; Vize *et al*. 2008; Webster *et al*., 2013; White Consultants, 2020; Wratten *et al.*, 2005.

For more information, see Health Canada Advice Response (iaac-aeic.gc.ca) Department of Fisheries and Oceans Canada Advice Response (iaac-aeic.gc.ca); Transport Canada Advice Response (iaac-aeic.gc.ca); Indigenous Services Canada Advice Response (iaac-aeic.gc.ca) available on the Registry.

5.7 Pathways for Socio-economic Interactions and Potential Impacts

There are many potential pathways that connect OSW development activities to the broader socio-economic environment. All phases of OSW development will provide varying levels of short and long-term employment and business opportunities, which will bring both potential positive and adverse impacts to the receiving socio-economic receptors. For the purposes of this analysis, the potential broad socioeconomic impacts from OSW development are categorized as follows:

- a change to employment and economy;
- a change to community services and infrastructure;
- a change to quality of life/health, and
- inequities and barriers to disadvantaged groups.

5.7.1 Employment and Economy

An increase in employment and expenditures in local communities from OSW development will generally have positive economic effects. It is to be noted that the Accord legislation requires that all Canadian corporations and individual residents "shall have a full and fair opportunity to participate on a competitive basis, including in the course of employment, in the supply of goods and services…" [35]However, there may be constraints to achieving the benefits and there may be challenges associated with development success. The standard procurement policies and practices of large suppliers to OSW developers may make it difficult for small to medium sized enterprises to participate competitively in the bidding process, or the supply capacity may simply not exist.

Employment opportunities will also be generated, but they too are influenced by several criteria including the desire of the operator to build and service locally and the readiness of the local workforce to take up the opportunities. Focusing early on supply chain preparedness and labour availability and training can help promote the local capture of benefits. It may also be possible to influence the degree to which an OSW developer commits to procure and hire locally, although this too may be constrained by existing international trade commitments (see the discussion above in section 2.6.6) or the simple lack of local capacity. Once OSW project development details are understood, these issues can be better assessed and addressed.

5.7.2 Community Infrastructure and Services

The development of a new industry and an influx of new employees to a community will impose pressure on existing infrastructure and services. As detailed in section 4.6.4, development of the OSW industry will place very specific demands on port infrastructure, but the pressure will also be felt on all facets of community services: housing, medical and emergency services, the educational system and recreational amenities. The degree of pressure will depend upon the scale and pace of development. This is a topic that is explored in greater detail in section 8. The availability of labour to meet the existing demand in NS is now routinely debated, without the potentially significant additional demands of a new industry. Education and reskilling are necessary but so too is the need for general OSW education and

[35] NS Accord Amendment Act s.98.7(a)

engagement with junior and high school students to make them aware of the emerging industry needs and employment opportunities. The Committee is aware that tentative steps are being taken to address some of these issues, but more is necessary. If the policy direction of government is to attempt to significantly capitalize on the OSW that exists within the RA Study Area, considerable immigration would be necessary from both Canada and beyond (see discussion in section 8). This would aggravate the pressure on infrastructure and services that are already stretched and would highlight the need for provincial and municipal strategic planning with respect to key infrastructure, housing and all necessary services.

5.7.3 Quality of Life/Health

The work undertaken by Engage Nova Scotia in developing its Nova Scotian 'Quality of Life Index' is unequivocal; a significant percentage of residents believe that success should be measured through improvements in their quality of life. OSW activity has the potential, particularly in smaller rural communities, to disrupt regular community life through:

- increased traffic levels,
- higher local housing prices due to an influx of non-local workers,
- decreased access to timely health care,
- exacerbation of alcohol or drug abuse due to an increase in disposable income,
- impairment to viewscapes, and
- loss of access to coastal areas (including lands adjacent to harbours, rivers and estuaries) that may impact their traditional or non-traditional use and enjoyment (restrictions so hunting and gathering activities, whether for food or social/ceremonial purposes, or recreation activities).

The cumulative impact of these negative consequences may erode community cohesion and identity and individual quality of life. They may also erode social acceptance of OSW development. Concern extends to Indigenous communities. If those who have historically taken part in traditional hunting and gathering activities can no longer do so because they are working away from their communities for substantial periods of time, there could be adverse consequences for both the individuals involved and their communities. Changes in diet, lack of association with community and Elders could have negative effects on individuals' perceived health and well-being, particularly for those who have a strong connection to the land and a strong sense of belonging.

These potential changes and consequences discussed in the above sections are real, need to be anticipated and resources deployed to mitigate negative impacts.

5.7.4 Inequities and Barriers to Disadvantaged Groups

The distribution of socio-economic impacts from large-scale resource development is seldom equitable either spatially or socially. A few communities may, because of location or existing capacity, be selected for new infrastructure investment; others will not. There is, however, general acceptance in Canada that everyone should have equality of opportunity and that every reasonable effort should be made to accommodate the aspirations and needs of all. Appropriate education and skills training are key factors that influence hiring. Historic practices in the energy sector suggest that gender, sexual orientation and disability must be recognised as barriers that inhibit the employment of women, Indigenous people

(including women), Black Nova Scotians, 2SLGBTQQIA+ and the disabled. The Committee contracted the Canadian Research Institute for the Advancement of Women (CRIAW) to conduct a Gender-based Analysis with respect to the OSW industry and to identify how as a society we might strive for greater equity for historically disadvantaged groups in its development. Key findings include:

- The energy sector has traditionally been, and remains, male dominated; 76% fewer women than men are employed in this sector (IEA, 2024). This disparity is mirrored in the OSW industry: in 2019, International Renewable Energy Agency (IRENA) found that women occupied an average of 21% of wind energy jobs but were overrepresented in administrative positions and under-represented in senior management and science, technology, engineering and mathematics (STEM) positions.
- Barriers exist to accessing pertinent education and training: these include traditional social and cultural norms that discourage girls and others from pursuing STEM subjects in grade school, the lack of childcare during training and the fact that tools, equipment and protective clothing are sized for men. These barriers are systemic in schools, colleges and workplaces:
    - Workplace retention: once in the workplace, women and other disadvantaged groups confront obstacles that may not only inhibit their advancement but discourage them from staying. This can include the fairness of internal company practices, the absence of flex time, inadequate parental leave and the absence of childcare.
    - Work schedules or work locations that do not accommodate the needs of women or other marginalized groups, including the disabled.
    - Unsafe work environments for women, Indigenous people, especially women, 2SLGBTQQIA+ and the disabled.
- The historical nature of resource development being a male-dominated industry has led to issues related to domestic violence and sexual harassment for women both in the workplace and in local communities (Fusco *et al.,* 2024; Reclaiming Power, 2019; Gibson *et al.*, 2017).
- Domestic violence and sexual harassment are more prominent in communities where large construction activity is occurring, or in, or in proximity to, work camps where they have been established to accommodate necessary workers (Fusco *et al.,* 2024; Reclaiming Power, 2019; Gibson *et al.,* 2017).
- Large influxes of workers with disposable income leads to increased economic activity but can also lead to increased drug and alcohol consumption, and illicit activities such as prostitution, sexual assault, harassment and domestic violence (Fusco *et al.,* 2024; Manning *et al.*, 2018; Stienstra *et al.*, 2016; Gibson *et al.*, 2017). This is more likely in situations where local workers are living directly in the communities, with full access to places like bars, liquor stores, etc. This type of violence was highlighted in the Missing and Murdered Indigenous Women and Girls report (Fusco *et al.*, 2024; Reclaiming Power, 2019).
- Historically, women either involved directly in resource projects, or who live adjacent to such developments, have been disproportionately affected by these projects (Fusco *et al.,* 2024).

The above barriers and circumstances are real inhibitors to disadvantaged groups. CRIAW explores the issues in greater detail in their report. Additional considerations relevant to the barriers and challenges identified above include:

- Participation in OSW is directly tied to the training, qualifications and experience of the individual.
- Women, racial minorities, Indigenous peoples and other disadvantaged groups in NS, and in Canada, have historically had lower levels of formal education including university degrees, trades, or high school diplomas and have had lower levels of representation in large resource projects.
- Societal trends have left these groups disenfranchised and unable, or faced with greater challenges, to obtain the qualifications and experience needed for meaningful employment on resource projects.

Efforts to improve outcomes have included establishing targets for the participation of minority groups or women, the implementation of gender equity and benefits plans, and targeted apprenticeship programs and partnerships between industry and educational institutions. The potential size of the investment and employment opportunity presented by the arrival of the OSW industry suggests that a concerted effort among developers, educators, municipalities, Band Councils and other support groups and service providers is justified to improve on the resource industry's track record and further redress these well documented historical and systemic inequalities. Initiatives, including providing information on opportunities and available supports should not only be instigated in grade schools, pursued though applicable training programs and higher education, but also integrated into workplace employment strategies.

The potential for the construction of a work camp to meet the needs of a project requires special consideration. Work camps are usually proposed as a means to address the accommodation needs of a large workforce and/or to reduce pressure on the local housing market and related services in a rural area during the initial and construction phases of a project. While good camp design, including the incorporation of adequate recreation opportunities and related services, can contribute to positive relationships being established with nearby communities, effective camp management is also a prerequisite. This may include a dry (no alcohol) regime, conditions on access to communities outside of the camps and policies on harassment and violence. The success of a work camp, however, is always project and location specific. A further consideration must be the fate of the camp structures when they are no longer needed for the construction workforce. A potential benefit - in an era when there is a severe housing shortage - is to incorporate a strategy/plan for potential reuse.

6.0 Potential Development Areas

This chapter describes the approach adopted by the Committee to identify Potential Development Areas (PDAs). (Note: PFDAs or Potential Future Development Areas refer to the areas identified in the Interim Report). There are many factors to consider when identifying sites for OSW development, as evidenced by the numerous efforts undertaken by others (see discussion in section 2.2). Site selection is an iterative process that often starts by identifying where development is precluded, e.g., prohibitions in Marine Protected Areas, followed by a consideration of the physical, ecological and socio-economic constraints that can present further challenges and restrictions to development, e.g.., seafloor characteristics or commercial fishing activity.

The primary purposes of the Interim Report were to identify PFDAs, to narrow the focus within the RA Study Area and to elicit feedback. It was recognized at the time that much of the information being relied upon was outdated, incomplete or limited in scope and precision. Since the publication of the Interim Report, the Committee has undertaken an extensive public and Indigenous engagement program, issued Information Requests and received additional submissions from government departments, received the completed work of contractors and continued to meet with NGO, fishery and industry representatives, all of whom have informed the iterative PDA selection process. The overall methodology employed by the Committee is summarized below followed by a discussion of the nominated PDAs. Changes or modifications to the Interim Report PFDAs are discussed in section 6.4. Any further changes made because of information received during the 50-day public comment period following this report will be noted when the document is finalized and submitted to the government.

6.1 Technical Considerations

At the outset, the Committee considered the primary technical factors within the RA Study Area that make OSW feasible within the region. These factors are:

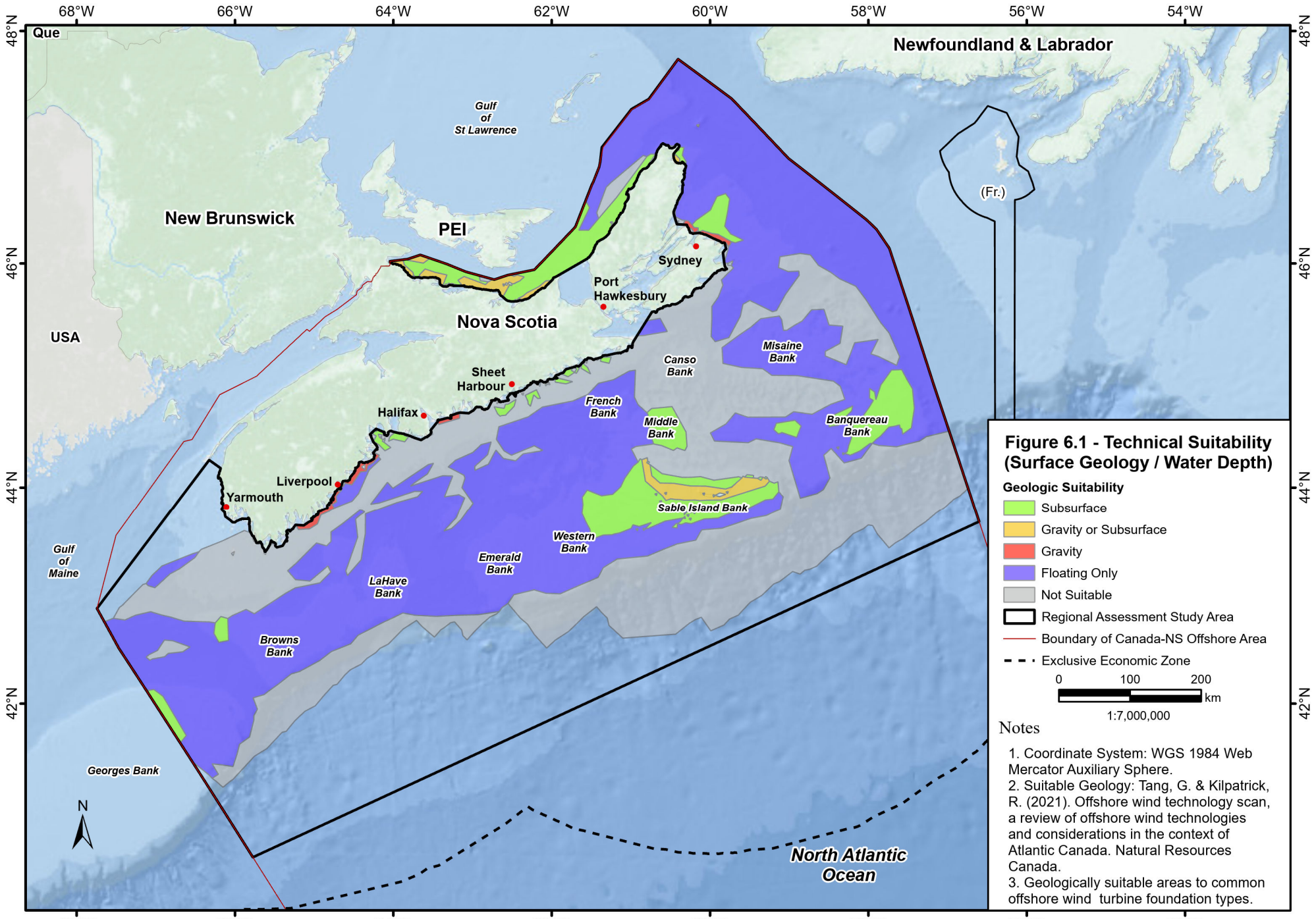
- **wind resource** – it is understood that the wind resource in the entire RA Study Area is conducive to OSW development; however, winds are stronger further to the east (Figure 4.2).
- **water depth** – based on existing technology, fixed turbine foundations can be deployed in water depths up to 60 m and floating turbines in water depths between 40 – 300 m (Kurth *et al*., 2024; Lin *et al.*, 2021).
- **surficial geology** – the characteristics of the seabed and substrate are key constraints that determine whether an area is feasible for OSW development and, if so, determine the appropriate turbine foundation.

With respect to surficial geology, the Committee has relied on CanmetENERGY's 'Preliminary Considerations Analysis of Offshore Wind Energy in Atlantic Canada' (2023) (discussed above in section 2.2.3). One of the twelve data layers used in the model developed by Canmet was geologic information sourced from the Geological Survey of Canada (GSC) in combination with water depth (see Figure 4.4).

The seabed was classified into five categories based on the expected compatibility with different offshore wind foundation types as follows:

- Category 1: Subsurface. Compatible with fixed foundations that penetrate the seafloor such as monopiles or jacketed foundations;
- Category 2: Gravity. Compatible with foundations that rest on top of the seafloor or require minimal penetration into the substrate such as gravity base structures and suction caissons;
- Category 3: Subsurface or Gravity. Compatible with any foundation type in Category 1 or 2; and
- Category 4: Floating Only. Compatible with floating foundations that are anchored in place in sandy, muddy, unconsolidated sediments.

Category 5 entitled ‘Challenges’ included areas where the presence of geohazards, high slopes or a heterogenous seabed presents challenging conditions for any foundation type, or where there are insufficient data available to classify these areas into a defined suitability category. This information is presented in Figure 6.1.


68°W
66°W
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62°W
60°W
58°W
56°W
54°W
48°N
46°N
44°N
42°N
Que
Newfoundland & Labrador
Gulf of St Lawrence
New Brunswick
PEI
Sydney
Port Hawkesbury
Nova Scotia
USA
Sheet Harbour
Halifax
Liverpool
Yarmouth
Canso Bank
Misaine Bank
French Bank
Middle Bank
Banquereau Bank
Sable Island Bank
Western Bank
Emerald Bank
LaHave Bank
Browns Bank
Gulf of Maine
Georges Bank
(Fr.)
North Atlantic Ocean
N
Figure 6.1 - Technical Suitability (Surface Geology / Water Depth)
Geologic Suitability
Subsurface
Gravity or Subsurface
Gravity
Floating Only
Not Suitable
Regional Assessment Study Area
Boundary of Canada-NS Offshore Area
Exclusive Economic Zone
0
100
200
km
1:7,000,000
Notes
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere.
2. Suitable Geology: Tang, G. & Kilpatrick, R. (2021). Offshore wind technology scan, a review of offshore wind technologies and considerations in the context of Atlantic Canada. Natural Resources Canada.
3. Geologically suitable areas to common offshore wind turbine foundation types.

The Committee understands that while the surficial geology of the Scotian Shelf may be relatively well understood, there remain unknowns that will impact OSW development. These include the thickness of the sand layers (up to 30 m required for monopile foundations), the presence of shallow hazards (gas seeps, landslides, sediment scour and transport), the degree of sediment compaction and the presence of large boulders or glauconite. Some of the data gaps are being addressed by current geophysical and geotechnical surveys in certain areas, and work is underway to reprocess seismic data and re-evaluate core samples previously acquired for oil and gas exploration. This survey work will take several years to complete, but as new information becomes available, further refinement of the areas identified as potentially suitable for OSW development will occur.

6.2 Primary Constraints

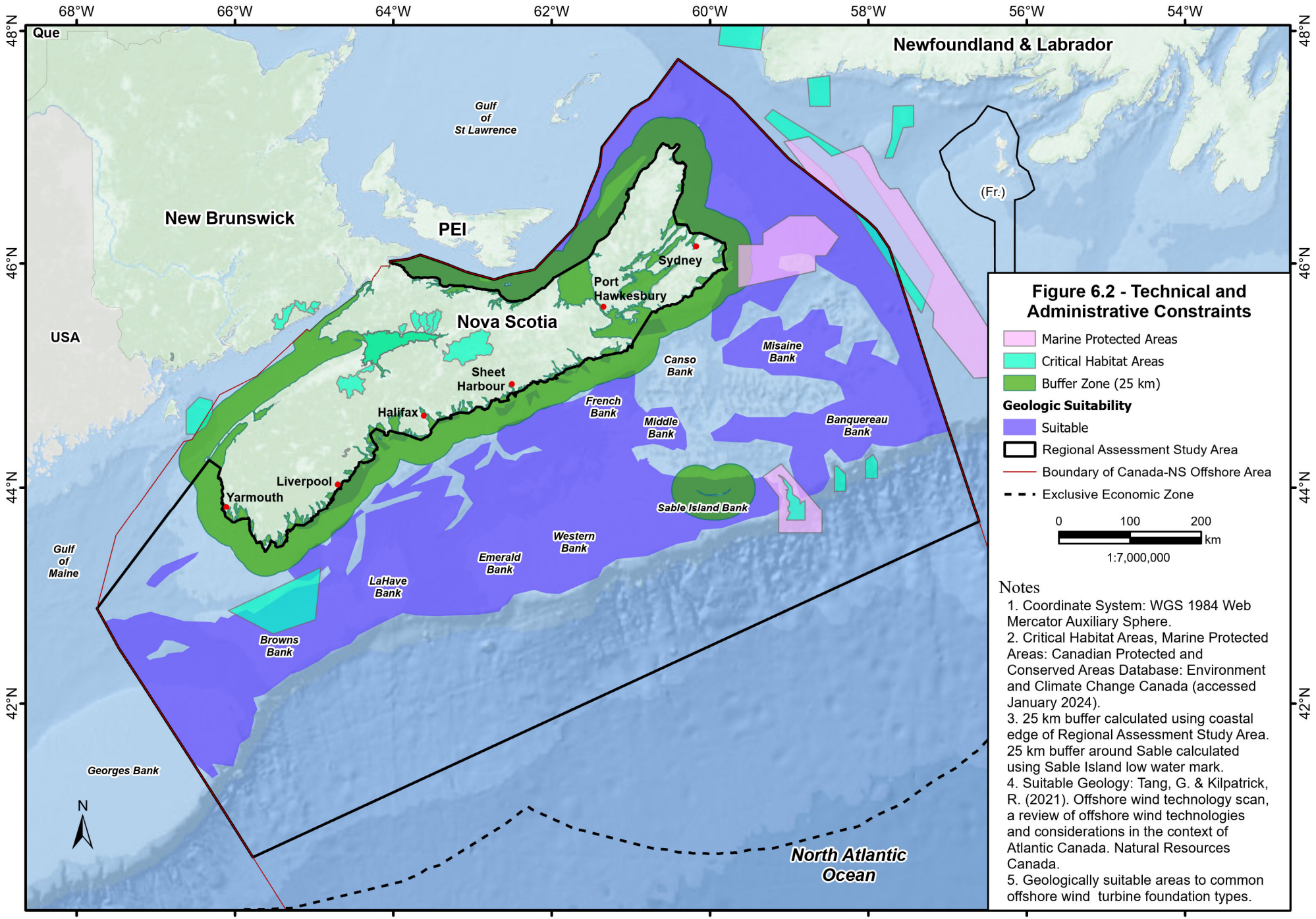
The Committee next identified primary constraints. These include the following:

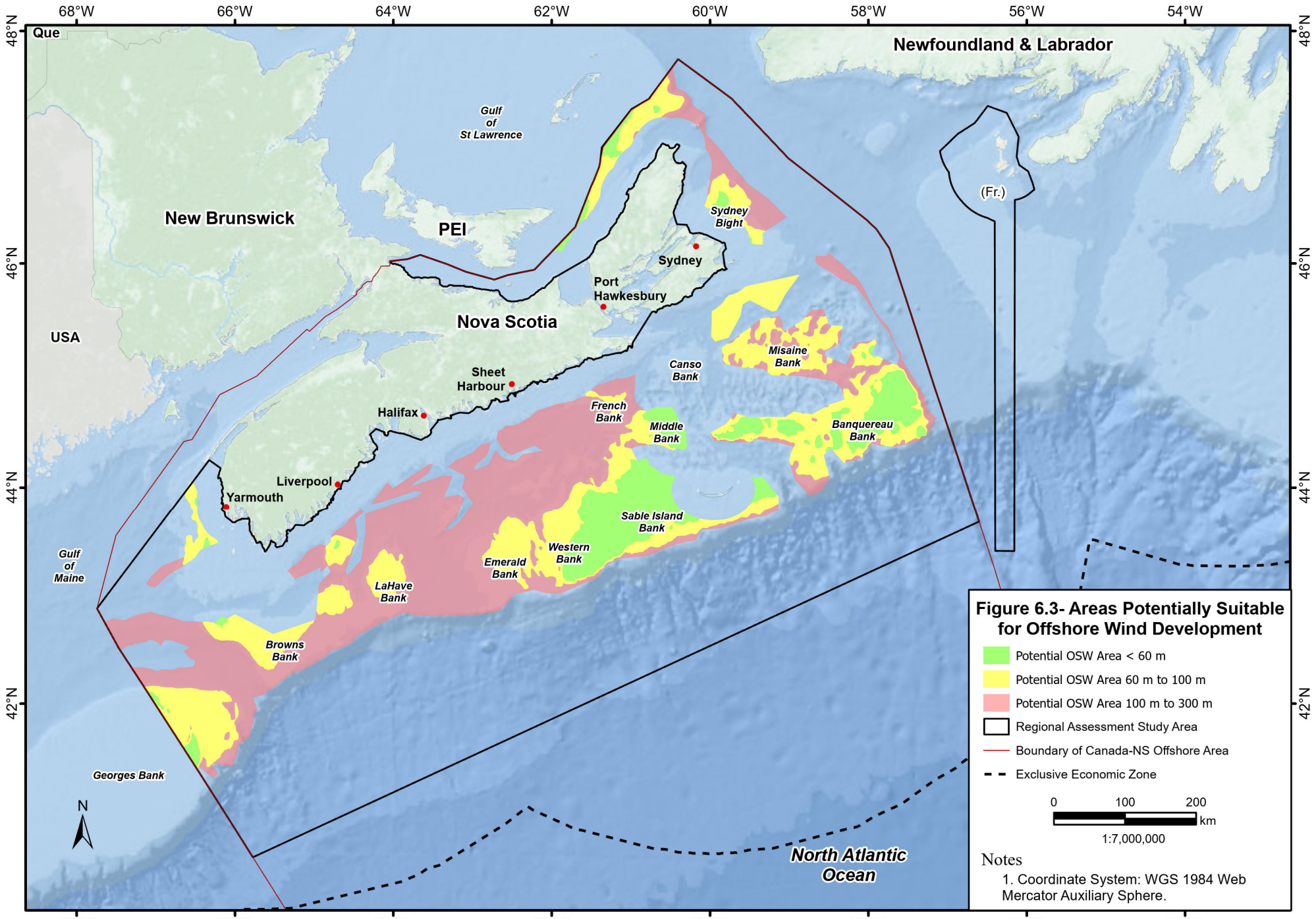
- **MPAs** – the Gully, St. Ann's Bank and the Laurentian Channel;
- **Critical Habitat** – North Atlantic right whale and northern bottlenose whale;
- **National Park Reserves** – Sable Island National Park Reserve; and
- **Marine Bird Sanctuaries** – Big Glace Bay, Port Joli, Sable River, Port Herbert, Haley Lake and Sable Island (See Figure 4.10).

Figure 6.2 illustrates the geologically suitable areas layered with the recommended buffer zone (see section 6.3) and other primary constraints discussed above.

Figure 6.3 illustrates the geologically suitable areas divided into the following water depths:

- <60 m
- 60 m to 100 m
- 100 m to 300 m


68°W
66°W
64°W
62°W
60°W
58°W
56°W
54°W
48°N
46°N
44°N
42°N
Que
Newfoundland & Labrador
Gulf of St Lawrence
New Brunswick
PEI
Sydney
Port Hawkesbury
Nova Scotia
USA
Sheet Harbour
Halifax
Liverpool
Yarmouth
Canso Bank
Misaine Bank
French Bank
Middle Bank
Banquereau Bank
Sable Island Bank
Western Bank
Emerald Bank
LaHave Bank
Browns Bank
Gulf of Maine
Georges Bank
North Atlantic Ocean
(Fr.)
N
Figure 6.2 - Technical and Administrative Constraints
Marine Protected Areas
Critical Habitat Areas
Buffer Zone (25 km)
Geologic Suitability
Suitable
Regional Assessment Study Area
Boundary of Canada-NS Offshore Area
Exclusive Economic Zone
0
100
200
km
1:7,000,000
Notes
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere.
2. Critical Habitat Areas, Marine Protected Areas: Canadian Protected and Conserved Areas Database: Environment and Climate Change Canada (accessed January 2024).
3. 25 km buffer calculated using coastal edge of Regional Assessment Study Area. 25 km buffer around Sable calculated using Sable Island low water mark.
4. Suitable Geology: Tang, G. & Kilpatrick, R. (2021). Offshore wind technology scan, a review of offshore wind technologies and considerations in the context of Atlantic Canada. Natural Resources Canada.
5. Geologically suitable areas to common offshore wind turbine foundation types.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Newfoundland & Labrador
Gulf of St Lawrence
New Brunswick
PEI
Sydney Bight
Sydney
Port Hawkesbury
Nova Scotia
USA
Sheet Harbour
Halifax
Liverpool
Yarmouth
Canso Bank
Misaine Bank
French Bank
Middle Bank
Banquereau Bank
Sable Island Bank
Western Bank
Emerald Bank
LaHave Bank
Browns Bank
Gulf of Maine
Georges Bank
(Fr.)
North Atlantic Ocean
N
Figure 6.3- Areas Potentially Suitable for Offshore Wind Development
Potential OSW Area < 60 m
Potential OSW Area 60 m to 100 m
Potential OSW Area 100 m to 300 m
Regional Assessment Study Area
Boundary of Canada-NS Offshore Area
Exclusive Economic Zone
0
100
200
km
1:7,000,000
Notes
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere.

6.3 Secondary Constraints

After the definition of the primary constraints, other factors were considered to refine the analysis and inform the selection of PDAs. These secondary constraints don't specifically prevent OSW development, but are important considerations. They include ecological considerations such as sensitive areas and constraints that are critical to the economy of the province, e.g., commercial fisheries. In certain instances, avoidance or mitigation techniques may allow OSW development to occur in such areas; in others, the potential impacts may point to incompatibility with OSW development. Table 6.1 identifies several key secondary constraints and the Committee's macro level assessment of OSW compatibility.

Table 6.1. Key Secondary Constraints

Valued Feature / Activity	Recommendations for Further Consideration
Significant Benthic Areas (SBA) and Ecologically and Biologically Significant Areas (EBSA), i.e., coral and sponge areas and sea pen areas (see Figure 4.11)	Coexistence may be possible. Avoidance of certain areas may be indicated at the project design stage which will be determined through engagement with DFO during the permitting process.
Important habitat for sensitive species, i.e., habitat for Species at Risk or important spawning areas (see Figure 4.11)	Coexistence may be possible with conditions to be determined at the project design stage through engagement with DFO during the permitting process.
Marine conservation network sites (see Figure 4.11)	Coexistence is possible. Recommend engagement with DFO on a project-by-project basis.
Military exercise areas (see Figure 4.15)	Coexistence is uncertain. Engagement with DND is required by provincial and federal governments.
Fisheries – fixed gear (see Figure 4.13)	Coexistence is generally possible.
Fisheries – mobile gear (see Figure 4.14)	Coexistence may be possible for certain gear types to be determined at the project design stage. Some gear types and activities are likely to be negatively impacted and/or incompatible with OSW development, e.g. longline fisheries.

6.4 The Recommended 25 km Buffer

The Interim Report included a recommendation that no development take place within a 25 km buffer from the coast and 20 km around Sable Island. The buffer around Sable Island has since been extended to 25 km for this draft Final Report. The buffer takes into consideration:

- the information received through the engagement process;

- the extensive lobster fishery and other fisheries (including eel) that occur in nearshore waters that:
    - are critical to the economy of NS and Canada,
    - contribute to Indigenous fisheries (commercial, food, social and ceremonial fisheries, and moderate livelihood fisheries),
    - provide an important food source for Nova Scotians and Canadians in general;
- important bird migration corridors and bird foraging areas along the coastline that include the presence of Species at Risk;
- established marine shipping routes and areas of heavy vessel traffic;
- the presence of bats within approximately 25 km of shore, three species of which are listed as Endangered provincially and federally: northern long-eared bat, tri-colored bat and the little brown bat; and
- visual impacts for coastal communities, parks and heritage sites – 70% of Nova Scotia's population live in coastal communities (ECEL, 2024) and numerous parks are sited adjacent to the coast and are valued for the undisturbed ocean views they provide.

The Committee understands that there will be circumstances where an incursion into the recommended coastal buffer may be either necessary or sought. The former includes the need to install the required transmission cables from an OSW farm to shore; the impact producing factors associated with the construction and operation of transmission lines and the associated mitigation are identified in section 5.6. Although the routing of power cables to shore is critical to the operation of an OSW farm, their routing and subsequent landfall are of interest to many, including fishers, residents, municipalities, regulators and those who seek to protect our coasts. Engagement with all interested parties in the early phases of route planning and landfall siting is an essential part of the regulatory process.

Other incursions are likely to be requested by developers for a variety of reasons including project economics (generally more favourable closer to shore) or changed circumstances such as the availability of new data or technological innovations. The Committee is very cognisant of the many unknowns in the marine environment including the impact of climate change on oceanographic conditions and species distributions. Some of the data gaps (see section 9) are specifically addressed in the report's recommendations (see section 10). Technologies continue to evolve that will improve OSW design and enhance data gathering and monitoring techniques. In recognition of all these facts, the Committee supports the adoption of principles of adaptive management to enable an evaluation of a request for an incursion into or modification of the buffer. In practice, this would require that the regulatory authorities, in conjunction with key interests but always including fishers and First Nations, develop hypotheses that the party seeking the incursion or modification to a boundary (coastal buffer or PDA) would have to address through planned engagement and a defined research program. Adaptive management allows for changes to the Committee's recommendations through engagement and analysis. This approach to adaptive management is addressed further in section 7.1.2.

6.5 Considerations Since the Issuance of the Interim Report

The PDAs are shown in Figure 6.4 and represent the following changes to the Interim Report:

- two classes of PDAs have been identified, namely five Tier 1 areas and three Tier 2 areas;
- Tier 1 PDAs, which include all the PFDA areas except Canso Bank, are recommended as areas for immediate consideration as prospective Wind Energy Areas (WEAs);
- Tier 2 PDAs are viewed as requiring additional investigation and/or stakeholder/rightsholder engagement before being elevated to the Tier 1 category or designated as WEAs;
- Canso Bank has been placed in the Tier 2 category for several reasons. Additional engagement with fisheries associations have heightened the Committee's concerns about the level of fishing taking place on the bank and on its slopes and the level of vessel traffic crossing the Bank. The GCIFA is now actively monitoring traffic levels for the area and mining an existing database which will eventually present a more robust picture of the collective level of activity. The issues associated with siting a transmission cable from the area to shore are also understood to be complex. Further, NRCan expressed concerns that the bathymetric complexity and the probable presence of boulder-scale sediments on Canso Bank may not be conducive to development. Geotechnical surveys are currently underway that will shed light on this issue. Given these unknowns and uncertainties, the Committee believes Canso belongs in the Tier 2 category;
- five of the PDAs are enlarged versions of the original PFDAs. Factors that influenced this action include:
    - original PFDA boundaries were identified with significant weight attached to the surficial geology (Figure 4.4) and DFO fisheries data. Subsequent engagement with representatives from the GSC and NRR and a preliminary interpretation of some of the recent survey findings has reinforced the fact that not all the area within an identified PDA will be suitable for development. The Committee also recognizes that governments require some flexibility in their efforts to identify technically feasible locations within a recommended area. Furthermore, subsequent engagement with fisheries representatives has reinforced the fact that the DFO commercial fishing information represents an approximation of areas that indicate limited fishing effort and hence the least amount of potential conflict,
    - climate change is impacting the location of fishing activity, and this is expected to continue,
    - the Committee has a better appreciation of the potential for some fisheries to co-exist with OSW development and is recommending compensation be considered only when avoidance and mitigation fail (see section 10),
    - the rapid pace of technological advances associated with the installation of floating turbine foundations indicate a current feasible water depth for their development of circa 300 m (well beyond the 100 m boundary used in the Interim Report). This depth may increase further as many countries grapple with the lack of shallow water development space,

    - representations from industry requesting adjustments to the French Bank and Middle Bank boundaries,
    - uncertainty around which sections of Western/Emerald Bank may be precluded from OSW development due to conflict with the DND training activities, and
- the identification of the Misaine Bank and La Have Basin Tier 2 PDAs resulted from a re-evaluation of the constraint analyses referenced in section 6.3, the fisheries data and the engagement feedback. Each of these locations had been previously identified as a potential development location by OSW developers. The DFO commercial fishing data suggest these areas are on the lower scale for potential conflict. One municipality indicated a desire for the South Shore to participate in the opportunities that would inevitably result from proximate OSW development including enhancements to the local grid and port infrastructure. There was significant feedback from fisheries stakeholders that not all potential development areas should be located east of Halifax. While fully appreciating that these locations have neither been the subject of engagement nor the same level of scrutiny as applied to the Tier 1 locations, the Committee is satisfied that these areas demonstrate development potential and are plausible candidates warranting further investigation.

Feedback received from geological experts and developers has confirmed that OSW turbine foundation types for varying water depths and geological conditions are hard to predict. As a result, turbine foundation types are no longer associated with water depths.

If OSW development occurs, there will inevitably be interactions with the marine environment and its users. This was clear to the Committee during the engagement process. The PDAs are based on currently available information, aimed at minimizing potential conflicts and adverse interactions on a large scale. The Committee recognizes that the actual location and configuration of the PDAs may evolve as governments identify WEAs and advance Nova Scotia's OSW industry. Much work remains, and the principles of adaptive management require an iterative approach that systematically analyzes changes in our understanding of the marine environment based on new data gathered over time.

6.6 Potential Development Area Details

The eight PDAs are presented in Figures 6.4 and 6.5 and in Table 6.2. Overall areas associated with each PDA, including a comparison to areas formerly identified as PFDAs in the Interim Report and the proportion of depth ranges within each PDA are also shown in Table 6.2. Areas are rounded to the nearest 5 km^2.

Table 6.2. PDA Areas and Water Depths

PDA	Total PDA Area (km^2)	Former PFDA Area (km^2)	Area (km^2 and %) in 0-60m	Area (km^2 and %) in 60-100m	Area (km^2 and %) in 100-100-300m
Sydney Bight	1,435	1,020	250 km^2, 17%	905 km^2, 63%	280 km^2, 20%
French Bank	2,855	495	0 km^2, 0%	381 km^2, 13%	2,474 km^2, 87%
Middle Bank	1,445	910	960 km^2, 66%	485 km^2, 34%	0 km^2, 0%
Sable Island Bank	5,620	5,195	5,170 km^2, 92%	450 km^2, 8%	0 km^2, 0%
Western/Emerald Bank	13,170	3,460	810km^2, 6%	4,975km^2, 38%	7,385km^2, 56%
Misaine Bank	2,830	n/a	0 km^2, 0%	2,130km^2, 75%	700km^2, 25%
LaHave Basin	3,415	n/a	0 km^2, 0%	0 km^2, 0%	3,415km^2, 100%
Canso Bank	430	430	0 km^2, 0%	430 km^2, 100%	0 km^2, 0%

Tier 2 PDAs identified in italics

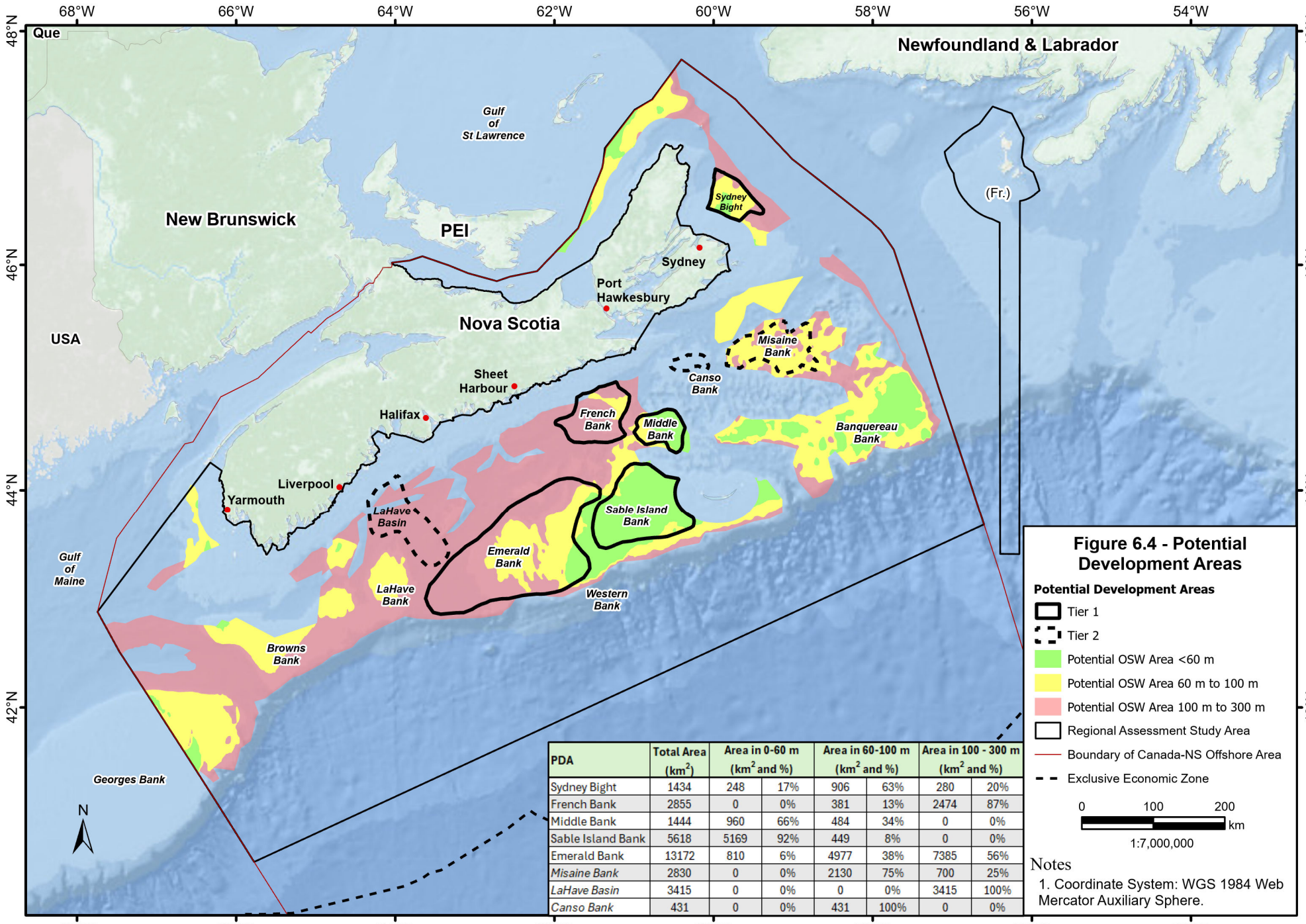


Figure 6.4 - Potential Development Areas

Potential Development Areas

- Tier 1
- Tier 2
- Potential OSW Area <60 m
- Potential OSW Area 60 m to 100 m
- Potential OSW Area 100 m to 300 m
- Regional Assessment Study Area
- Boundary of Canada-NS Offshore Area
- Exclusive Economic Zone

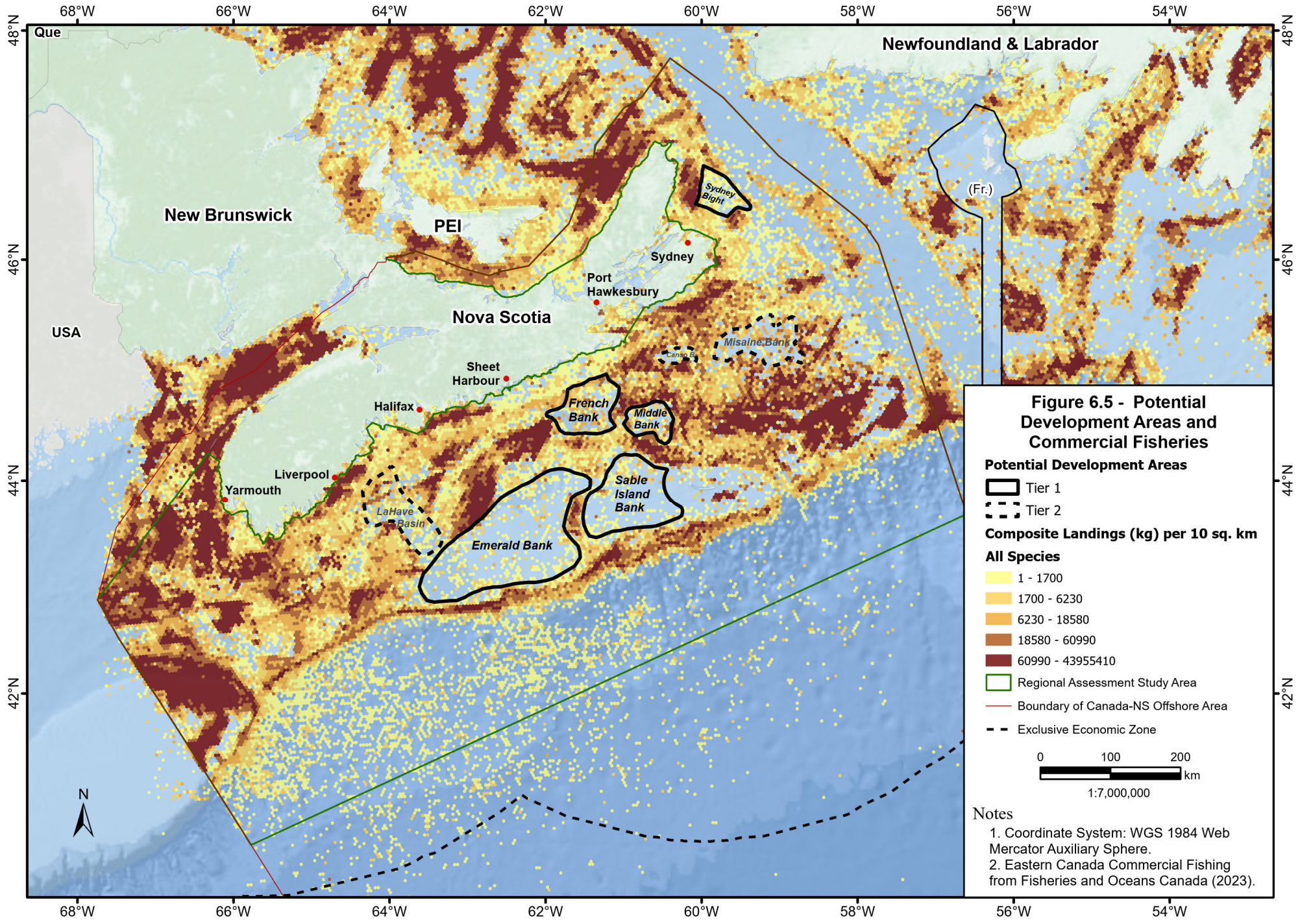
0 100 200 km

1:7,000,000

PDA	Total Area (km^2)	Area in 0-60 m (km^2 and %)		Area in 60-100 m (km^2 and %)		Area in 100 - 300 m (km^2 and %)	
Sydney Bight	1434	248	17%	906	63%	280	20%
French Bank	2855	0	0%	381	13%	2474	87%
Middle Bank	1444	960	66%	484	34%	0	0%
Sable Island Bank	5618	5169	92%	449	8%	0	0%
Emerald Bank	13172	810	6%	4977	38%	7385	56%
Misaine Bank	2830	0	0%	2130	75%	700	25%
LaHave Basin	3415	0	0%	0	0%	3415	100%
Canso Bank	431	0	0%	431	100%	0	0%

Notes

1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere.


68°W
66°W
64°W
62°W
60°W
58°W
56°W
54°W
48°N
46°N
44°N
42°N
Que
Newfoundland & Labrador
New Brunswick
PEI
Nova Scotia
USA
Sydney
Port Hawkesbury
Sydney Bight
(Fr.)
Misaine Bank
Canso
Sheet Harbour
Halifax
French Bank
Middle Bank
Liverpool
Yarmouth
LaHave Basin
Emerald Bank
Sable Island Bank
N
Figure 6.5 - Potential Development Areas and Commercial Fisheries
Potential Development Areas
Tier 1
Tier 2
Composite Landings (kg) per 10 sq. km
All Species
1 - 1700
1700 - 6230
6230 - 18580
18580 - 60990
60990 - 43955410
Regional Assessment Study Area
Boundary of Canada-NS Offshore Area
Exclusive Economic Zone
0
100
200
km
1:7,000,000
Notes
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere.
2. Eastern Canada Commercial Fishing from Fisheries and Oceans Canada (2023).

The following sections summarize information for each PDA. Note that the presentation format for Misaine Bank and LaHave Basin PDAs is different due to less information being available and to the absence of engagement feedback. As noted in section 6.5, the areas of four of the five Interim Report PFDAs have been expanded (see Table 6.2). While the Committe has undertaken its own evaluation of the consequences of these changes and has continued to rely on the PFDA feedback as generally representative of the enlarged PDAs, it recognizes that no engagement has taken place or been received with respect to the enlarged PFDAs. Where circumstances dictate, the report continues to use the term PFDA.

As part of ECCC's feedback on PFDAs, they have completed some modelling of bird presence, density, and preliminary collision or displacement vulnerability in relation to those areas. A summary of the modelling results is provided in Tables 6.3-6.8. The basic data used in the modelling result from Eastern Canada Seabirds at Sea (ECSAS) surveys across the Atlantic region over four seasons between 2006 and 2022. The data are therefore inherently limited and need to be augmented by subsequent work to amplify the reliability of the predictions.

6.6.1 Sydney Bight

The Sydney Bight PDA is approximately 1,435 km^2 in area comprising water depths of less than 60 m (17% of the PDA), 60-100 m (63% of the PDA) and 100-300 m (20% of the PDA). Figures 6.6 to 6.7 show the location of the PDA and key surrounding features. Table 6.3 summarizes the information that has informed the Committee's evaluation process.

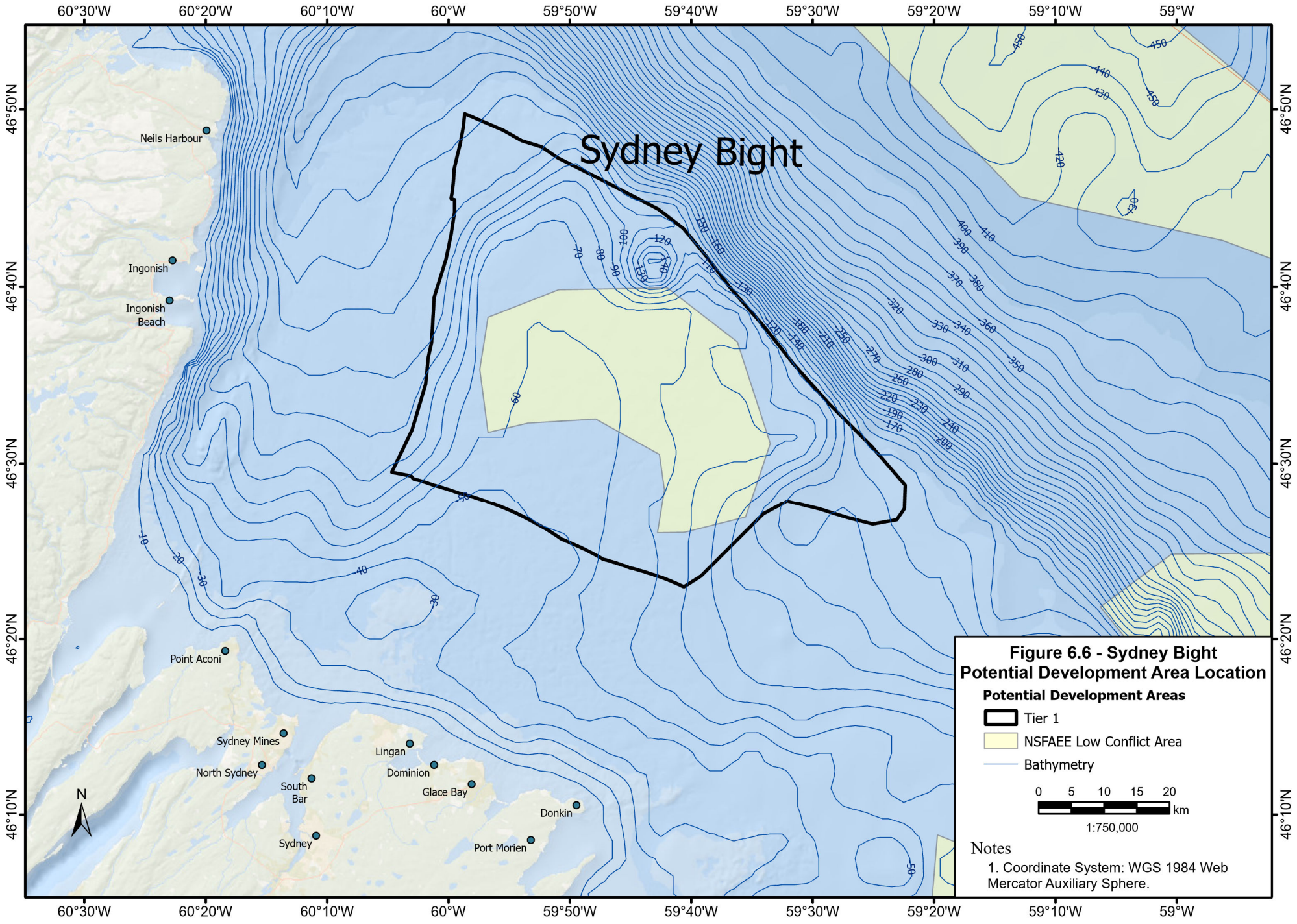
The PDA is configured to minimize potential conflicts with the commercial fishery. Local lobster harvesters assisted in identifying the 'Red Ground' lobster fishing area, and this area has been substantially avoided. Some representatives of the fishing industry (through the NSFAEE) identified a portion of this area as "low conflict." The Committee has received feedback from local harvesters that the surrounding area is important for snow crab and that intense snow crab and fixed gear fishing occurs between the PDA and the coastline; this would need to be considered in the planning of an export cable route.

The Sydney Bight PDA is relatively close to shore, existing grid connections and to port facilities that could provide the support and infrastructure required for development. This area has been identified by industry stakeholders as a potential area of interest and has been identified in various studies as a candidate for OSW development (Aegir, 2023; Kilpatrick *et al.,* 2023) (see section 6.2).

The PDA does not include any areas of current Critical Habitat. The Canadian Science and Advisory Secretariat (CSAS) advises that this area is important habitat for leatherback sea turtle (LBST). The important habitat advice will be used to inform the identification of Critical Habitat in an amended recovery strategy, which is in development. There is potential for the presence of cold-water corals and sponges within two overlapping ESBAs, and the surrounding area is an important migration route for marine mammals (notably cetaceans) including species at risk.

Other important factors for consideration within the PDA include the Marine Atlantic Port aux Basque

ferry route which traverses the PDA, viewscapes from the Cape Breton Highlands National Park, potential Unexploded Explosive Ordnance (UXO) Legacy Sites and three shipwrecks that have been identified.


Sydney Bight
Neils Harbour
Ingonish
Ingonish Beach
Point Aconi
Sydney Mines
North Sydney
South Bar
Sydney
Lingan
Dominion
Glace Bay
Donkin
Port Morien
60°30'W
60°20'W
60°10'W
60°W
59°50'W
59°40'W
59°30'W
59°20'W
59°10'W
59°W
46°50'N
46°40'N
46°30'N
46°20'N
46°10'N
N
Figure 6.6 - Sydney Bight
Potential Development Area Location
Potential Development Areas
Tier 1
NSFAEE Low Conflict Area
Bathymetry
0 5 10 15 20
km
1:750,000
Notes
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere.

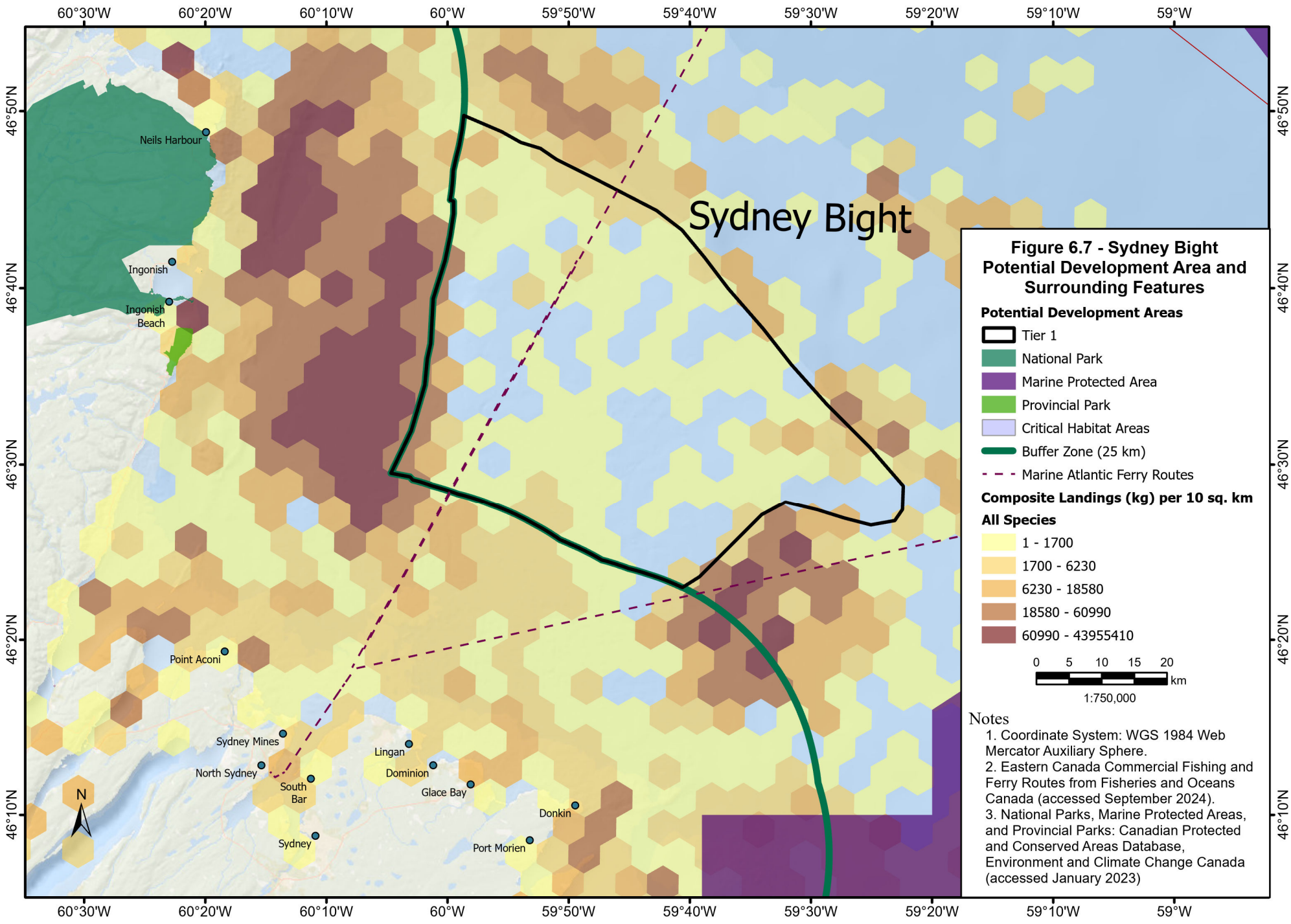

60°30'W
60°20'W
60°10'W
60°W
59°50'W
59°40'W
59°30'W
59°20'W
59°10'W
59°W
46°50'N
46°40'N
46°30'N
46°20'N
46°10'N
Sydney Bight
Neils Harbour
Ingonish
Ingonish Beach
Point Aconi
Sydney Mines
North Sydney
South Bar
Sydney
Lingan
Dominion
Glace Bay
Donkin
Port Morien
N
Figure 6.7 - Sydney Bight Potential Development Area and Surrounding Features
Potential Development Areas
Tier 1
National Park
Marine Protected Area
Provincial Park
Critical Habitat Areas
Buffer Zone (25 km)
Marine Atlantic Ferry Routes
Composite Landings (kg) per 10 sq. km
All Species
1 - 1700
1700 - 6230
6230 - 18580
18580 - 60990
60990 - 43955410
0 5 10 15 20
km
1:750,000
Notes
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere.
2. Eastern Canada Commercial Fishing and Ferry Routes from Fisheries and Oceans Canada (accessed September 2024).
3. National Parks, Marine Protected Areas, and Provincial Parks: Canadian Protected and Conserved Areas Database, Environment and Climate Change Canada (accessed January 2023)

Table 6.3. Sydney Bight PDA Suitability Summary Table

Category	Engagement Feedback		Considerations
	Source	**Comment**	
Ecological Sensitivity	DFO Feedback	**Species at Risk Habitat and Presence** PFDA overlaps with: • Leatherback sea turtle important habitat which will inform future consideration of Critical Habitat designations in an amended recovery strategy. • Blue whale important habitat. • The overall distribution of SAR species (known/likely to occur): fin whale, North Atlantic right whale, Atlantic wolffish, spotted wolffish, northern wolffish, white shark. These conditions are expected to apply to the PDA.	Potential interactions between OSW development and sensitive species, necessitating avoidance, mitigation and monitoring techniques to be determined at the project level.

	DFO	**Unique Habitats**
		PFDA overlaps with:
		• Western Sydney Bight Ecologically and Biologically Significant Area (EBSA) (King *et al.*, 2016) that includes:
		  ○ Area of species richness
		  ○ Important summer habitat (including larval aggregations) for multiple fish species
		  ○ Dense aggregations of snow crab and overwintering of Atlantic cod
		  ○ Important habitat areas for the leatherback sea turtle
		  ○ High degree of finfish species richness compared to the rest of the Scotian Shelf
		  ○ Supports significant at-sea aggregations of several seabird functional guilds
		• St. Ann's Bank EBSA (King *et al.*, 2016) that includes:
		  ○ Species rich area including invertebrates, small fish and larval fish
		  ○ Important habitat for Atlantic cod (including overwintering) and Atlantic wolfish
			Site surveying during project planning to confirm presence of sensitive benthic habitats /sponges that should then be considered in project layout and design.

Category	Engagement Feedback		Considerations
	Source	**Comment**	
		○ Big Shoal herring spawning habitat ○ Regionally significant sea pen and sponge concentrations ○ Important migration route for many fish and cetacean species ○ Important summer feeding habitat for leatherback turtles ○ Persistent high chlorophyll concentrations ○ High density seabird species and important habitat • Possible presence of significant benthic areas: "significant areas of cold-water corals and sponge dominated communities" (Kenchington *et al.*, 2016). These conditions are expected to apply to the PDA.	
	ECCC Feedback	• Several marine bird species frequent the area in high numbers during different seasons including: ○ Spring: black-legged kittiwake, northern gannet ○ Summer: Atlantic puffin, black-legged kittiwake, northern gannet ○ Fall: black-legged kittiwake, murres, northern gannet, razorbill • Several other species that breed in the vicinity are known to forage extensively in the area: razorbill, Atlantic puffin, greater black-backed gull, Northern gannet and black kittiwake.	Site specific baseline surveys will inform potential risk of proposed OSW development to birds. Potential interactions between OSW development and sensitive species, including avoidance (micro siting of infrastructure), mitigation and monitoring techniques will need to be determined at the project level.
	Fishers and public at the Sydney Open House (April 25, 2024)	• Marine mammals (various species) sightings are common near the PFDA (and therefore the PDA).	Potential interactions between OSW development and sensitive species, including avoidance, mitigation and monitoring techniques will need to be determined at the project level.

Category	Engagement Feedback		Considerations
	Source	**Comment**	
Commercial Fisheries and Other Ocean Users	DFO Feedback	• Fish species (other than SAR listed) presence include: Atlantic cod, Atlantic halibut, Atlantic herring, cusk, greysole-witch flounder, haddock, hake, queen-snow crab, pollock, redfish, scallop, sculpin, sea urchin, swordfish, whelk, winter flounder.	Potential interactions between OSW development and the fishing industry will need to be determined at project level.
	NSFAEE Feedback (2024a)	• A portion of the PDA was identified by the NSFAEE as relatively "low conflict" (Figure 6.6). • Extensive halibut and snow crab fisheries exist within PFDA, and the area is heavily transited by vessels to other fishing grounds. • Recommendation to reduce PFDA size to the relatively "low conflict" area.	Potential interactions between OSW development and the fishing industry will need to be determined at project level. Suitability of substrate will be evaluated by developers to determine appropriate turbine foundation
	Fishers and public at the Sydney Open House (April 25, 2024)	• Feedback from fishers at the Sydney Open House indicated that fishing for the following species occurs within the Sydney Bight PFDA: herring, swordfish and potentially some lobster (the same is expected within the PDA). • Higher density lobster fishing (known locally as Red Grounds) indicated as occurring between the PDA boundary and the shoreline, an activity that could interact with potential cable infrastructure to shore.	
	Feedback from Areas 22 and 23 and 27 snow crab fishery and lobster advisory for Areas 27, 35 and 34 during a meeting (July 22, 2024)	• Fixed gear is more predominant around the Sydney Bight PFDA than mobile gear (the same is expected within the PDA). • Fishers described the heavy snow crab fishing areas near Sydney Bight. • Most of the fishing occurs within 20 km from North Sydney; which is > 25 km from the shoreline.	
	GCIFA Feedback	• No PFDA specific comments provided.	

Category	Engagement Feedback		Considerations
	Source	**Comment**	
Physical and Human Use Conditions	Canmet (Kilpatrick *et al.*, 2023)	• PDA located in area identified by modelling as suitable for fixed or floating structures. • PDA located in an area identified by modelling as having a high (67-84%) median ice concentration.	Analysis of substrate is ongoing by NRCan and DNRR and would also be part of project pre-development surveys to confirm micro-siting of turbines and foundation types. Suitability of substrate will be evaluated by developers to determine appropriate turbine foundation. Visual impacts will need to be evaluated at the project level.
	NS DNRR – Subsurface and Offshore Energy Branch (see Figure 4.4)	• PDA is located entirely within Post-Glacial Sand and Gravel unit. Information obtained from recent geotechnical program indicates that the depth of sediment may be insufficient for monopiles.	
	Parks Canada Feedback	• Concern expressed about the potential impacts on viewscapes. • Depending on the height of the land, the height of the turbines and other factors, 45 km may be needed to have negligible impacts on the viewscapes from Cape Breton Highlands National Park.	
	NS Department of Communities, Culture, Tourism and Heritage (CCTH) Feedback	• Three shipwrecks (Mac Hinevy, Lupin and George Cairns) are located within the PFDA boundaries and are likely the final resting place of their crews. • Given the passage of time and the high energy ocean environment, there may not be much left of the structures.	Project planning will require interface with CCTH, the provincial archaeology regulator, to ensure shipwreck sites are not impacted Buffers around shipwrecks may be recommended by CCTH as part of this process.
	Transport Canada Feedback	• The constitutionally mandated Port aux Basque ferry route passes through the western portion of the Sydney Bight PDA (Figure 6.7).	Project design would need to ensure Marine Atlantic's continued ability to operate in a safe, reliable and environmentally responsible manner.
	DND Feedback	• There are potential UXO Legacy Sites located between the PFDA boundary and the coastline (the same is expected within the PDA).	Potential UXO sites will need to be considered when siting the routing of electricity transmission cables to shore. Underwater Remotely Operated Vehicle (ROV) surveys will be particularly important in these areas.

Category	Engagement Feedback		Considerations
	Source	Comment	

[1] *The habitat that contains the functions, features and attributes necessary to support survival and recovery. While these areas are subject to change before they become Critical Habitat, important habitat informs the identification and protection of Critical Habitat (DFO, 2024)*

6.6.2 Middle Bank

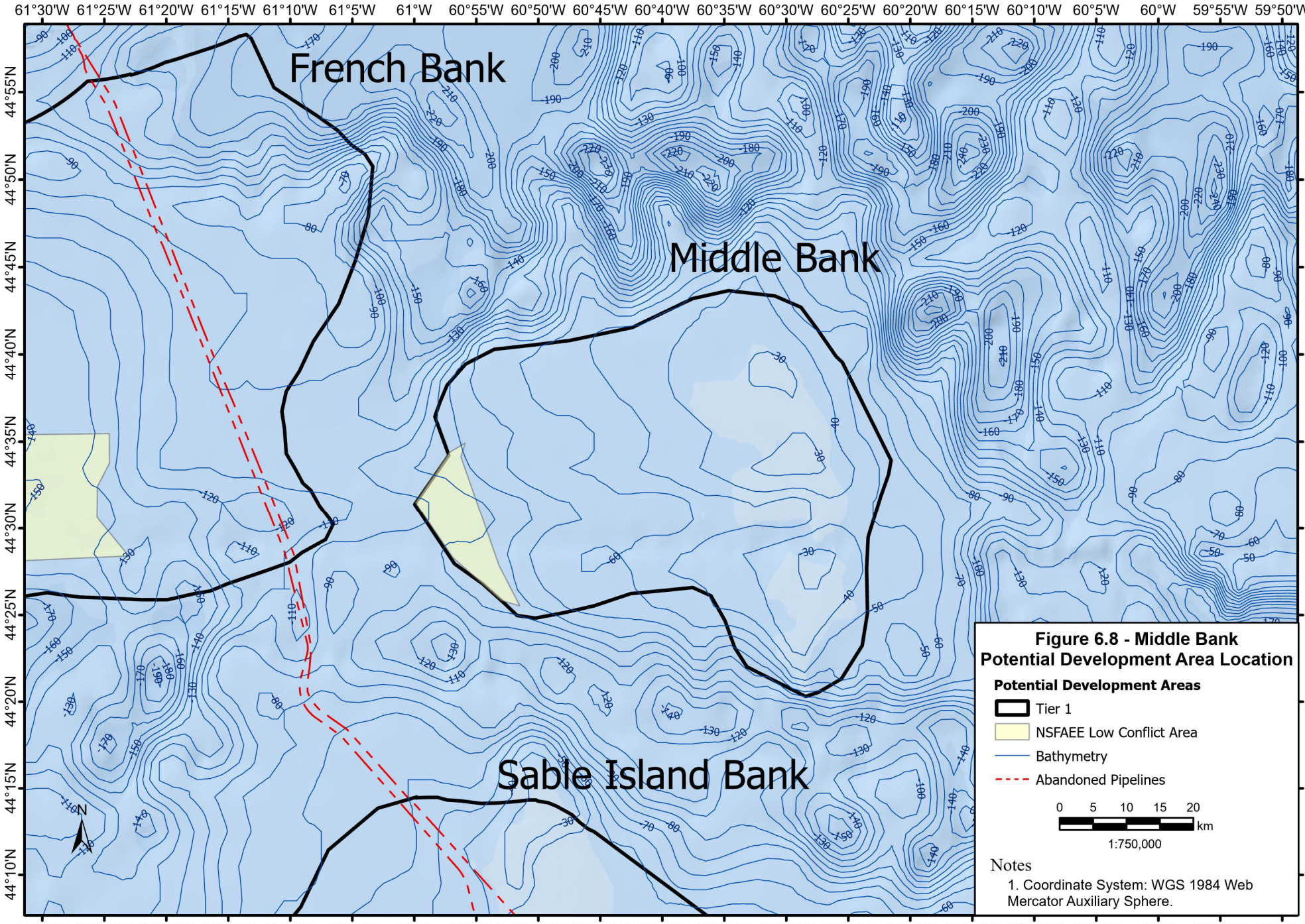
The Middle Bank PDA is approximately 1,445 km^2 in area comprising water depths less than 60 m (66% of the PDA) and 60-100 m (34% of the PDA). Figures 6.8 to 6.9 show the location of the PDA and key surrounding features. Table 6.4 summarizes the information that has informed the Committee's evaluation process.

The Middle Bank PDA is located ~60 km from shore and ~120 km from the port of Port Hawkesbury that could provide the support and infrastructure required for development. Travel distances to the ports of Sheet Harbour and Sydney Harbour are ~125 km and ~230 km respectively. This area has been identified by multiple industry stakeholders as a potential area of interest and has been identified by various studies as a candidate area for further consideration for OSW development (Aegir 2023; Kilpatrick *et al.,* 2023) (see Section 6.2).

The PDA does not include any areas of current Critical Habitat. A portion of the PDA overlaps with the Middle Bank EBSA, known to be a species rich area for larval fish, invertebrates and small fish as well as spawning and nursery habitat for multiple species. High primary productivity for phytoplankton blooms is known to occur in the area. Minke and fin whales also frequent this area. This PDA, especially the western portion, may overlap with sea pen.

DFO has identified the presence of several fish species in the PFDA and surrounding waters and noted moderate to high landings of Atlantic halibut and queen-snow crab. MRC has acknowledged snow crab as the predominant fishery on Middle Bank and noted the potential for pot fisheries to coexist with OSW development. The Committee has met with sea cucumber harvesters who are active within the PDA, a bottom trawl fishery that has potential to coexist within a well-designed monopile development. The Seafood Producers of Nova Scotia (SPANS) advised the Committee that based on scallop landings between 2000-2010, viable commercial scallop habitat exist within portions of Middle Bank and adjacent areas. Some representatives of the fishing industry (through the NSFAEE) identified a portion of this area as "low conflict". The Nova Scotia Swordfishermen's Association has expressed concerns due to the significant drift usually associated with their gear type and the potential for both damage to gear and displacement.

The Middle Bank PDA exists in proximity (~15 km) to the location of an existing, but abandoned, pipeline route that carried natural gas from Sable Island to Goldborough. This pipeline corridor offers potential for routing an OSW export cable to shore. Fishing vessels have been recorded as transiting through the area to access more distant offshore fishing grounds. Major shipping lanes are not identified within the PDA. Two historic shipwrecks are known to exist within the PFDA.


French Bank
Middle Bank
Sable Island Bank
61°30'W 61°25'W 61°20'W 61°15'W 61°10'W 61°5'W 61°W 60°55'W 60°50'W 60°45'W 60°40'W 60°35'W 60°30'W 60°25'W 60°20'W 60°15'W 60°10'W 60°5'W 60°W 59°55'W 59°50'W
44°55'N 44°50'N 44°45'N 44°40'N 44°35'N 44°30'N 44°25'N 44°20'N 44°15'N 44°10'N
N
Figure 6.8 - Middle Bank
Potential Development Area Location
Potential Development Areas
Tier 1
NSFAEE Low Conflict Area
Bathymetry
Abandoned Pipelines
0 5 10 15 20
km
1:750,000
Notes
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere.

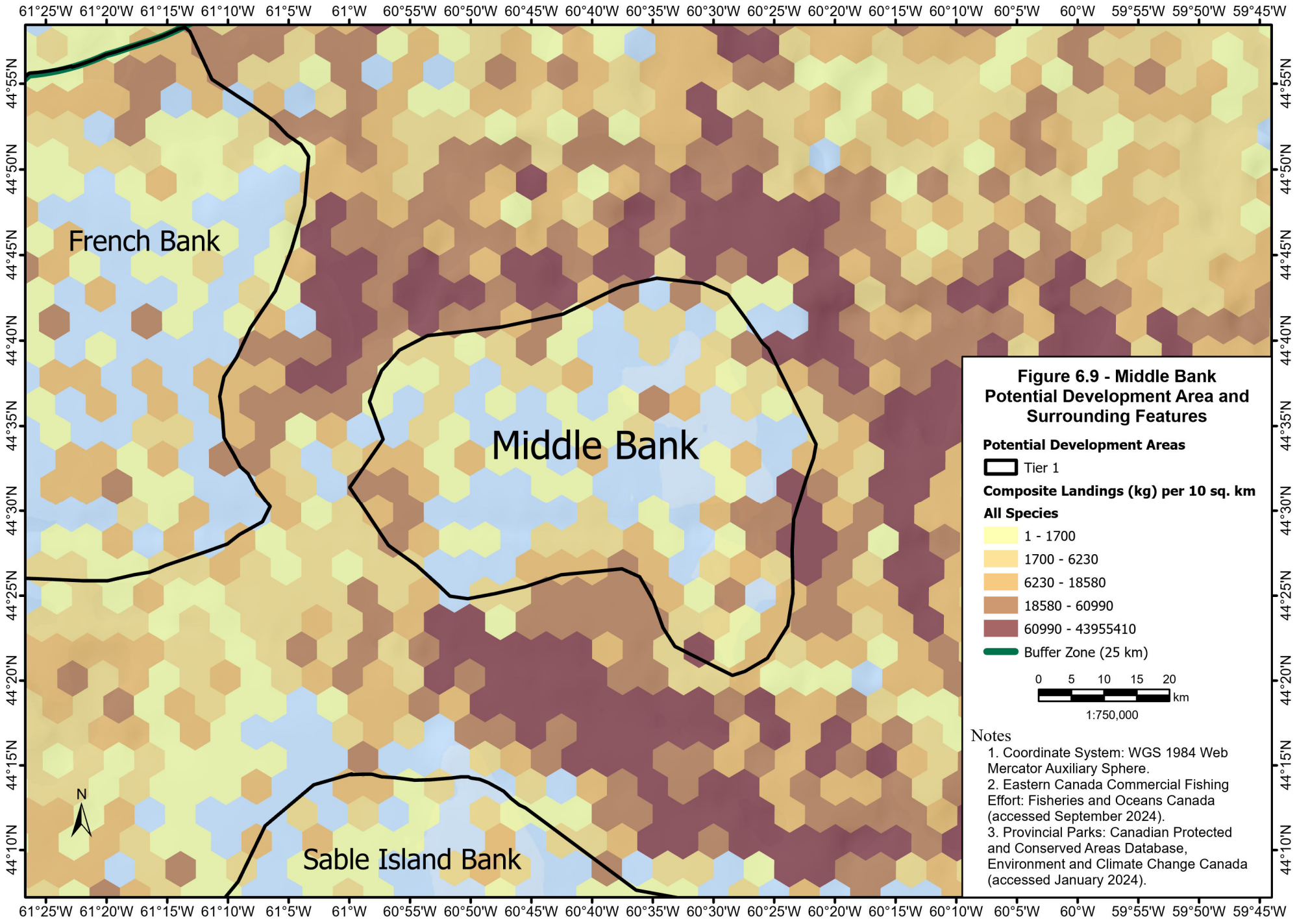

61°25'W 61°20'W 61°15'W 61°10'W 61°5'W 61°W 60°55'W 60°50'W 60°45'W 60°40'W 60°35'W 60°30'W 60°25'W 60°20'W 60°15'W 60°10'W 60°5'W 60°W 59°55'W 59°50'W 59°45'W
44°55'N
44°50'N
44°45'N
44°40'N
44°35'N
44°30'N
44°25'N
44°20'N
44°15'N
44°10'N
French Bank
Middle Bank
Sable Island Bank
N
Figure 6.9 - Middle Bank Potential Development Area and Surrounding Features
Potential Development Areas
Tier 1
Composite Landings (kg) per 10 sq. km
All Species
1 - 1700
1700 - 6230
6230 - 18580
18580 - 60990
60990 - 43955410
Buffer Zone (25 km)
0 5 10 15 20
km
1:750,000
Notes
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere.
2. Eastern Canada Commercial Fishing Effort: Fisheries and Oceans Canada (accessed September 2024).
3. Provincial Parks: Canadian Protected and Conserved Areas Database, Environment and Climate Change Canada (accessed January 2024).

Table 6.4. Middle Bank PDA Suitability Summary Table

Category	Engagement Feedback		Considerations
	Source	**Comment**	
Ecological Sensitivity	DFO Feedback	**Species at Risk Habitat and Presence** • The PFDA is within the distribution area of the following SAR species, i.e., species that are known/likely to occur: leatherback sea turtle, blue whale, fin whale, Atlantic wolffish, spotted wolffish, northern wolffish, white shark. These conditions are expected to apply to the PDA.	Potential interactions between OSW development and sensitive species; avoidance, mitigation and monitoring techniques will need to be determined at the project level.

	DFO	**Unique Habitats**
		PFDA overlaps with:
		• Middle Bank EBSA as per multiple sources referenced in King *et al.*, 2016:
		  ○ Important Atlantic cod spawning and nursey area
		  ○ Species rich area including larval fish, invertebrates and small fish
		  ○ Possible spawning and/or nursery habitat for multiple species
		  ○ Area where fin whales and minke whales are observed
		  ○ High primary productivity and phytoplankton blooms in fall
		  ○ Important seabird habitat
		• Potential sea pen presence in the western portion of the PFDA
		
		These conditions are expected to apply to the PDA.
			Confirmation of sea pen presence should be confirmed through underwater benthic habitat surveys (UBHS) during the planning stage.

Category	Engagement Feedback		Considerations
	Source	**Comment**	
	ECCC Feedback	• Several marine bird species frequent the area in high numbers during different seasons, e.g.: ○ Spring: murres, razorbill ○ Summer: dovekie, northern gannet ○ Fall: black-legged kittiwake, dovekie, northern gannet • At present, there are no indications of species occurring and foraging on Middle Bank in great numbers specifically, except for brief periods in spring and fall. However, the modelling suggests that for these species, there may be high collision and displacement vulnerability, particularly in the fall.	Site specific baseline surveys will inform potential risk of proposed OSW development to birds. Potential interactions between OSW development and birds, including avoidance (micro siting of infrastructure), mitigation and monitoring techniques will need to be determined at the project level.
Commercial Fisheries and Other Ocean Users	DFO Feedback	• Fish species (other than SAR listed) presence within the PFDA (and PDA) include: Atlantic Halibut **(moderate to high landings)**, Atlantic herring, cusk, haddock, mackerel, other crab species, other groundfish species, pollock, queen-snow crab **(moderate to high landings)**, redfish, scallop, sculpin, shrimp, turbot/Greenland halibut, whelk, winter flounder (DFO, 2024).	Potential interactions between OSW development and the fishing industry will need to be determined at the project level. Engagement with longline fishers at the project stage to determine setbacks and minimize adverse impacts to that fishery.
	DFO	• The PFDA (and PDA) overlap with the 4W midshore Sea Cucumber fishing area. • The PFDA (and PDA) overlap with the experimental 4W offshore Whelk fishery.	
	W.T. Grover Fisheries Ltd. and Ocean Pride Fisheries (sea cucumber fishers)	• Exclusive harvest zones exist within the Middle Bank PFDA (and PDA). • Bottom trawl harvesting technique.	

Category	Engagement Feedback		Considerations
	Source	**Comment**	
	Nova Scotia Swordfishermen's Association (long line fishers) during a meeting (Aug 19, 2024)	• Longline fishery takes place adjacent to Middle Bank.	
	Marine Renewables Canada	• An expansion to the PFDA was recommended to the Committee. Snow crab was identified by MRC as the predominant fishery in the proposed expansion area, and it was indicated that OSW could co-exist with this fishing type (crab pots).	
	GCIFA Feedback	Utilizing Transport Canada's Enhanced Maritime Situational Program (EMSP) which analyses the movement of vessels, the following observations were received between mid-April to August 2024: • 113 fishing traffic transects have been made (including vessels conducting fishing and those travelling though the PFDA further offshore). • To protect lucrative fishing grounds to the north and south, eliminate the northern end of the PFDA and trim the eastern end to widen the buffer between fishing and a renewable lease area.	
	NSFAEE Feedback (2024a)	• A small area of "low conflict" was identified by NSFAEE along the western PFDA (and PDA) boundary (Figure 6.8). • Spatial distribution of scallop resource should be surveyed prior to OSW development. • Rod and reel tuna fishery occurring in this area isn't being appropriately identified by the methods currently employed. • Heavy snow crab and halibut fishing occur in the area although precise locations cannot be identified. A use of a buffer to protect these fisheries is recommended.	

Category	Engagement Feedback		Considerations
	Source	**Comment**	
	SPANS	• Middle Bank has been utilized in the past as an important commercial scallop fishery. • While the offshore scallop fleet has not focused on this bank in recent years, it is still considered a key area for the fishery. • Scallops are a bottom contact mobile gear fishery that is unlikely to co-exist with the OSW industry.	
Physical and Human Use Conditions	Canmet (Kilpatrick *et al.,* 2023)	• PDA is predominantly located in areas identified by modelling as suitable for subsurface structures and a smaller area identified as suitable for floating structures.	Analysis of substrate is ongoing by NRCan and NS NRR and would also be part of project pre-development surveys to confirm micro-siting of turbines and foundation types. Suitability of substrate will be evaluated by developers to determine appropriate turbine foundation.
	NS NRR Subsurface and Offshore Energy Branch (see Figure 4.4)	• PDA located entirely within Post-Glacial Sand and Gravel unit.	
	CCTH Feedback	• Two shipwrecks (A. Piatt Andrew and Gertie) exist within the PFDA boundaries. • Shipwrecks vary in levels of significance, recognizing that there may not be much left of the structures due to high energy ocean environments. • The Piatt Andrews wreck is a foreign vessel and sovereignty laws may apply.	Project planning will require interface with CCTH as the provincial archaeology regulator to ensure shipwreck sites are not impacted. Buffers around shipwrecks may be recommended by CCTH as part of this process.
	DND	No PDA specific feedback.	N/A

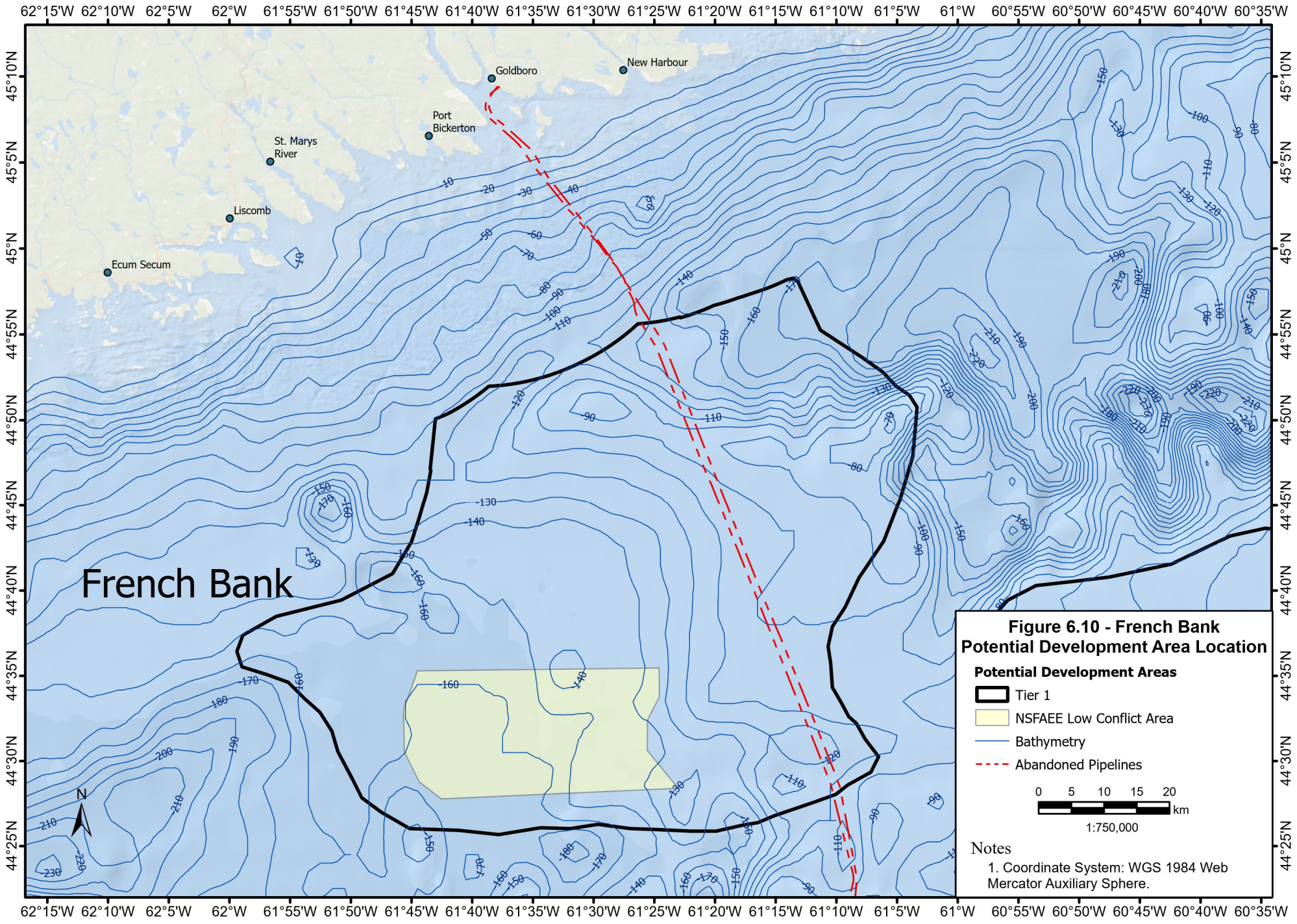
6.6.3 French Bank

The French Bank PDA is approximately 2,855 km^2 in area with 87% of the PDA consisting of water depths in the range of 100-300 m; the remaining 13% comprises water depths ranging between 60-100 m. Figures 6.10 to 6.11 show the location of the PDA and key surrounding features. Table 6.5 summarizes the information that has informed the Committee's evaluation process.

At its closest point, the PDA is located ~25 km from shore approximately ~ 33 km from the community of Goldboro and 65 km from the port of Sheet Harbour, communities which could service OSW development in the PDA. This area has been identified by an industry stakeholder as an area of interest for floating OSW development. The NSFAEE identified an area of low conflict for fisheries within the southern extent of the PDA. It has been identified by various studies as a candidate area for further consideration for OSW (Aegir, 2023; Kilpatrick *et al*., 2023) (see section 6.2).

The PDA does not include any areas of current Critical Habitat, but an area of sea pen significant benthic habitat extends into the southern portion of the PDA and borders the western PDA boundary. DFO has indicated that this area is known to be in the distribution range of multiple Species at Risk including leatherback sea turtle, blue whale, fin whale, Atlantic wolffish, northern wolffish and white shark. The French Bank PDA has been configured to avoid higher density fishing areas to the extent possible based on published DFO data and borders the recommended 25 km shoreline buffer. The GCIFA has noted that this area accommodates relatively more fishing vessel traffic than PDAs further offshore, that most vessel traffic occurs at the northern extent of the PDA and that they expect increased levels of fishing during the Fall season compared to that observed during the spring and summer months in 2024. DFO also noted that the PDA overlaps with the 4W midshore sea cucumber fishing areas, although the Committee were not made aware of any current sea cucumber fishing activities within the area or immediately surrounding waters.

The existing abandoned pipeline corridor intersects the French Bank PDA and could be used as an export cable route to shore from an OSW project. CCTH advised the committee that one historic shipwreck exists within the PFDA.


French Bank
Goldboro
New Harbour
Port Bickerton
St. Marys River
Liscomb
Ecum Secum
N
Figure 6.10 - French Bank
Potential Development Area Location
Potential Development Areas
Tier 1
NSFAEE Low Conflict Area
Bathymetry
Abandoned Pipelines
0 5 10 15 20
km
1:750,000
Notes
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere.

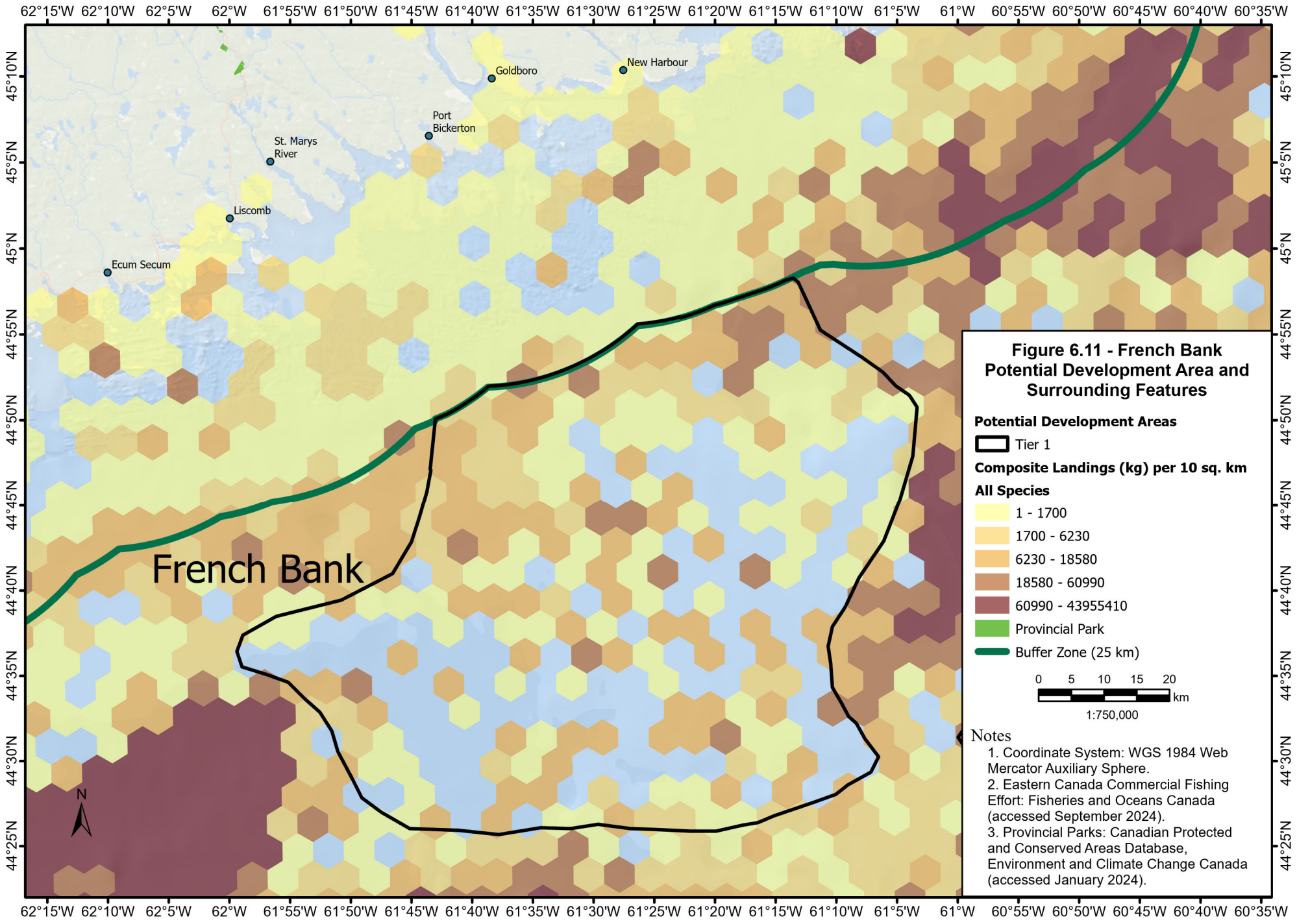

62°15'W 62°10'W 62°5'W 62°W 61°55'W 61°50'W 61°45'W 61°40'W 61°35'W 61°30'W 61°25'W 61°20'W 61°15'W 61°10'W 61°5'W 61°W 60°55'W 60°50'W 60°45'W 60°40'W 60°35'W
45°10'N
45°5'N
45°N
44°55'N
44°50'N
44°45'N
44°40'N
44°35'N
44°30'N
44°25'N
Goldboro
New Harbour
Port Bickerton
St. Marys River
Liscomb
Ecum Secum
French Bank
N
Figure 6.11 - French Bank Potential Development Area and Surrounding Features
Potential Development Areas
Tier 1
Composite Landings (kg) per 10 sq. km
All Species
1 - 1700
1700 - 6230
6230 - 18580
18580 - 60990
60990 - 43955410
Provincial Park
Buffer Zone (25 km)
0 5 10 15 20
km
1:750,000
Notes
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere.
2. Eastern Canada Commercial Fishing Effort: Fisheries and Oceans Canada (accessed September 2024).
3. Provincial Parks: Canadian Protected and Conserved Areas Database, Environment and Climate Change Canada (accessed January 2024).

Table 6.5. French Bank PDA Suitability Summary Table

Category	Engagement Feedback		Considerations
	Source	**Comment**	
Ecological Sensitivity	DFO Feedback	Species at Risk Habitat and Presence • The PFDA is within what is known to be the overall distribution of the following SAR species: leatherback sea turtle, blue whale, fin whale, Atlantic wolffish, northern wolffish, white shark. These conditions are expected to apply to the PDA.	Potential interactions between OSW development and sensitive species avoidance, mitigation and monitoring techniques will need to be determined at the project level.
	DFO	PFDA overlaps with: • Potential sea pen presence in the southern portion of the PFDA.	Confirmation of sea pen presence should be confirmed through underwater benthic habitat surveys (UBHS) during the planning stage (DFO, 2024).
	Canmet (Kilpatrick *et al.*, 2023)	• A mapped extent of sea pen significant benthic area now extends within the southern portion of the revised PDA boundary (Figure 4.11).	

	ECCC Feedback	• Several marine bird species frequent the area in high numbers during different seasons, e.g.:
		  ○ Spring: razorbill
		  ○ Fall: black-backed gull, herring gull, northern gannet
		• Several other species that breed in the vicinity are known to forage extensively in the area, e.g.: herring gull, greater black-backed gull.
		• Collision vulnerability has been modelled as high during the fall season within this PDA.
			Site specific baseline surveys will inform potential risk of proposed OSW development to birds.
			
			Potential interactions between OSW development and sensitive species, including avoidance (micro siting of infrastructure), mitigation and monitoring techniques will need to be determined at the project level.

Category	Engagement Feedback		Considerations
	Source	**Comment**	
Commercial Fisheries and Other Ocean Users	DFO Feedback	• Fish species' (other than SAR listed) presence within the PFDA (and PDA) include: Atlantic halibut, cusk, greysole-witch flounder, winter flounder, yellowtail flounder, other flounder species, other groundfish species, haddock, turbot/Greenland halibut, Atlantic herring, bluefin tuna, other tuna species, hagfish-slime eel, mackerel, other crab species, pollock, queen-snow crab, redfish, sculpin, sea urchin, shrimp, whelk.	Potential interactions between OSW development and the fishing industry will need to be determined at project level.
	DFO	• Overlap with the 4W midshore sea cucumber fishing area.	
	GCIFA Feedback	Utilizing Transport Canada's Enhanced Maritime Situational Program (EMSP) which analyses the movement of vessels, the following observations were noted between mid-April-August 2024: ○ AIS data suggest that fishing vessel density is greater in the northern part of the PFDA. ○ Vessels under 45 feet are not required to have AIS, therefore the recorded numbers of vessel movements are likely underestimated. ○ GCIFA recommends removing the PFDA due to its economic importance to the fishing industry. If this is not possible, a reduction in the size of the PFDA is recommended including removal of the northern extent of the PFDA and a 5 km area in the eastern portion of the PFDA.	

Category	Engagement Feedback		Considerations
	Source	**Comment**	
	NSFAEE Feedback (2024a) and NSFAEE briefing (2024b)	• A small area of "low conflict" was identified by NSFAEE within the southern extent of the PFDA. • The region is heavily used by multiple fisheries including those for which no explicit spatial information has been provided. • An extensive record of halibut fishing and lobster fishing (according to local harvesters) occurs in the region. Concern raised about potential impacts to the herring fishery as a result of OSW. • The region is transited regularly to and from fishing grounds. • NSFAEE recommendations include: continued engagement with fishers, the pausing of any immediate development due to lobster fishing, excluding any halibut fishing areas in future PDA design, exercising caution of OSW development in proximity to herring fishing areas and consideration of important transit routes.	
Physical and Human Use Conditions	Canmet (Kilpatrick *et al.*, 2023)	• PDA is in areas identified by modelling as suitable for floating structures. The western PDA boundary borders a modelled area indicating challenging substrate for OSW structures.	Analysis of substrate is ongoing by NRCan and NS NRR and would also be part of project pre-development surveys to confirm micro-siting of turbines and foundation types.
	NS NRR Subsurface and Offshore Energy Branch - (see Figure 4.4)	• PDA predominantly located within Post-Glacial Sand and Gravel unit and a smaller area of glacial diamict.	
	CCTH Feedback	• One shipwreck (Morris Wilson) exists within the PFDA boundaries. Shipwrecks vary in levels of significance, recognizing that there may not be much left of the structures due to high energy ocean environments.	Project planning will require interface with CCTH as the provincial archaeology regulator to ensure shipwreck sites are not impacted. Buffers around shipwrecks may be recommended by CCTH as part of this process.
	DND	No PFDA specific feedback.	N/A

6.6.4 Sable Island Bank

The Sable Island Bank PDA is approximately 5,620 km^2 in area and is predominantly situated in water depths ranging between 0-60 m (92% of PDA). A small area (8%) of the PDA comprises water depths between 60-100 m. Figures 6.12 to 6.13 show the location of the PDA and key surrounding features. Table 6.6 summarizes the information that has informed the Committee's evaluation process.

The Sable Island PDA is located ~110 km from shore at its closest point. Its size makes it a candidate for development at scale involving either a large OSW development project, or multiple phased projects possibly including shared infrastructure including substation. The PDA offers access to an existing pipeline corridor which could be used for export cables to shore. Several government and industry studies (Aegir, 2023; Kilpatrick *et al*., 2023; Nagel *et al.*, 2024) and industry participants identified the PDA as an area of interest.

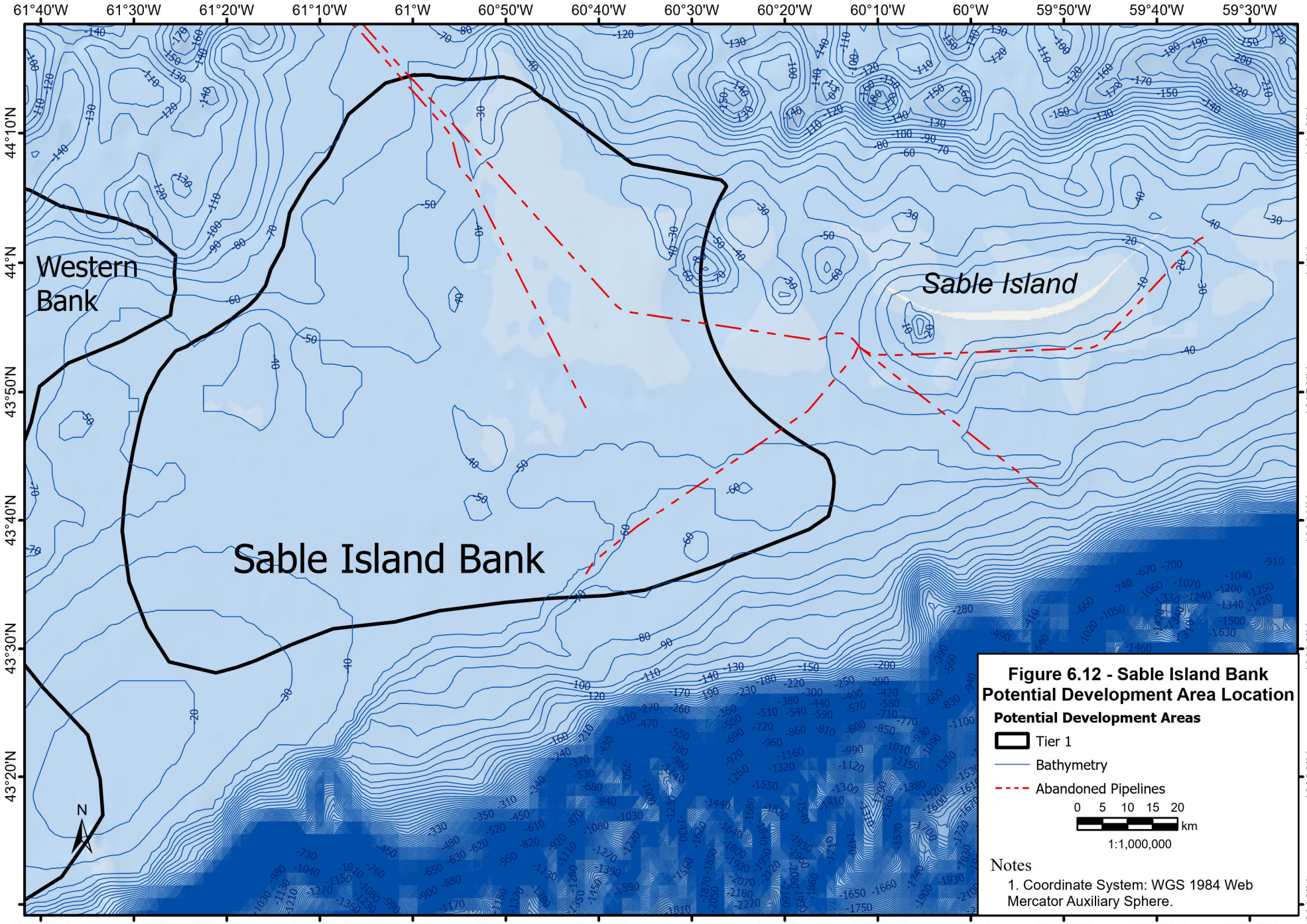
A portion of the PDA falls within the Western/Emerald Banks Marine Refuge (WEBMR) which is designated as a Marine Refuge under the *Fisheries Act.* The refuge provides habitat for regionally important groundfish and a complex benthic-shelf habitat that supports significant spawning and nursery ground for haddock (DFO, 2024). Prohibited activities within this area include all commercial and recreational fisheries activities that use bottom-contact gear, or that are known to interact with groundfish.

DFO's preferred approach is for OSW development to take place outside any area identified as a Marine Refuge, but that a risk management assessment be completed at the time of any proposed development to ensure that risks to the biodiversity conservation benefits associated with such areas can be avoided or mitigated (DFO, 2024). The Committee accepts that development within a Marine Refuge would require a determination that the conservation objectives that gave rise to the designations would not be substantially compromised by the co-location of a wind farm. Some fisheries industry feedback supports this type of proposed co-location as limiting the cumulative effect of multiple initiatives that already restrict or reduce their fishing areas (various government designations and industrial activities). As with the PDA identified for Western/Emerald Bank, the possibility of co-locating an OSW development within an area with a protection designation requires a better understanding of net habitat benefit(s), potential impact(s) to existing conservation objectives and the value of placing OSW development in an area already restricted for fishing activity. Given the infancy of the OSW industry in NS, the Committee expects that the findings of research undertaken during any initial OSW projects will support decision-making regarding the future utilization of Marine Refuge areas.

Other ecological conditions relevant to the location of Sable Island Bank include its proximity to SAR habitat and species that are known to be distributed within the general area. Blue whale important habitat abuts the eastern PDA boundary, and an area of northern bottlenose whale important habitat partially overlaps the PDA (Feyrer *et al.*, 2024). DFO also note the presence of sponge and sea pen presence to the east of the PDA. Sable Island PDA also overlaps with the Sable Island Bank Tier 2 marine conservation network site (see section 4.4.5).

The PDA has been defined to avoid higher density fishing along the slopes of the bank and in adjacent deeper waters. DFO identified moderate to high landings of Atlantic halibut, hagfish and queen-snow crab within the PFDA and that the PFDA overlaps with the 4W sea cucumber fishery and 4W whelk fishery. The long line fishery has expressed concerns, as described above, related to gear conflict and potential exclusion. Currently, whelk populations are being explored by one exploratory license holder, but since this is a fixed gear pot fishery, co-existence with OSW development might be possible. There is a history of scallop fishing on Sable Bank (and Western/Emerald Bank), especially in the 90s and early 2000s, during which time landings were notably higher than they are today. The Committee has been advised of continued scallop presence on Sable Western/Emerald Banks and future interest in continuing to exploit the resource. The scallop fishery employs a mobile bottom-contact gear, which presents greater challenges to co-existence than fixed gear pot fisheries.

Commercial shipping lanes are not present within this PDA and the distance from shore protects viewscapes of any OSW development from shore. The recommended 25 km buffer placed around Sable Island would reduce interaction with the roseate tern and other bird species that may forage from the island. There are three known shipwrecks within the PFDA.


61°40'W
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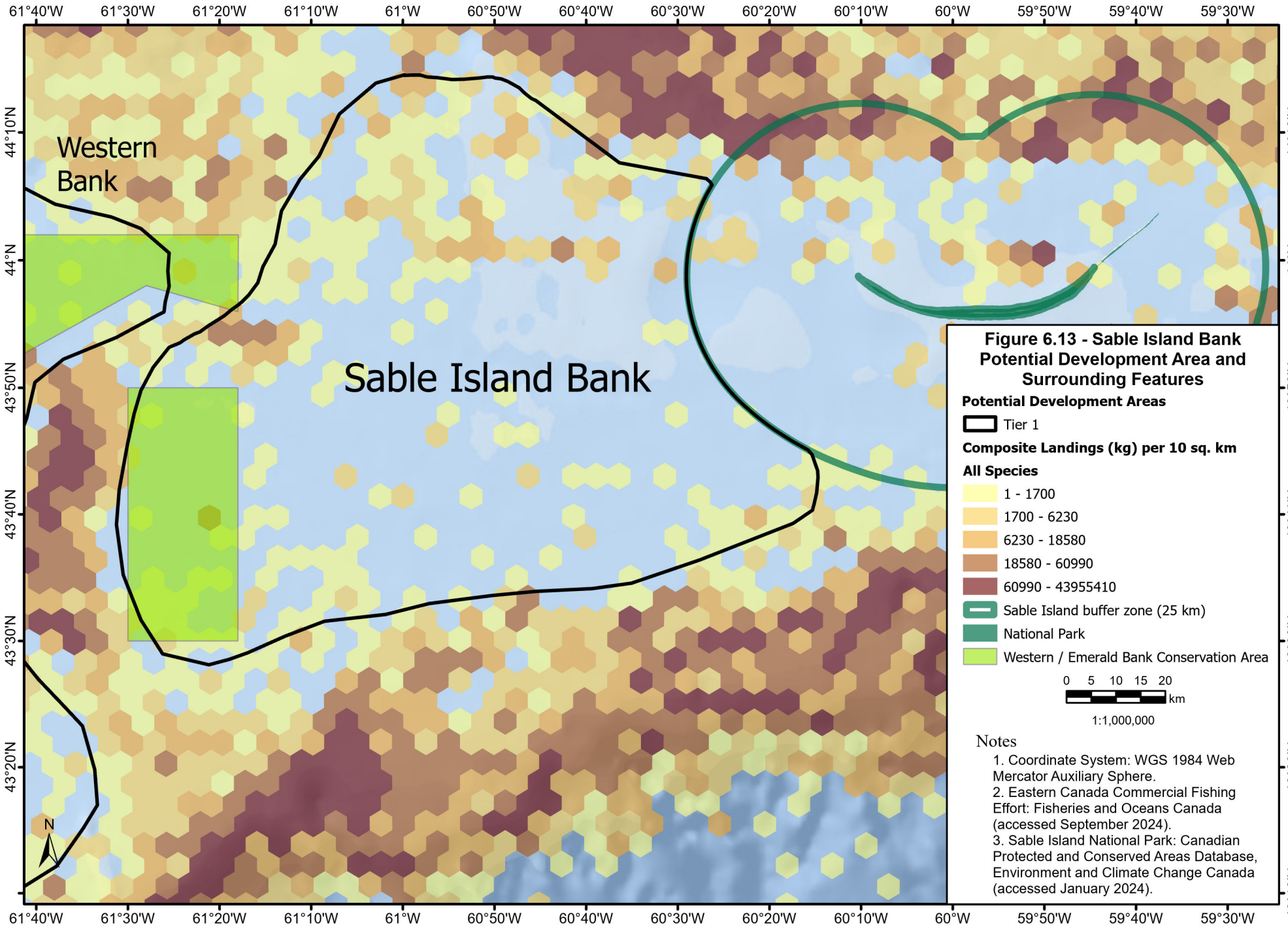
60°W
59°50'W
59°40'W
59°30'W
44°10'N
44°N
43°50'N
43°40'N
43°30'N
43°20'N
Western Bank
Sable Island
Sable Island Bank
N
Figure 6.12 - Sable Island Bank Potential Development Area Location
Potential Development Areas
Tier 1
Bathymetry
Abandoned Pipelines
0 5 10 15 20
km
1:1,000,000
Notes
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere.


61°40'W
61°30'W
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60°20'W
60°10'W
60°W
59°50'W
59°40'W
59°30'W
44°10'N
44°N
43°50'N
43°40'N
43°30'N
43°20'N
Western Bank
Sable Island Bank
N
Figure 6.13 - Sable Island Bank Potential Development Area and Surrounding Features
Potential Development Areas
Tier 1
Composite Landings (kg) per 10 sq. km
All Species
1 - 1700
1700 - 6230
6230 - 18580
18580 - 60990
60990 - 43955410
Sable Island buffer zone (25 km)
National Park
Western / Emerald Bank Conservation Area
0 5 10 15 20
km
1:1,000,000
Notes
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere.
2. Eastern Canada Commercial Fishing Effort: Fisheries and Oceans Canada (accessed September 2024).
3. Sable Island National Park: Canadian Protected and Conserved Areas Database, Environment and Climate Change Canada (accessed January 2024).

Table 6.6. Sable Island Bank PDA Suitability Summary Table

Category	Engagement Feedback		Considerations
	Source	**Comment**	
Ecological Sensitivity	DFO Feedback	**Species at Risk Habitat and Presence** • The PFDA is immediately adjacent to blue whale Important Habitat. • The PFDA partially overlaps with northern bottlenose whale Important Habitat. • The PFDA is within what is known to be the overall distribution of the following SAR species, i.e., species are known/likely to occur: leatherback sea turtle, fin whale, Atlantic wolffish, spotted wolffish, northern wolffish, loggerhead sea turtle. These conditions are expected to apply to the PDA.	Potential interactions between OSW development and sensitive species; avoidance, mitigation and monitoring techniques to be determined at the project level.
	DFO	**Unique Habitat** PFDA overlaps with: • Western/Emerald Bank Marine Refuge (WEBMR). This Marine Refuge is of regional importance for groundfish and is characterized by complex benthic-shelf habitat that supports significant spawning and nursery grounds for haddock and high invertebrate density. o Marine Refuges are established to achieve conservation objectives and contribute to Canada's marine conservation targets o WEBMR aims to protect continental shelf habitats and their associated communities including important benthic species, fish habitat and juvenile groundfish o The site contains important habitat for depleted Atlantic cod, American plaice and winter skate o The presence of a partial gyre near the Western/Emerald Banks leads to increased retention of larval fish and increased zooplankton diversity. Correspondingly, larval fish diversity is exceptionally high compared to other areas on the Eastern Scotian Shelf o The lack of human activity in WEBMR (originally established in 1987, revised in 2017) over many decades contributes to the high	DFO recommends taking a conflict-avoidance approach to OSW planning and siting that avoids existing conservation areas, including WEBMR. • If a potential development did overlap with a designated Marine Refuge, a risk and management assessment would be required to confirm that the biodiversity conservation objectives can be avoided or mitigated effectively. • The lack of detail around the proposed technology and development plan prevents a comprehensive risk assessment at this time. Based on detailed surveying results, OSW development should avoid significant concentrations of sensitive

Category	Engagement Feedback		Considerations
	Source	**Comment**	
		conservation value of this site that would be at risk if industrial activities were introduced • Overlap with Sable Island Bank Tier 2 marine conservation network site. Features of this site include: o Spawning and nursery area for groundfish, particularly haddock o Important fish habitat o Area of high invertebrate, fish and larval fish diversity o Western/Emerald Banks Marine Refuge located to the west o Representative example of bank and basin habitat o Unique oceanography (partial gyre) o Support for ocean pout and depleted groundfish species including Atlantic cod, winter skate and smooth skate • Sponge and sea pen presence east of the PDA that should be considered during cable route design and layout.	benthic features like corals and sponges within the WEBMR. Confirmation of sea pen presence should be confirmed through underwater benthic habitat surveys (UBHS) at the project planning stage.
	ECCC Feedback	• Several marine bird species frequent the area in high numbers during different seasons, e.g.: o Spring: shearwaters o Winter: Leach's storm petrel and shearwaters • At present, there are no indications of species occurring and foraging in high numbers on Sable Island Bank. • The modelling suggests that for species occurring, there may be high collision and displacement vulnerability, in spring, fall and winter.	Potential interactions between OSW development and birds; avoidance (micro siting of infrastructure), mitigation and monitoring techniques will need to be determined at the project level.

Category	Engagement Feedback		Considerations
	Source	**Comment**	
Commercial Fisheries and Other Ocean Users	DFO Feedback	• Fish species present (other than SAR listed) presence within the PFDA (and PDA) include: Atlantic cod, Atlantic halibut **(moderate to high landings)**, Atlantic herring, bluefin tuna, cusk, greysole-witch flounder, haddock, hagfish slime eel **(moderate to high landings)**, hake, mackerel, other crab species, other flounder species, other groundfish species, other tuna species, pollock, queen-snow crab **(moderate to high landings)**, redfish, scallop, sculpin, shark, shrimp, swordfish, turbot/Greenland halibut, whelk, winter flounder, yellowtail flounder (DFO, 2024). • High chlorophyll-a concentrations and fish and invertebrate species evenness (King *et al.,* 2016).	Potential interactions between OSW development and the fishing industry will need to be determined at project level. Engagement with longline fishers at the project stage to determine setbacks and minimize adverse impacts to that fishery.
	DFO	• Overlap with the 4W offshore sea cucumber fishing area. • Overlap with the experimental 4W offshore whelk fishery.	
	W.T. Grover Fisheries Ltd. and Ocean Pride Fisheries (sea cucumber fishers)	• Exclusive harvest zones exist within the Sable Island Bank PFDA 9and PDA). • Harvested using drag trawls.	
	Nova Scotia Swordfishermen's Association (long line fishers) during a meeting (Aug 19, 2024)	• Longline fishery takes place adjacent to Sable Island Bank. • OSW would result in loss of access due to gear setback requirements.	
	GCIFA Feedback	• GCIFA recommends utilizing Sable Island PFDA instead of French Bank and Canso Bank to reduce the impact to commercial fisheries.	

Category	Engagement Feedback		Considerations
	Source	**Comment**	
	NSFAEE Feedback (2024a)	• There is a strong sea cucumber fishery and developing whelk fishery within the area, although precise locations of these fishing areas are not available. • Surf clam and scallop are known to exist, and extensive work is required to determine precise areas and understand how they might be impacted by OSW. • The area is heavily transited by vessels to and from other fishing grounds. Further assessment should take place to avoid these routes.	
	SPANS	• Sable Island Bank has been utilized in the past as an important for the commercial scallop fishery. • While the offshore scallop fleet has not focused on this bank in recent years, it is still considered a key area for the fishery. • Scallops are a bottom contact gear fishery that may not be compatible with OSW development.	
	Louisburg Seafoods; Whelk Fishery	• The fishery is a fixed gear pot fishery. • An exploratory license is held near the Sable Bank PFDA. While the populations appear to be isolated in this area, further exploration to determine the extent of the resource is required.	
Physical and Human Use Conditions	Canmet (Kilpatrick *et al.*, 2023)	• PDA is predominantly located in areas identified by modelling as suitable for fixed turbine foundations.	Site specific substrate analysis is required to determine appropriate foundation selection.
	NS NRR Subsurface and Offshore Energy Branch (see Figure 4.4)	• PDA mostly located within Post-Glacial Sand and Gravel unit and a minor area of Glacial Marine Mud.	

Category	Engagement Feedback		Considerations
	Source	**Comment**	
	CCTH Feedback	• Three shipwrecks (Sylvia Mosher, Mahaska and Stella Maris) exist within located within the PFDA. • Shipwrecks are likely varying in levels of significance, recognizing that there may not be much left of the structures due to high energy ocean environments. • The Stella Maris wreck is a foreign vessel and sovereignty laws may apply.	Project planning will require interface with CCTH as the provincial archaeology regulator to ensure shipwreck sites are not impacted Buffers around shipwrecks may be recommended by CCTH as part of this process.
	DND	No PFDA specific feedback.	N/A

6.6.5 Western/Emerald Bank

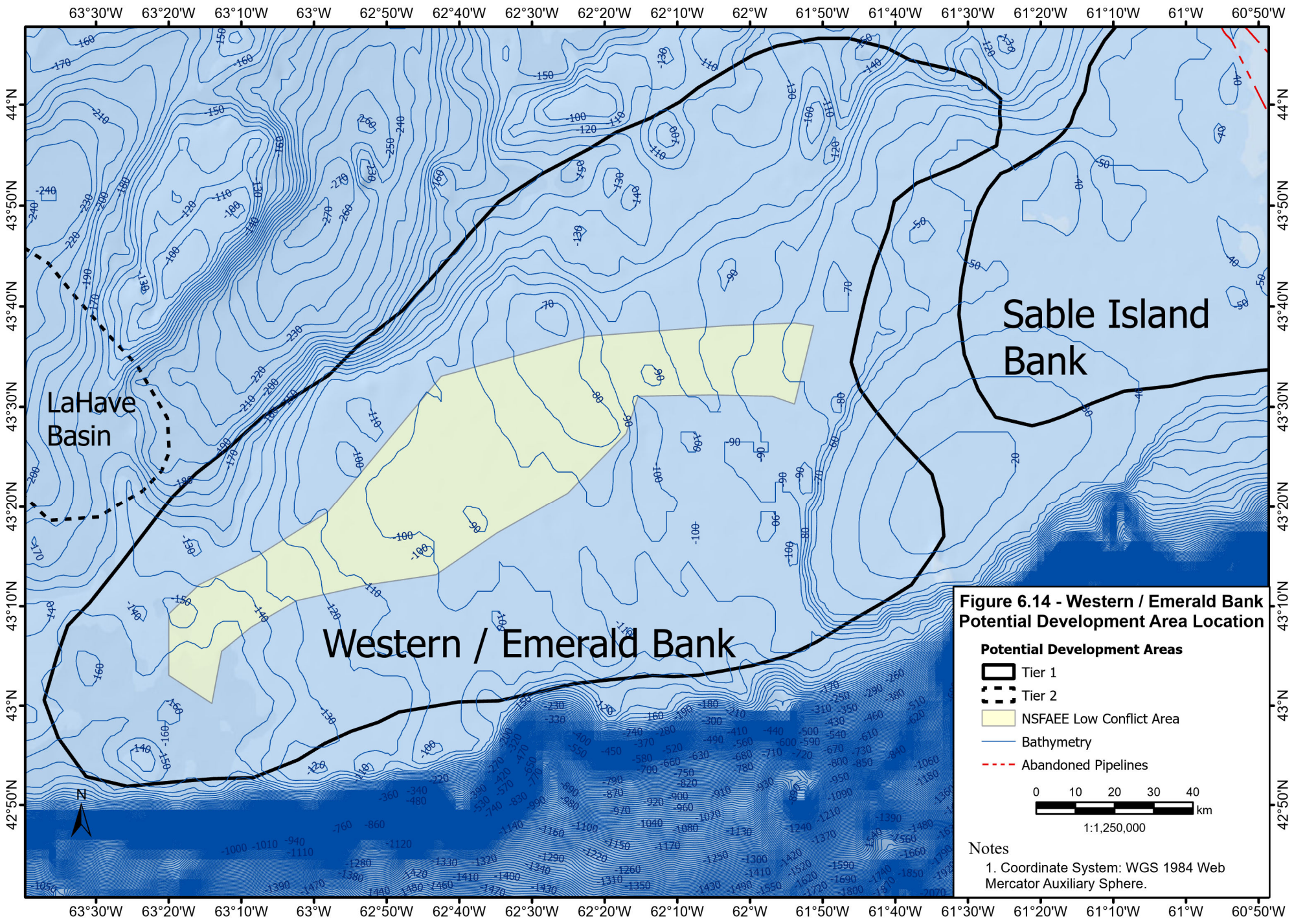
The Western/Emerald Bank PDA is ~ 13,170 km^2 in area and is ~ 95 km at its the closest point to the mainland; the area offers an opportunity for larger or phased projects over time. The PDA consists of variable water depths with ~6% in the 0-60m depth range, ~38% within the 60-100 m depth range and ~56% within the 100-300 m depth range. Figures 6.14 to 6.15 show the location of the PDA and key surrounding features. Table 6.7 summarizes the information that has informed the Committee's evaluation process.

While the Western/Emerald Bank PDA doesn't overlap with any areas of Critical Habitat, a large proportion (75%) of the PDA overlaps the Western/Emerald Bank Marine Refuge (WEBMR). A description of the WEBMR and its possible implications for OSW development has been provided in the preceding description of the Sable Island PDA and is not repeated here. In addition to the WEBMR, DFO identify that sponge and sea pens may be present and that a great number of whale sightings of multiple species have been recorded in the area. Multiple SAR fish species have distributions that overlap the PFDA, and blue whale important habitat abuts the southern PDA boundary; an area of northern bottlenose whale important habitat partially overlaps the PDA (Feyrer *et al.*, 2024)

Based on engagement feedback, a significant number of fishers and their associations support OSW development on Western/Emerald Bank because the area is closed to all fishing that uses bottom-contact gear or gear known to interact with groundfish. Fishing activity is generally low throughout the PDA; this was reinforced by the NSFAEE who identified large portions of the PDA as "low conflict" areas and supports OSW development in the area. Conversely, the longline fishery expressed reservations for the reasons expressed above, anticipating a loss of access due to required gear setbacks, i.e., drifting fishing gear and loss of ability to fish within a certain distance of the PFDA boundary. The concerns expressed by SPANS with respect to the Sable Island Bank scallop resource also apply to Western/Emerald Bank; scallop fishing is viewed as an important industry where bottom contact gear presents significant coexistence challenges with the OSW industry.

A potentially significant development constraint is the Royal Canadian Navy's (RCNs) Maritime Local Operating Areas (MARLOAs). Figure 4.15 depicts MARLOA areas Deltas 1-4, Golfs 1-4 and Hotels 1-4. DND state that *"building infrastructure within areas Delta 1-4, Golf 1-4 or Hotel 1-4 would limit the RCN's ability to test and certify equipment to prepare ships to defend Canada and Canada's allies. This would negatively impact RCN activities. Moving these military activities to other areas would significantly increase the cost of conducting operational testing, evaluation, certification and training for RCN vessels and personnel. This could also reduce RCNs ability to operate both by ourselves and with Canada's allies as some operational activities require certain water depths"* (DND, 2024). While the Committee appreciates what appears to be a significant issue, it has decided to retain Western/Emerald Bank as a PDA due to its limited understanding of the precise nature, aerial extent or frequency of these exercises and whether coexistence with OSW development may be possible in portions of such a large area.

Three shipwrecks have been identified by CCTH within the PFDA.


Sable Island Bank
LaHave Basin
Western / Emerald Bank
Figure 6.14 - Western / Emerald Bank Potential Development Area Location
Potential Development Areas
Tier 1
Tier 2
NSFAEE Low Conflict Area
Bathymetry
Abandoned Pipelines
0 10 20 30 40
km
1:1,250,000
Notes
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere.
N
63°30'W
63°20'W
63°10'W
63°W
62°50'W
62°40'W
62°30'W
62°20'W
62°10'W
62°W
61°50'W
61°40'W
61°30'W
61°20'W
61°10'W
61°W
60°50'W
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43°50'N
43°40'N
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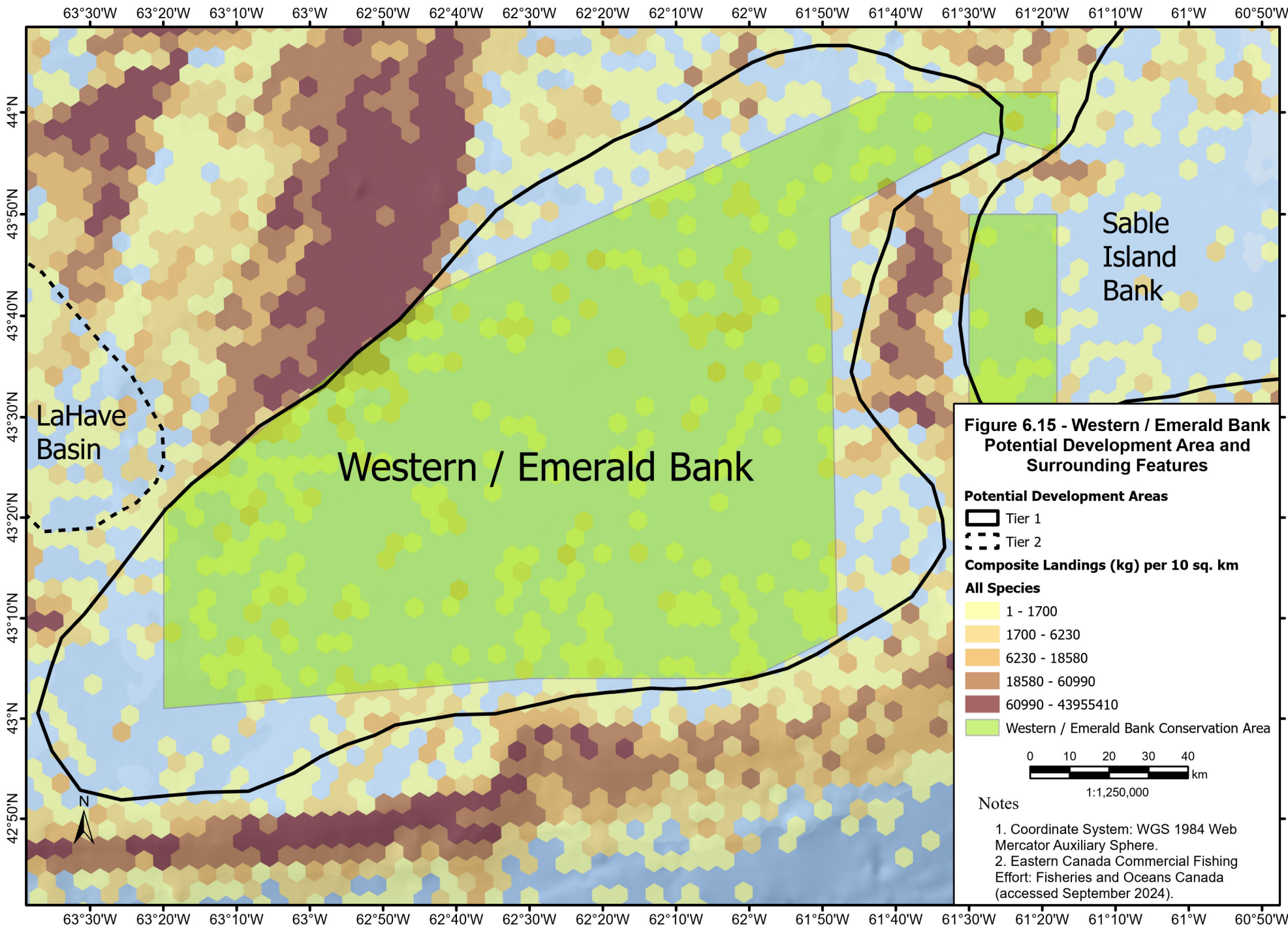
43°20'N
43°10'N
43°N
42°50'N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60°50'W
44°N
43°50'N
43°40'N
43°30'N
43°20'N
43°10'N
43°N
42°50'N
Sable Island Bank
LaHave Basin
Western / Emerald Bank
N
Figure 6.15 - Western / Emerald Bank Potential Development Area and Surrounding Features
Potential Development Areas
Tier 1
Tier 2
Composite Landings (kg) per 10 sq. km
All Species
1 - 1700
1700 - 6230
6230 - 18580
18580 - 60990
60990 - 43955410
Western / Emerald Bank Conservation Area
0 10 20 30 40
km
1:1,250,000
Notes
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere.
2. Eastern Canada Commercial Fishing Effort: Fisheries and Oceans Canada (accessed September 2024).

Table 6.7. Western/Emerald Bank PDA Suitability Summary Table

Category	Engagement Feedback		Considerations
	Source	**Comment**	
Ecological Sensitivity	DFO Feedback	**Species at Risk Habitat and Presence** • SAR species with distribution that overlaps with this area: leatherback sea turtle, blue whale, fin whale, Atlantic wolffish, spotted wolffish, white shark, loggerhead sea turtle. • Fin whale and blue whale sightings have been identified within the PFDA. • An area of blue whale important habitat borders the southern PFDA boundary, and an area of northern bottlenose whale Important Habitat overlaps the PFDA. These conditions are expected to apply to the PDA.	Potential interactions between OSW development and sensitive species; avoidance, mitigation and monitoring techniques will need to be determined at the project level.
	DFO	**Unique Habitats** • PFDA (and PDA) extends over the Western/Emerald Bank Marine Refuge (WEBMR). See WEBMR description provided for Sable Island Bank (Table 6.6). • Sponge and sea pens may be present within the PFDA. • DFO have identified a diverse whale presence in the PFDA. These conditions are expected to apply to the PDA.	See considerations related to WEBMR provided for Sable Island Bank (Table 6.7). Confirmation of sea pen presence to be confirmed through underwater benthic habitat surveys (UBHS) during the project planning stage.
	ECCC Feedback	• Dovekie is the only marine bird species that has been identified in high numbers during the Winter season in the Western/Emerald Bank area. • At present, there are no indications of species occurring and foraging in high numbers on Western/Emerald Island Bank. • At present, collision and displacement vulnerability has been modelled as low to moderate within the Emerald/Western Bank area.	Site specific baseline surveys will inform potential risk to birds. Potential interactions between OSW development and birds; avoidance (micro siting of infrastructure), mitigation and monitoring techniques will need to be determined at the project level.

Category	Engagement Feedback		Considerations
	Source	**Comment**	
Commercial Fisheries and Other Ocean Users	DFO Feedback	• Fish species present (other than SAR listed) presence within the PFDA (and PDA) include: Atlantic cod, Atlantic halibut **(moderate to high landings)**, Atlantic herring, bluefin tuna, dogfish, greysole-witch flounder, hake **(moderate to high landings)**, mackerel, other crab species, other flounder species, pollock, redfish, scallop, swordfish, winter flounder, yellowtail flounder.	Potential interactions between OSW development and the fishing industry will need to be determined at the project level. Engagement with longline fishers at the project stage to determine setbacks and minimize adverse impacts to that fishery.
	Nova Scotia Swordfishermen's Association (long line fishers) during a meeting (Aug 19, 2024)	• Longline fishery takes place adjacent to Western/Emerald Bank. • OSW would result in loss of access due to gear setback requirements.	
	GCIFA Feedback	• GCIFA recommends development within Western/Emerald Bank PFDA instead of French Bank and Canso Bank to reduce the impact to other commercial fisheries.	
	NSFAEE Feedback	• Area of "low conflict" identified by NSFAEE in Western/Emerald Bank PDA (see Figure 6.14).	
Physical and Human Use Conditions	CanMET (Kilpatrick *et al.*, 2023)	• The PDA is predominantly located in areas identified by modelling as suitable for floating structures. A very small area is modelled as suitable for subsurface structures.	Substrate will be evaluated by developers as part of OSW development feasibility processes. This will inform the design including identification of suitable turbine structure suited to the conditions present.
	NS NRR Subsurface and Offshore Energy Branch (see Figure 4.4)	• PDA entirely located within Post-Glacial Sand and Gravel unit.	
	CCTH Feedback	• Three shipwrecks (Anita, Blake and Doris V. Myra) exist within the PFDA. • Shipwrecks vary in levels of significance, recognizing that there may not be much left of the structures due to high energy ocean environments. • The Anita wreck is a foreign vessel and sovereignty laws may apply.	Project planning will require interface with CCTH as the provincial archaeology regulator to ensure shipwreck sites are not impacted. Buffers around shipwrecks may be recommended by CCTH as part of this process.

Category	Engagement Feedback		Considerations
	Source	**Comment**	
	DND (see Figure 4.15)	• The Royal Canadian Navy (RCN) relies on Maritime Local Operating Areas (MARLOAs) Deltas 1-4, Golfs 1-4 and Hotels 1-4 to conduct military training so they can fulfill their departmental mandate. • These areas overlap with the Western/Emerald Bank PDA. • Building infrastructure within these areas would limit the RCN's ability to test and certify equipment to prepare ships to defend Canada and Canada's allies. • The use of the MARLOAs is critical for the RCN as they are geographically close to Halifax, aligning within DND requirements for fuel, travel allowances and vessel restrictions during training and testing. • Development within these areas would limit the RCN's ability to test and certify equipment to prepare ships to defend Canada and Canada's allies. • There appears limited flexibility for OSW and MARLOAs to coexist given the nature of the military's use of the area and the lack of suitable alternatives. • DND recommends that Western/Emerald Basin be removed from the list of PFDAs.	More work is required to understand whether OSW may be possible within portions of the PDA.
		• There are potential UXO Legacy Sites located in-between the Sydney Bight PFDA boundary and the coastline of NS.	Potential UXO sites will need to be considered when siting the routing of electricity transmission cables to shore. The use of underwater Remotely Operated Vehicle (ROV) surveys will be particularly important in these areas.

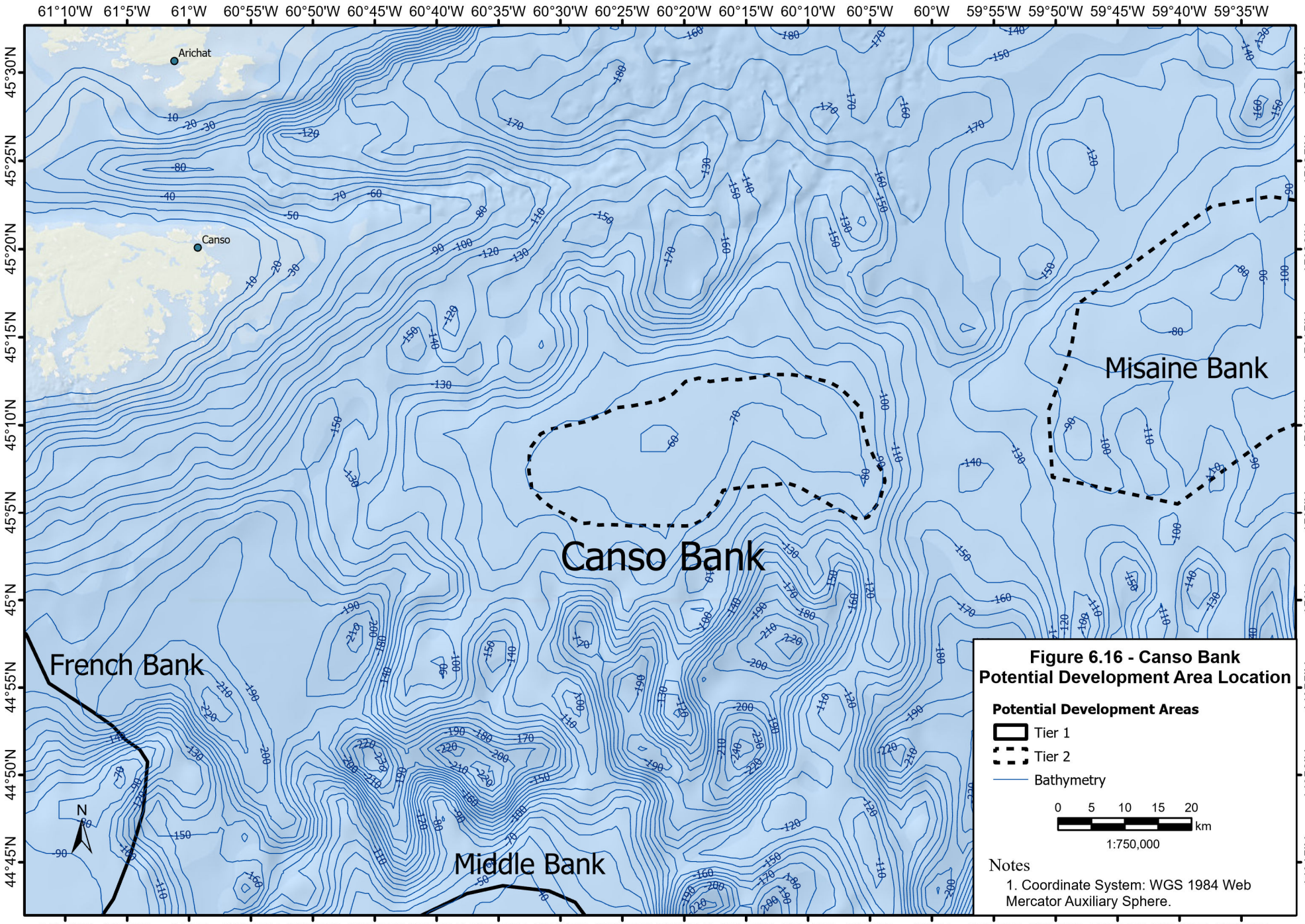
6.6.6 Canso Bank

The Canso Bank PDA is unchanged in size compared to the original PFDA and is approximately 430 km^2 in area and situated entirely within water depths ranging between 60-100 m. At its closest point, the PDA is ~35 km to the shoreline, ~ 85 km from Port Hawkesbury and the Port of Sydney lies ~ 160 km to the north. Figures 6.16 to 6.17 show the location of the PDA and key surrounding features. Table 6.8 summarizes the information that has informed the Committee's evaluation process.

The Canso Bank PDA is not located within Critical Habitat. Canadian Science and Advisory Secretariat (CSAS) documents confirm overlap with important habitat for leatherback sea turtle (LBST). DFO advice indicates multiple Species at Risk are known to have a distribution that overlaps with the PDA. The PDA falls within the Canso Bank and Channels Tier 2 site in the marine conservation network (see section 4.4.5).

Canso Bank PDA was situated on the top of the bank to avoid high density fishing areas. During the feedback process, DFO noted moderate to high landings of queen-snow crab from the bank. The GCIFA are also concerned about potential impacts to the crab fishery and have noted that the bank is a high fishing vessel traffic area. As mentioned above, GCIFA is actively monitoring vessel traffic on Canso Bank and anticipates an increase in activity level during the fall months (not currently in the dataset).

Canso Bank is the only PDA identified as having "challenging" substrate (see the discussion above in section 6.1). NRCan have suggested that recent testing indicates surficial geology and geomorphology similar to Middle Bank and therefore potentially suitable for floating OSW installation; these data are preliminary and more detailed analysis is required to better understand the area's potential.


61°10'W 61°5'W 61°W 60°55'W 60°50'W 60°45'W 60°40'W 60°35'W 60°30'W 60°25'W 60°20'W 60°15'W 60°10'W 60°5'W 60°W 59°55'W 59°50'W 59°45'W 59°40'W 59°35'W
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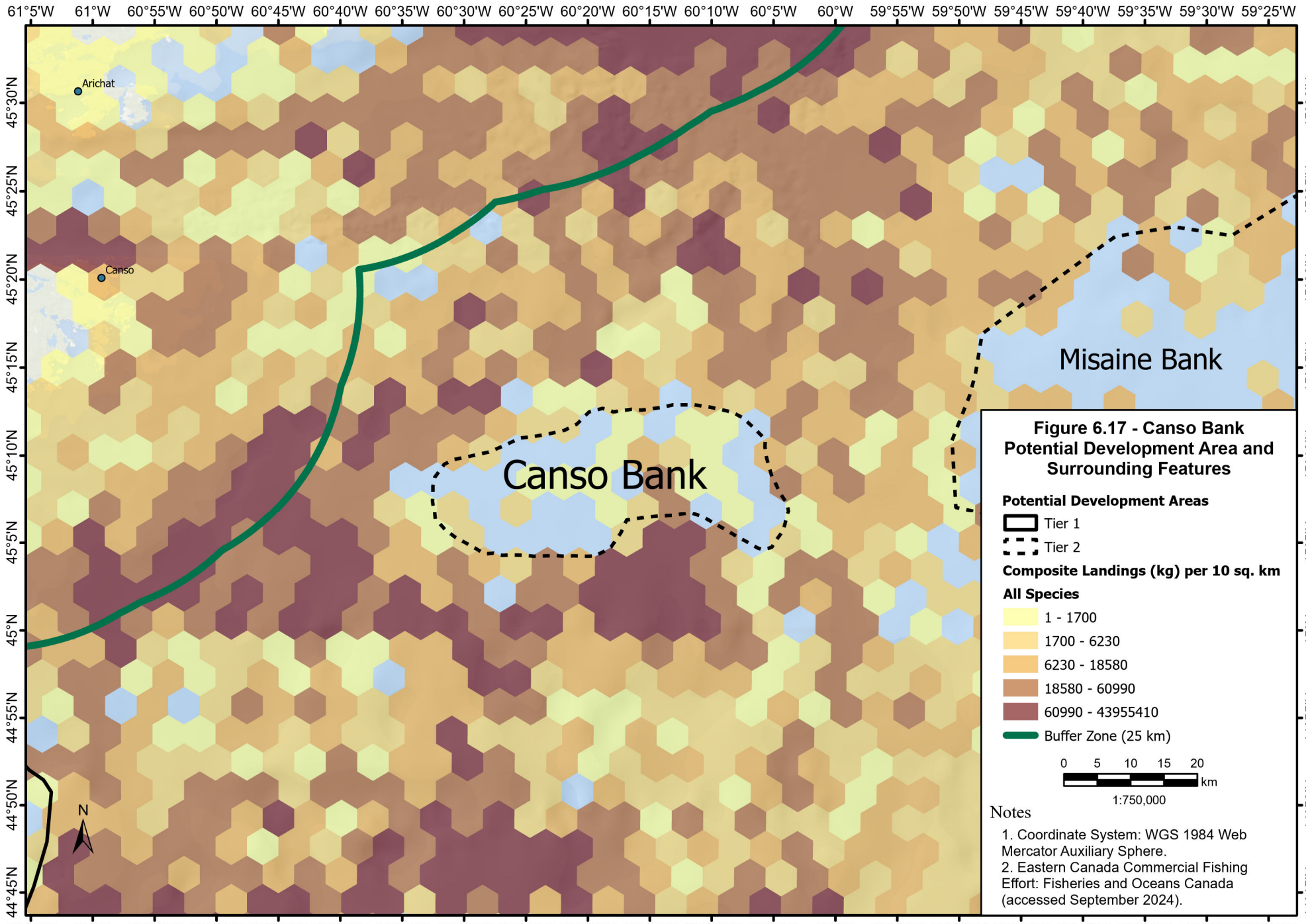
Arichat
Canso
Misaine Bank
Canso Bank
French Bank
Middle Bank
N
Figure 6.16 - Canso Bank
Potential Development Area Location
Potential Development Areas
Tier 1
Tier 2
Bathymetry
0 5 10 15 20
km
1:750,000
Notes
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere.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45°30'N
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45°15'N
45°10'N
45°5'N
45°N
44°55'N
44°50'N
44°45'N
Arichat
Canso
Canso Bank
Misaine Bank
N
Figure 6.17 - Canso Bank Potential Development Area and Surrounding Features
Potential Development Areas
Tier 1
Tier 2
Composite Landings (kg) per 10 sq. km
All Species
1 - 1700
1700 - 6230
6230 - 18580
18580 - 60990
60990 - 43955410
Buffer Zone (25 km)
0 5 10 15 20
km
1:750,000
Notes
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere.
2. Eastern Canada Commercial Fishing Effort: Fisheries and Oceans Canada (accessed September 2024).

Table 6.8. Canso Bank PDA Suitability Summary Table

Category	Engagement Feedback		Considerations
	Source	**Comment**	
Ecological Sensitivity	DFO Feedback	**Species at Risk Habitat and Presence** The PFDA (and PDA) overlaps with: • Leatherback sea turtle important habitat which will inform the future consideration of Critical Habitat designations in an amended recovery strategy. • SAR species with distribution that overlaps with this area: blue whale (Endangered), fin whale (Special Concern), North Atlantic right whale (Endangered), Atlantic wolffish (Special Concern), northern wolffish (Threatened), White Shark (Endangered).	Potential interactions between OSW development and sensitive species will need to be determined at the Project level, including an evaluation of potential interactions, avoidance, effects, mitigation and monitoring requirements.

	DFO	**Unique Habitat**
		The PFDA (and PDA) overlaps with:
		• Habitat in the area supports species such as sand lance, depleted groundfish populations such as Atlantic cod, American plaice, thorny skate and Atlantic wolffish.
		• Canso Bank and Channels is a Tier 2 site in marine conservation network. Features of this area include:
		  ○ Significant concentrations of sponges and sand dollars
		  ○ Foraging habitat for seabirds
		  ○ Important habitat for groundfish
		  ○ Area of high larval, fish and invertebrate diversity
		  ○ Area of high primary productivity
		  ○ Diverse habitat types include sandy banks, small channels, deep holes and mounds that are important for sand lance and depleted groundfish species
		• Large gorgonian corals may be present to the northeast of the PDA which may influence the routing of transmission cables to shore.
			Sensitive areas should be confirmed during the planning stage and avoided to the extent possible. An evaluation of potential interactions, including avoidance, mitigation and monitoring requirements should be completed at project level.
			
			Confirmation of large gorgonian corals should be confirmed through underwater benthic habitat surveys (UBHS) during the planning stage.

Category	Engagement Feedback		Considerations
	Source	**Comment**	
	ECCC Feedback	• Several marine bird species frequent the area in high numbers during different seasons, e.g.: o Spring: murres, razorbill o Summer: dovekie, northern gannet o Fall: Atlantic puffin, black-legged kittiwake, dovekie, northern gannet • Several other species that breed in the vicinity are known to forage extensively in the area, e.g.: northern gannet and greater black-backed gull. • At present, no areas within the Canso Bank PDA haven modelled as having high collision and displacement vulnerability.	Site specific baseline surveys will inform potential risk of proposed OSW development to birds. Potential interactions between OSW development and birds; avoidance (micro siting of infrastructure), mitigation and monitoring techniques need to be determined at the project level.
Commercial Fisheries and Other Ocean Users	DFO Feedback	• Fish species (other than the SAR listed) presence within the PFDA (and PDA) include: turbot/Greenland halibut, Atlantic halibut, hake, haddock, greysole-witch flounder, swordfish, sculpin, redfish, queen-snow crab **(moderate to high landings),** bluefin tuna, Atlantic herring.	Potential interactions between OSW development and the fishing industry will need to be determined at project level.

Category	Engagement Feedback		Considerations
	Source	**Comment**	
	GCIFA Feedback	Utilizing Transport Canada's Enhanced Maritime Situational Program (EMSP) which analyses the movement of vessels, the following observations were made between mid-April-August 2024: • 227 fishing traffic transects have been made (including vessels conducting fishing and those travelling though the PFDA further offshore). • There is no distinct highway/route within the PFDA. Vessel routes depend on where fishing occurs (the transit destination) or where the destination port is. • It is hard to estimate the total volume of traffic since vessels under 45 feet are not required to have AIS tracking. • Increased herring and swordfish fishing activity is expected in the area during the fall. • There is a concern about potential impacts to the snow crab fishing that takes place in the area surrounding the PFDA. • There is concern that cable laying from the PFDA will disrupt fish habitat and affect the commercial fishery. • Recommendation to either remove Canso Bank as a PFDA or decrease the area to the middle of the bank to avoid edges used for high fishing activity.	
	NSFAEE briefing (2024b)	• Spatial distribution of scallop resource should be surveyed prior to OSW development. • Rod and reel tuna fishery is expanding in this region but is not currently captured by publicly available data. • Heavy snow crab and halibut fishing occur in the area although precise locations cannot be identified. Use of a buffer to protect these fisheries is recommended.	
	Canmet (Kilpatrick *et al.,* 2023)	• PDA is in an area identified by substrate modelling as "Challenging" (see the discussion above under section 6.1)	Substrate will be evaluated by developers as part of OSW development feasibility

Category	Engagement Feedback		Considerations
	Source	**Comment**	
Physical and Human Use Conditions	NS NRR Subsurface and Offshore Energy Branch (See Figure 4.4)	• PDA entirely located within Post-Glacial Sand and Gravel unit.	processes. This will inform the design including the identification of turbine structure suited to the physical conditions.
	CCTH Feedback	• No known shipwrecks exist within the PDA boundaries.	N/A
	DND	No PDA specific feedback.	N/A

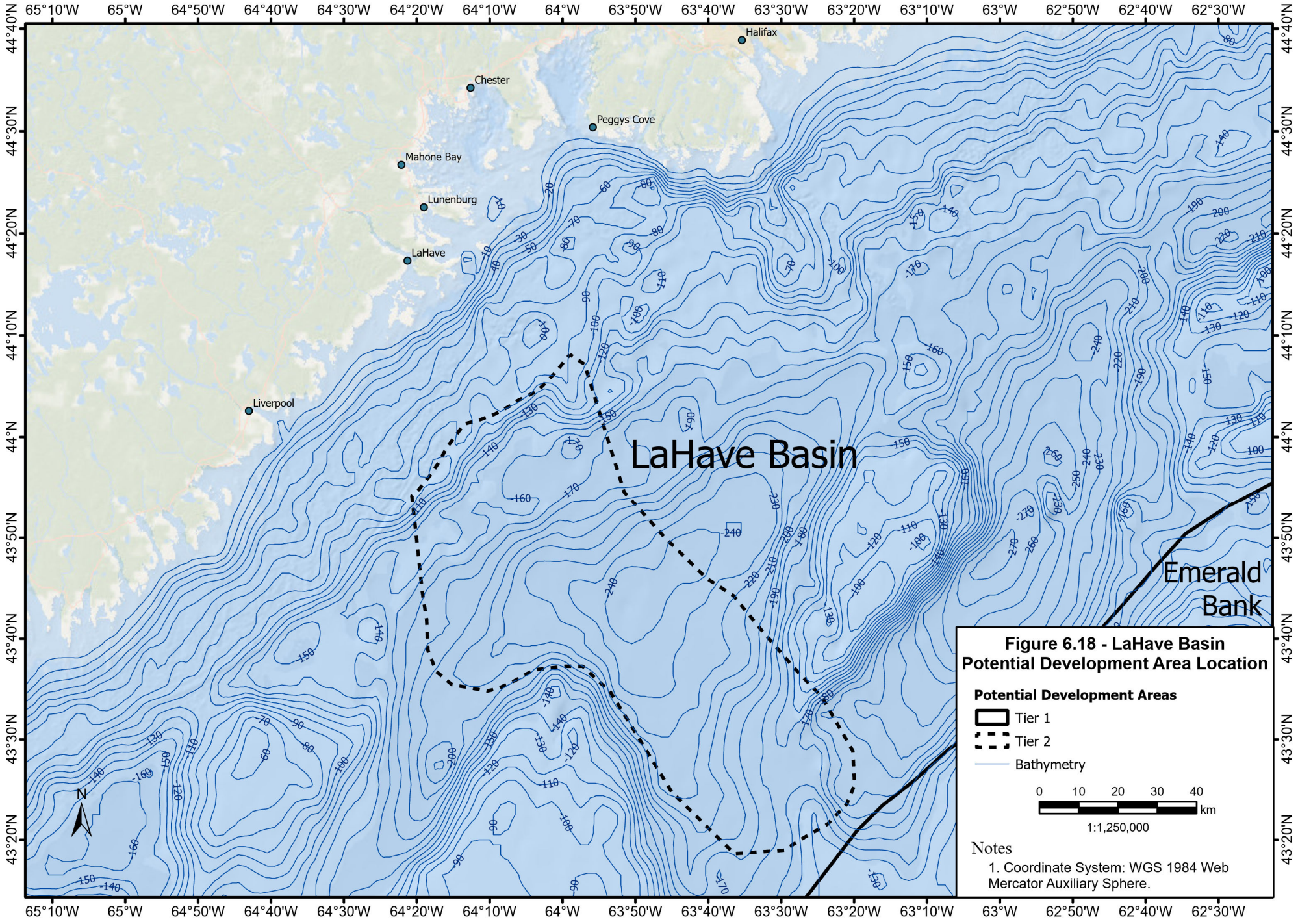
6.6.7 LaHave Basin

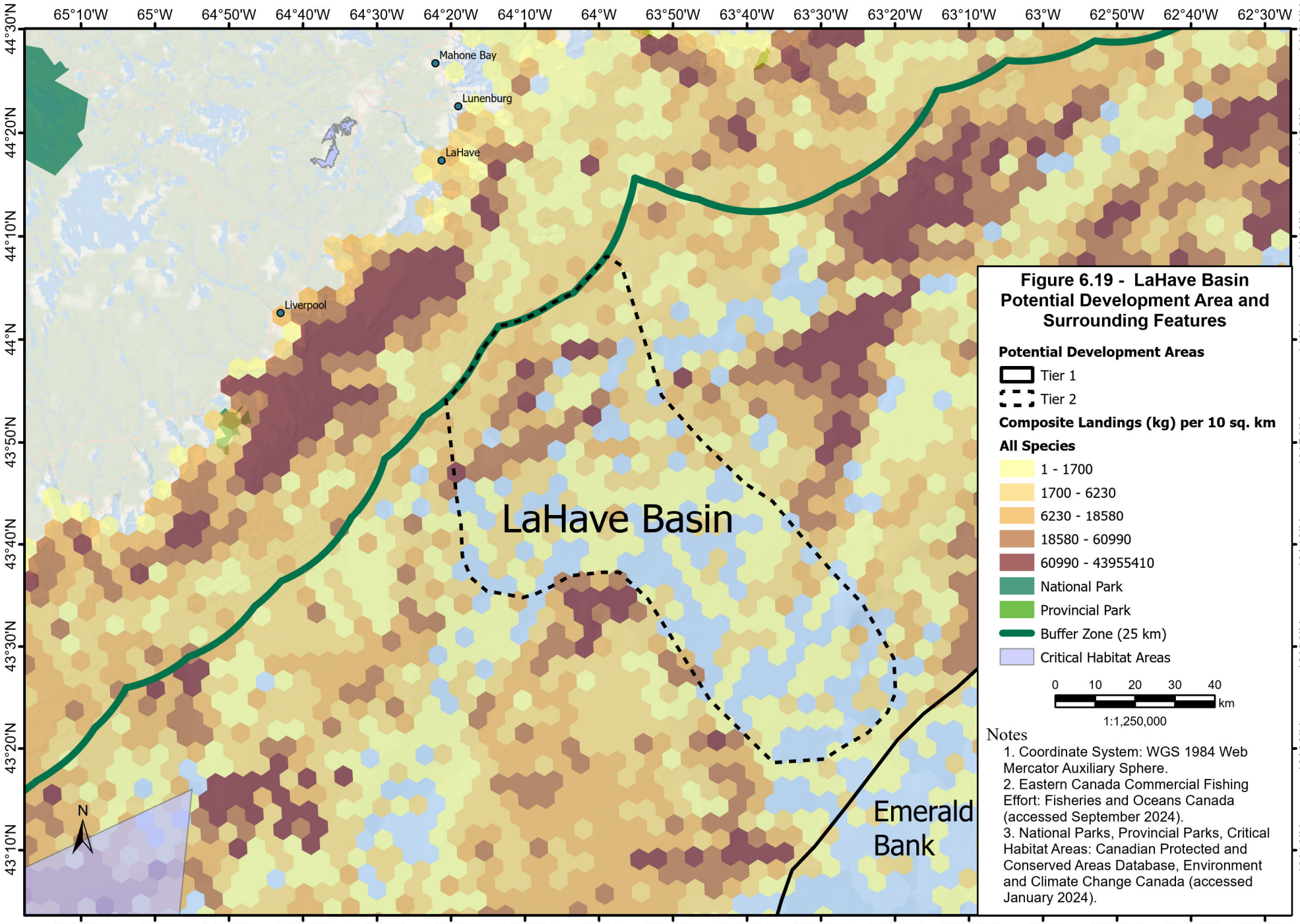
The LaHave Basin PDA is located approximately 32 km east of Liverpool, NS and encompasses an area of ~ 3,415 km^2. The PDA has water depths ranging from 100 to 300 m. As discussed in section 6.4, the Committee received comments from multiple stakeholders during the spring 2024 engagement process suggesting that a potential OSW development area along the South Shore of NS could be beneficial and facilitate a more equitable distribution of the benefits and challenges associated with this new industry. Proximate OSW development is perceived as likely to result in positive impacts to grid and port infrastructure and to provide associated local economic benefits. The Municipality of Shelburne expressed interest in an OSW project that would involve their communities provided adequate protection was afforded to fisheries (Municipality of Shelburne, 2023). Although the south shore region is generally associated with dense fishing activity, the PDA boundary has been designed with reference to the DFO published data which indicates an area of relatively less fishing density.

The area has been identified by at least one developer as a viable OSW candidate. Preliminary feasibility work suggested, according to discussions with local fishers, that the bulk of the inshore lobster fishery occurs within 100 m water depth, which is within approximately 23-27 km of the shoreline. As a result of past industrial users, including the pulp mill, a substation exists, and a transmission corridor from Liverpool to Bridgewater and beyond also exists; developers could also consider Bridgewater for grid power connection.

The PDA is relatively close to shore (25 km at its closest point) and is situated in proximity to the ports of Shelburne, Liverpool and Halifax. For the most part, the PDA is situated within the geologically suitable areas presented in Figure 6.2.

Over half of the PDA exists within the Royal Canadian Navy's (RCNs) Maritime Local Operating Areas (MARLOAs). These areas present a potential significant development constraint for the same reasons discussed in Section 6.6.5 (Western/Emerald Bank) and presented on Figure 4.15.


Halifax
Chester
Peggys Cove
Mahone Bay
Lunenburg
LaHave
Liverpool
LaHave Basin
Emerald Bank
N
Figure 6.18 - LaHave Basin
Potential Development Area Location
Potential Development Areas
Tier 1
Tier 2
Bathymetry
0 10 20 30 40
km
1:1,250,000
Notes
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere.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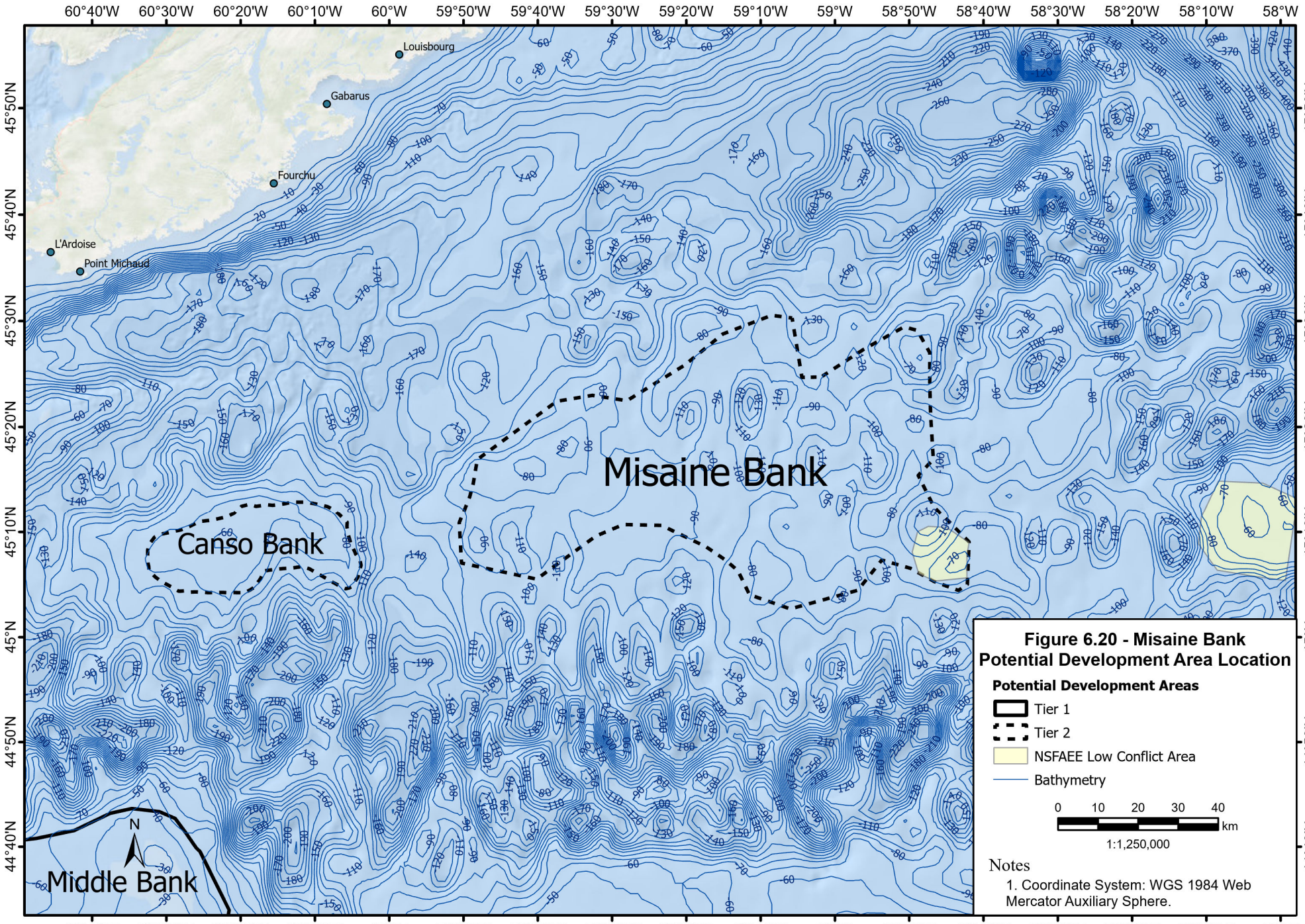
62°30'W
44°30'N
44°20'N
44°10'N
44°N
43°50'N
43°40'N
43°30'N
43°20'N
43°10'N
Mahone Bay
Lunenburg
LaHave
Liverpool
LaHave Basin
Emerald Bank
N
Figure 6.19 - LaHave Basin Potential Development Area and Surrounding Features
Potential Development Areas
Tier 1
Tier 2
Composite Landings (kg) per 10 sq. km
All Species
1 - 1700
1700 - 6230
6230 - 18580
18580 - 60990
60990 - 43955410
National Park
Provincial Park
Buffer Zone (25 km)
Critical Habitat Areas
0 10 20 30 40
km
1:1,250,000
Notes
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere.
2. Eastern Canada Commercial Fishing Effort: Fisheries and Oceans Canada (accessed September 2024).
3. National Parks, Provincial Parks, Critical Habitat Areas: Canadian Protected and Conserved Areas Database, Environment and Climate Change Canada (accessed January 2024).

6.6.8 Misaine Bank

The Misaine Bank PDA is located ~60 km offshore and is ~ 2,830 km^2 in size in water depths ranging from 60-100 m (75% of PDA) and 100-300 m (25% of PDA). The location was identified as an area of interest by an OSW developer. The area is 130 km and 135 km from the ports of Sydney and Port Hawkesbury respectively. Viewscapes would not be impacted, and the area is not associated with high density vessel traffic. The PDA is located entirely within the geologically suitable areas presented in Figure 6.2, although the GSC have indicated that the area presents some complex geological and substrate conditions that would require further detailed investigation to ascertain suitability for an OSW development.

The PDA boundary has been designed with reference to the DFO published data to avoid the denser areas of commercial fishing.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60°30'W
60°20'W
60°10'W
60°W
59°50'W
59°40'W
59°30'W
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58°50'W
58°40'W
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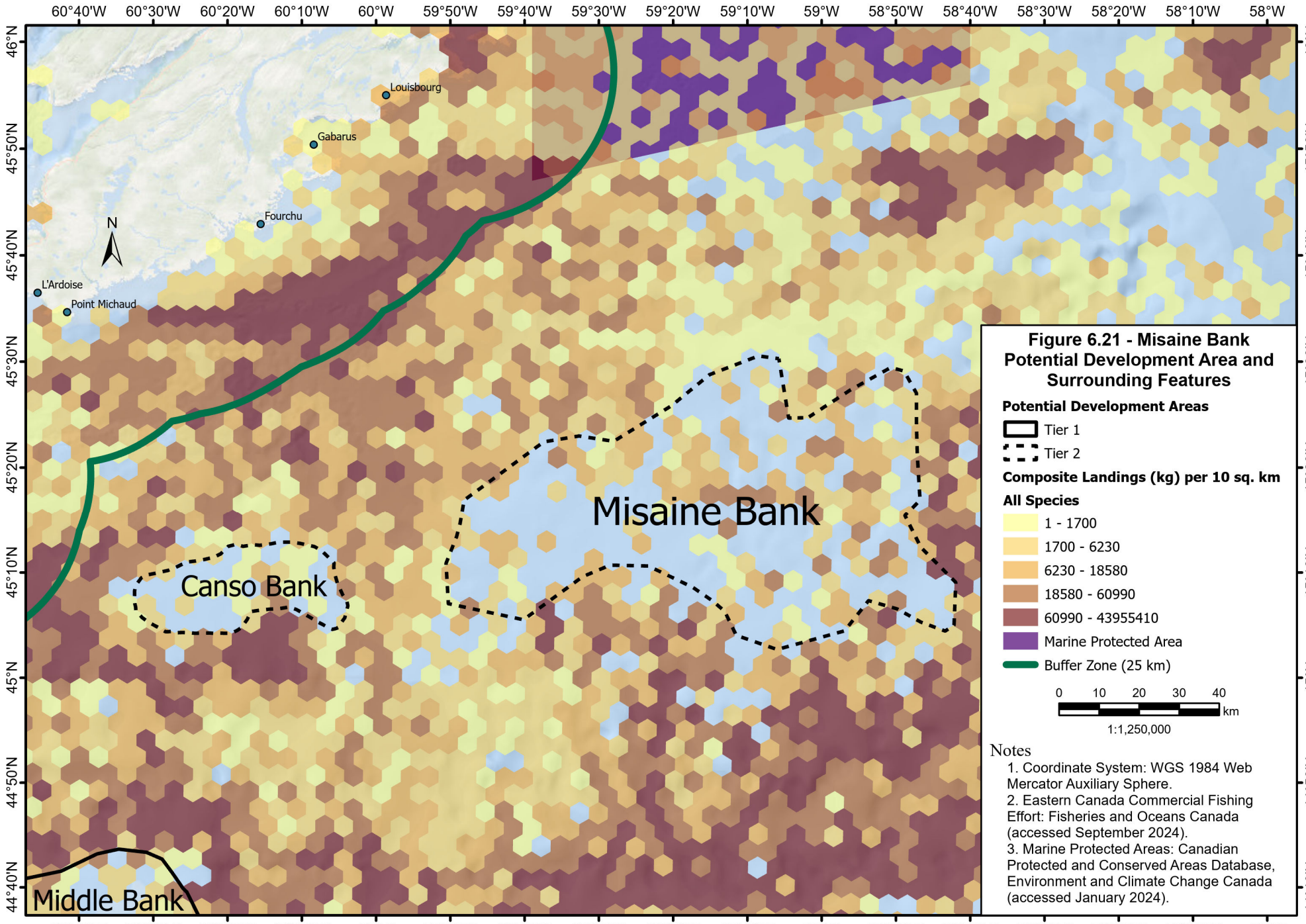
58°20'W
58°10'W
58°W
45°50'N
45°40'N
45°30'N
45°20'N
45°10'N
45°N
44°50'N
44°40'N
Louisbourg
Gabarus
Fourchu
L'Ardoise
Point Michaud
Misaine Bank
Canso Bank
Middle Bank
N
Figure 6.20 - Misaine Bank
Potential Development Area Location
Potential Development Areas
Tier 1
Tier 2
NSFAEE Low Conflict Area
Bathymetry
0 10 20 30 40
km
1:1,250,000
Notes
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere.


60°40'W
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59°50'W
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59°20'W
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58°50'W
58°40'W
58°30'W
58°20'W
58°10'W
58°W
46°N
45°50'N
45°40'N
45°30'N
45°20'N
45°10'N
45°N
44°50'N
44°40'N
Louisbourg
Gabarus
Fourchu
L'Ardoise
Point Michaud
N
Misaine Bank
Canso Bank
Middle Bank
Figure 6.21 - Misaine Bank Potential Development Area and Surrounding Features
Potential Development Areas
Tier 1
Tier 2
Composite Landings (kg) per 10 sq. km
All Species
1 - 1700
1700 - 6230
6230 - 18580
18580 - 60990
60990 - 43955410
Marine Protected Area
Buffer Zone (25 km)
0 10 20 30 40
km
1:1,250,000
Notes
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere.
2. Eastern Canada Commercial Fishing Effort: Fisheries and Oceans Canada (accessed September 2024).
3. Marine Protected Areas: Canadian Protected and Conserved Areas Database, Environment and Climate Change Canada (accessed January 2024).

7.0 Cumulative Effects

7.1 Approach, Operating Principles and Limitations

7.1.1 Definitions

The *Impact Assessment Act (IAA)* defines “adverse effects within federal jurisdiction” as non-negligible adverse changes to:

- components of the environment that are within the legislative authority of Parliament;
- the marine environment outside Canada, boundary waters, international waters, interprovincial waters, caused by pollution; and
- Indigenous peoples of Canada (s2).

Section 2 of the *Impact Assessment Act (IAA)* defines “effects" as “...changes to the environment or to the health, social or economic conditions and the positive and negative consequences of those changes”. *Cumulative* effects are the effects that are likely to result from a designated project in *combination* with other physical activities that have been or will be carried out (s. 22); activities from past events, events that are happening now and events that could or may happen in the future.

In the context of OSW development (the “designated project”) in the RA Study Area, this requires an assessment of OSW activities in combination with other physical activities such as climate change, changes in fishing methodologies and gear types, harvesting of different species, pollution, military activities and changes in the movements of commercial and recreational vessels. The importance of considering cumulative effects is that minor impacts of one project or activity may collectively be of significance, or the impacts of one project may coalesce with those of another activity to become significant.

7.1.2 Operating Principles

As indicated in section 1.5, the Committee has undertaken the RA through the lens afforded by specific frameworks: the precautionary principle, Etuaptmumk or Two-Eyed Seeing which incorporates the principle of Netukulimk and highlights the importance of embracing different cultural approaches to environmental decision making, and adaptive management. These are considered legitimate foundations on which to address unforeseen circumstances posed by change, whether in technologies, because of new physical, ecological or socio-economic data, or, indeed, as a result of unforeseen consequences of climate change. Both the application of the precautionary principle and Two-Eyed Seeing demand caution. Action, such as developing an OSW farm to generate green energy, will pose some level of risk. The challenge lies in seeking a balance between assuming an acceptable level of risk and doing harm, particularly when that risk is being taken to address a greater harm, i.e., to combat climate change by reducing GHG emissions. This balancing, whether in the context of a project assessment, or in confronting the challenges posed by the requirement to consider cumulative effects in

a RA, promotes reflection, identifies the need for further research and necessitates the responsible application of mitigative measures and rigorous monitoring.

Attempting to understand and effectively consider the cumulative effects of a new industry is particularly pertinent. As the scale of OSW development increases, so will the associated risk of significant cumulative effects (Guşatu *et al.,* 2021; Willsteed *et al.,* 2018). It is therefore not only an important part of assessing the effects of OSW development, but also a critical factor in planning for OSW. Put simply, it is important to determine what is possible and where responsibility for action resides, a consideration that is addressed below.

Adaptive management is a decision-making process that can be adjusted in the face of uncertainties based on technological advances and new data. The careful monitoring of outcomes, e.g., of the first OSW farm installed in the RA Study Area, will advance scientific understanding and help to refine policies, mitigation and monitoring as part of an iterative learning process. Adaptive management, however, should not be considered a random process, but as a hypothesis-based approach to meet objectives. Research questions and hypotheses should be developed by the CNSOER in association with other regulators, developers, First Nations, fishers and other interests and tested; the outcomes should be provided along with detailed reasoning in support of recommendations for change or adaptations to prevailing regulatory practice. It is an active approach to management in a changing and dynamic environment, but one whose value resides in rigorous and meaningful collaboration and sharing of objectives and information.

7.1.3 Work Undertaken

The OSW industry is well established in several parts of the world and the Committee has drawn insights from the experiences of OSW development and regulatory practices from projects in several jurisdictions (section 2.6). Experience indicates that there have been and are consequences of the development of the OSW industry to the physical, ecological and socio-economic receiving environments; most impacts, however, appear to be moderate and the benefits, both in terms of socio-economic effects and in addressing GHG emissions can be substantial. Investment in research and technological innovation to address identified challenges continues apace. Despite apparent acceptance worldwide, however, the OSW industry is new to NS.

In section 5, the Committee identified the impact producing factors (IPFs) associated with the development of an OSW project, the important valued components (VCs) that might be impacted and suggested mitigation should avoidance not be possible. This provides a platform on which to consider cumulative effects. The task posed by the TOR is broad:

> *Identify and consider the potential positive and adverse effects, including cumulative effects of future offshore wind development activities in the RA Study Area.*
>
> *This will include consideration of:*

i) the potential effects of planned physical activities associated with offshore wind development activities in the RA Study Area;
ii) the potentials effects of possible malfunctions or accidents;
iii) any cumulative effects that may result from the effects of offshore wind developments in the RA Study Area in combination with other physical activities that have been or will be carried out; and
iv) the result of any interaction between the effects referenced above.

The TOR continues by identifying the environmental, health, social and economic components that should be considered. It is an ambitious remit given not only the timeline and resources available to the Committee, but also the other requirements of the TOR including the design, planning and execution of an extensive engagement program. The Committee has had neither the time nor the resources to develop a sophisticated approach to the challenge posed by the TOR with respect to cumulative effects.

The Committee has, however, considered the remit and has approached the challenge as follows:

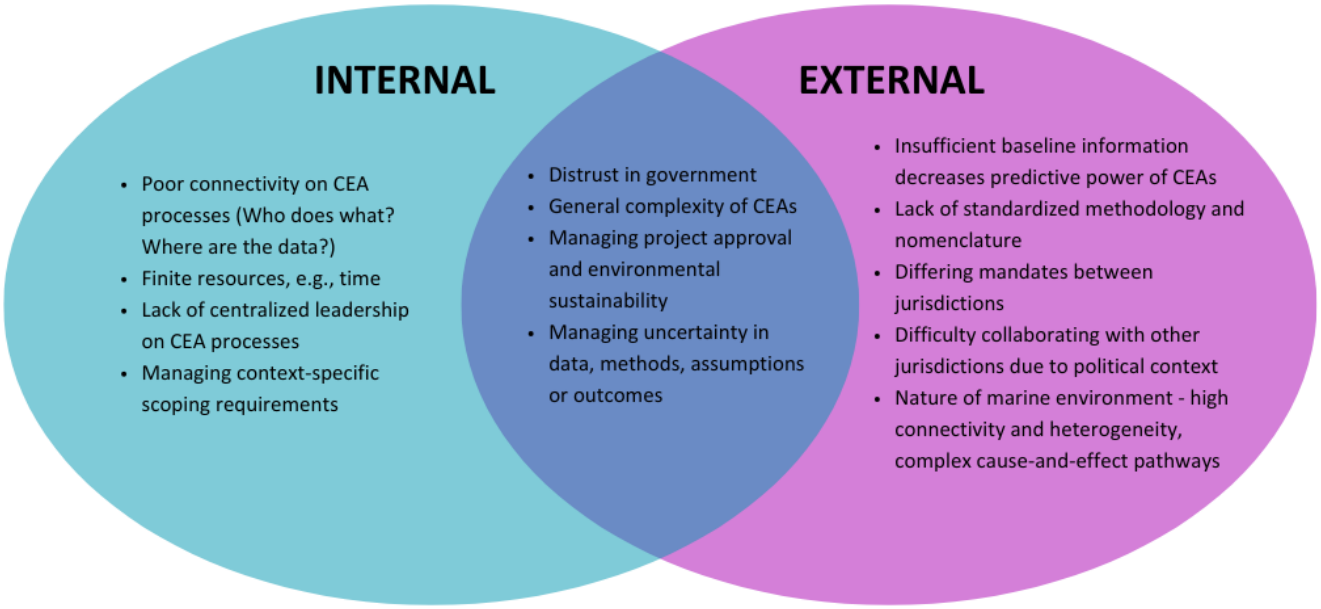
i) considered approaches to cumulative effects assessment undertaken elsewhere;
ii) examined the requirements and guidance provided by the Impact Assessment Agency of Canada with respect to cumulative effects assessment;
iii) prepared an account of the physical, ecological and socio-economic conditions in the RA Study Area;
iv) taken into consideration the resident expertise and research undertaken by DFO, ECCC and TC with respect to OSW impact assessment;
v) identified the likely effects of OSW development on the receiving waters of the RA Study Area;
vi) identified the principal activities that have, are occurring and may occur in the future in the RA Study Area and summarized possible cumulative effects on the marine environment;
vii) developed offshore development scenarios;
viii) commissioned two studies: one to identify the infrastructure, particularly port infrastructure, required to accommodate the potential needs of the OSW industry as described in the development scenarios, and the second to present in broad terms the socio-economic consequences for the province of the investment envisaged in the development scenarios; and
ix) identified data gaps, made recommendations pertinent to collaborative research and identified other actions required to improve both project level and other cumulative effects assessment (CEA) processes.

Items i) -vi) have been or will be discussed in section 7; items vii) and viii) are addressed in section 8; and item ix) is presented in section 9 and 10.

It is suggested that given the scope of the TOR and the approach adopted, the latter, including accessing several significant regional data bases and modelling exercises (see section 2), identifying PDAs and making a recommendation on the establishment of a coastal buffer to mitigate impacts to VCs, this RA is responsive to the principles of CEA analysis and the Committee's mandate.

7.2 Approaches to Cumulative Effects Assessment

Although CEAs tend to follow the same general structure, there is no widely accepted scientific methodology as to how they are undertaken (Adams *et al*., 2023; Gill and Hein, 2022; Stelzenmüller *et al.,* 2018). Government practitioners and developers both face numerous challenges when confronted with the requirement to prepare a cumulative effects assessment. Figure 7.1 identifies some of these factors as identified in peer reviewed literature and government reports; the situation is aggravated, however, as will be referenced in section 7.2.2, by the limits imposed by legislation and defined departmental responsibilities. Project proponents confront both comparable and different challenges.



Sources: Adams *et al.*, 2023; Durning and Broderick, 2019; Gill and Hein, 2022; Pickard *et al.,* 2021; Scottish Government, 2019; Stelzenmüller *et al.,* 2018.

Figure 7.1. Internal and External Challenges to Effective Cumulative Effects Assessment

Cumulative effects include changes to an ecosystem that result from the interaction of effects from human activities and natural processes (Jones, 2016). In a regulatory setting, cumulative effects are considered to occur when multiple developments produce residual effects that have a combined influence on valued components (VCs) (Durning and Broderick, 2019; Jones, 2016; Willsteed *et al.,* 2018). These dynamics can be broken down into the following components (Gill and Hein, 2022):

- stressor, or impact producing factor (IPF), causing the risk;
- vulnerability of VC, i.e., the extent to which an IPF affects a VC; and
- risk exposure, namely the frequency and duration of interaction between the IPF and the VC.

CEAs are not limited to a specific project; they can be conducted at a larger scale to better understand the cumulative effects of development in a region (Nunami Stantec Ltd., 2018). This reflects the mandate of the RA Committee, i.e., to consider the cumulative effects of introducing a new industry,

namely OSW development, in the RA Study Area. Its execution will facilitate the identification of the data gaps, the monitoring and research necessary and the additional mitigation, or regulatory changes that should be implemented to reduce or effectively manage the cumulative effects (Government of Canada, 2024).

CEAs must contend with uncertainties in terms of risk analysis (Stelzenmüller *et al.,* 2018). This is illustrated in the UK OSW sector, where project-level CEAs are planned according to the "worst-case" assumption of the Rochdale Envelope principle (Shearer, 2013), a concept similar to the precautionary principle (Josimović *et al.,* 2021). In this case, when predicted effects on a valued component had wide ranges of uncertainty, mitigations were designed according to the upper limits of the range possible. If new or additional information was later presented that indicated that the effects would be less significant, i.e., research undertaken in response to an articulated hypothesis, the pre-determined mitigation measures would be scaled back in accordance with the new information (Shearer, 2013), i.e., an example of an adaptive management process. Another way uncertainty has been managed in OSW CEAs is the establishment of multiple development scenarios to account for uncertain predictions of the extent and nature of future wind energy development in an area (Scottish Government, 2019).

Project-level assessments tend to be more common than regional ones in most jurisdictions and are a required component of the environmental assessment process in Canada. There have been CEAs undertaken in the eastern US in advance of OSW development including NYSERDA's consideration of a model project in the waters of New York state in 2017 (NYSERDA, 2017a) and BOEM's effort to establish a common cumulative impacts scenario framework for use by regulators and developers pursuant to the Natural Environment Policy Act (NEPA) for OSW activities on the South Atlantic Outer Continental Shelf (BOEM, 2020). The NYSERDA and BOEM examples came about as a result of pre-planning exercises undertaken by their respective commissioning bodies. When conducted, regional assessments tend to be reactive to project and industry development; few are undertaken proactively to mitigate effects ahead of time (Adams *et al.,* 2023). This regional assessment is being undertaken in advance of OSW development in the RA Study Area.

The Committee has undertaken the RA in accordance with a precautionary and Two-Eyed Seeing (Etuaptmumk) approach and sought to identify PDAs capable of accommodating a substantial OSW industry while avoiding areas of greatest conflict with other offshore users and of greatest ecological value. This process is detailed in the preceding chapters. The following sections provide evidence of process outcomes by identifying: the potential cumulative consequences OSW development would have for the marine ecosystem; data gaps; research priorities; and the need for systematic, better integrated and enhanced levels of collaboration. The required collaboration extends well beyond the parties with an inherent stake in a particular project being evaluated, and includes provinces, departments within the federal government, and local Indigenous groups. The socio-economic consequences of OSW development for NS are significant; the Committee has in section 8 articulated and analyzed alternative development scenarios to better understand the relationship between potential economic benefits, the scale and type of investment required to realize those benefits and the associated social consequences. It is evident that the scope far exceeds the capacity of any single province (see discussion in section 8).

7.2.1 Value of Models

The Committee recognizes that models are important and essential to the consideration of cumulative effects. A model is a tool, often designed to facilitate the handling of multi-levels of data in the analysis of an identified issue or question. However, just as there is no single correct approach to CEA, there is no single "model" to provide an answer to the questions associated with CEA at either the regional or project level.

The models that have been used in cumulative assessments have varied widely (Gill and Hein, 2022). In some cases, models can be based on the comparison of different risk criteria and thresholds, such as mortality and recoverability rates (Stelzenmüller *et al.,* 2018). In other cases, a model may quantitatively map baseline vulnerabilities within valued components (Stelzenmüller *et al.*, 2018). CEA models may also incorporate multiple development scenarios to account for uncertainties in future project development. For example, the Scottish Government (2019) used low, medium and high installed capacity scenarios when evaluating the cumulative effects of the country's OSW industry at both a regional and national scale. Whatever approach is adopted, or model used, the findings of the analysis reflect the data used and the questions asked.

In helping analysts work through complicated problems and better understand complex systems, models also facilitate the testing of theories and potential solutions to framed problems. Indeed, the Committee, as referenced above and in section 2, has accessed the results of several models and relied on the materials presented in the determination of the PDAs and in the recommendation to establish a 25 km coastal buffer. These recommendations were made with reference to the data and modelling results available to the Committee, to the information provided by those who participated in the engagement programs and to additional data sought and received by the Committee. The Committee also recognizes the importance of modelling to the determination of the many factors that must be considered in the cumulative effects assessment of OSW projects going forward. This includes the work of the numerous international and national bodies, such as the Intergovernmental Panel on Climate Change (IPCC) and NOAA, with respect to climate change. It includes the modelling undertaken by the Bedford Institute of Oceanography and DFO to better understand the changes taking place in the waters of the RA Study Area. It includes the modeling undertaken by ECCC to facilitate a better understanding of the fate of Species at Risk and modelling undertaken to better understand the distribution of economic benefits. The spectrum of tools is enormous and of immense value. The decisions around how to employ, integrate and iteratively improve these models over time needs serious consideration.

7.2.2 Federal Approaches to Cumulative Effects Assessment

The IAA states that cumulative effects are the effects that are likely to result from a designated project in combination with other physical activities that have been or will be carried out. The Policy Framework for Assessing Cumulative Effects under the IAA states that impact assessment calls for examining the potential effects of a project on VCs and that assessing cumulative effects supports a fuller

understanding of a project's likely residual effects which, in turn, inform the public interest, facilitate decision making and the design and implementation of follow-up programs.

Most CEAs tend to follow the same procedural steps:

- ***Scoping:*** *identify stressors, i.e, IPFs, VCs and baseline conditions* (Durning and Broderick, 2017; Gill and Hein, 2022; Government of Canada, 2024; NYSERDA, 2017b; Willsteed *et al.,* 2018):
    - Identify past, present and reasonably foreseeable future activities and the IPFs associated with them, that could interact with the project (Adams *et al.,* 2023; Gill and Hein, 2022; Government of Canada, 2024; NYSERDA, 2017b)
    - Determine the general spatial and temporal boundaries for the assessment (Gill and Hein, 2022)
    - Identify VCs based on their sensitivity to adverse effects (Gill and Hein, 2022; Government of Canada, 2024; NYSERDA, 2017b)
    - Baselines should be determined for each VC, as well as specific spatial and temporal boundaries (BOEM, 2019; Gill and Hein, 2022; Government of Canada, 2024)
- ***Engagement:***
    - Provide opportunities for and engage with all interested parties
    - Engage with Indigenous communities throughout the assessment
- ***Analysis*** (Durning and Broderick, 2017; Gill and Hein, 2022; Government of Canada, 2024):
    - Determine the effect the IPFs, including accidents and malfunctions, will have on VCs to the extent of the CEA's scope (Gill and Hein, 2022)
    - Analyze based on available data and insights from community engagement (Adams *et al.,* 2023; Government of Canada, 2024)
- ***Identification of mitigation measures*** (Durning and Broderick, 2017; Gill and Hein, 2022; Government of Canada, 2024):
    - Avoidance – siting development away from vulnerable areas
    - Minimization – reduce the direct effects of a turbine and associated infrastructure on VCs through technically and economically feasible measures
    - Compensation – when avoidance or minimization cannot be achieved
- ***Identification of residual effects:***
    - Identify the residual effects to the extent practical
- ***Follow up:***
    - Identification of data gaps
    - Recommendations with respect to monitoring and research

Several federal government departments have established approaches to cumulative effects assessment to address responsibilities pursuant to specific legislative requirements. The *Fisheries Act,* for example, sets the parameters as to how DFO approaches cumulative effects assessment and ensures that their work is aligned with specific departmental priorities. Section 34.1(1)(d) of the act states that there is a requirement to consider cumulative effects of a proposed project, in comb*ination* with past or ongoing projects, prior to making a decision under the fish and habitat protection provisions of the Act (prior to a *Fisheries Act* authorization decision).

DFO is, however, considering other options that would support a broader view of cumulative effects assessment for the OSW industry including Cumulative Impact Mapping (Murphy *et al.*, 2024; Murray *et al.,* 2024) and the Marxan with Zones Spatial Analysis (see section 2.2.4). This is a method of mapping that seeks to identify the relative cumulative effects of human activities on marine habitats and species. In the Scotian Shelf bioregion, Murphy *et al.* in 2024 mapped potential cumulative impacts of 45 human activities (not including OSW) from 5 sectors (land-based, coastal, marine, commercial fishing and climate change) on 21 benthic and pelagic marine habitat types. The results highlighted areas with higher or lower overall cumulative impact scores that can guide where greater protection or management may be required. Cumulative effects mapping will continue to be a useful tool with numerous applications including the identification of environmental changes, informing environmental assessments and prioritizing areas or activities requiring mitigation or management (DFO, 2024). The *Marxan with Zones Spatial Analysis Tool* can identify and quantify potential overlap between OSW Developments, other ocean activities and ecological features, a capacity that will be of inordinate value as developers work to address the requirements of the IAA.

ECCC have developed an approach for assessing the cumulative effects of OSW development and other pressures on aerofauna within the RA Study Area. This framework presents a cohesive and flexible tool for assessing cumulative effects from OSW development, other human activities and natural processes that are specific to areofauna VCs. Again, this tool will be of immense relevance to developers both in the design of their turbine layouts and in executing project assessments. However, models are most valuable when the data upon which they rely are reliable and up to date. As discussed in section 4, much of the aerofauna data are based upon little more than seasonal surveys and observations in some limited areas where and when vessels with observers are available. This weakness should become less as modern tracking technology becomes more widely used and well-coordinated with other ocean data (see section 10).

Transport Canada looks at cumulative effects assessment from the perspective of marine shipping (commercial vessels, ferry services, cruise ships, vessel related activities such as fishing vessels, but not fishing activities) and potential stressors. TC has completed multiple pathway modeling of these factors and produced a resulting cumulative effects mapping product for several locations including the Bay of Fundy. This product can be used to identify and recommend cumulative effects management strategies and mitigation measures and implementation methods. Should shipping movements associated with OSW development expand exponentially in one or more of the provincial ports, TC's model could be applied to facilitate better management of ship movements in time and space to protect VCs.

While it is clear that some federal departments are considering CEA associated with the development of the OSW industry, there is much to be done to understand how cumulative effects among multiple VCs interact at a broader level. Assessment at the individual department or VC level alone does not suffice. Inter-disciplinary and by definition inter-governmental department collaboration among technical specialists within government, academia, First Nations, fishers and industry must become systemic to effectively address OSW cumulative effects on an ongoing basis, encompassing not only environmental but also socio-economic factors.

7.3 Impact Producing Factors

It may be largely accepted that OSW farms provide a net benefit to the global environment by reducing CO_2 emissions, but it is not clear how such installations may influence local ecosystems and impact local and regional biodiversity. Changes to the marine environment associated with the construction of a single turbine may have a minor effect, but cumulatively across the scale of one OSW farm, or across several farms in an area, e.g., a PDA, or multiple PDAs challenge a clear understanding of effects. In the RA Study Area, an area as described in section 4 as having physical diversity and ecological richness, further research and empirical evidence are essential. The reward is capturing the benefits of OSW as a measure in the fight against climate change; the risk is adversely impacting what is still a diverse and productive ecosystem. The balance to be sought is to capture a portion of the benefits while protecting the diversity and productivity of the waters.

If high biodiversity supports high ecosystem functionality, as some have suggested, it might therefore follow that if the introduction of new hard surfaces into a marine area could be shown to enhance biodiversity, there might be a corresponding enrichment of the larger marine ecosystem. That there will be modifications to the marine habitat as a result of the installation of a monopile or floating turbine, i.e., the turbine towers, foundations, cables and scour protection, is inevitable. These features will, as have shipwrecks, sea walls and oil and gas platforms, act as artificial reefs, increasing and diversifying local biomass; they will represent an increase in habitat heterogeneity which may attract different benthic communities. A wind farm poses a network of interconnected, relatively small artificial reefs varying from approximately 50 m^2 for a monopile to 400 m^2 for a jacket foundation. As indicated in the tables in section 5, direct effects include physical changes to the sea floor habitat, to the hydrodynamic regime, to a possible loss or gain of habitat and the provision of shelter from fishing in their immediate vicinity. The indirect effects include the establishment of new epi-benthic communities and changes to biodiversity and benthic community structures and functions; the latter may impact food provision to higher levels including fish, birds and mammals.

Figure 5.1 depicts the cause-and-effect relationship between the IPFs associated with OSW and the effects on the VCs and Table 5.2 summarizes the potential IPFs that could impact each of the VCs identified. Subsequent tables in that section reference the potential effects of each IPF and whether the effect will take place during construction, project operation or at the time of decommissioning. Reference is also made in section 5 to the OER and its role in developing Best Practice Guidelines for the OSW industry with reference to international precedents. The latter will ensure that the necessary mitigation and monitoring is applied during all project phases in accordance with required environmental management, safety and monitoring plans. The tables in section 5 provide not only an account of what may occur in the marine environment if OSW development occurs in the RA Study Area, but also identify the competing users of the marine waters and where continued engagement is warranted, e.g., with Indigenous communities, fishers and DND.

In addition, several factors identified in the tables in section 5 need further consideration in advance of any OSW development. These include, but are not necessarily limited to, the following:

- the military training areas identified by DND located within the Emerald Bank PDA;
- DFO's ongoing evaluation of the conservation objectives of the Marine Refuge within the Emerald Bank and Sable Bank PDAs; and
- the accommodation of the Marine Atlantic ferry crossing from North Sydney to Newfoundland that transits the Sydney Bight PDA.

In the absence of multi-disciplinary modelling, or even a model project, the Committee identified activities that have occurred, are occurring, or may occur, in or in proximity to one or more PDAs. Table 7.1 identifies these activities, other OSW areas that reference the same use, the rationale for their identification and a brief description of their importance in the RA Study Area.

Table 7.1. Types of Activities Commonly Included in OSW and Marine CEAs

Occurring Use	OSW Sector(s) that included it	Rationale	NS Context
Commercial fishing	North Sea, US, Canada	Bottom trawling is one of the most impactful activities on benthic biomass and biodiversity in the North Sea due to the abrasion of the seabed caused by the fishing equipment. US Atlantic waters support a wide variety of commercially important fisheries. Fishing activities can affect organism behaviour, as well as habitat availability; these effects apply not only to fished species, but non-target species, such as marine mammals. When reviewing fisheries within an OSW study area, NYSERDA (2017b) considered their spatial use of the area, target species, common vessel/gear types, industry dynamics, and relative revenue in the region. The presence of OSW farms in commercial fishing areas may also have a positive effect on fish health by acting as artificial reefs and creating fishery exclusion zones.	The Nova Scotian commercial fishing industry now targets over 30 species using both mobile and fixed gear types. The fisheries are economically significant and take place across the RA Study Area. Based on consideration of the research of NRCan, DFO and others plus extensive consultation with fishers, Indigenous communities and other stakeholders, the Committee has identified PDAs, based on the data currently available, that technically could serve as locations for OSW development while avoiding the most intensely fished and valued locations in the RA Study Area. It is acknowledged that some fishing interests will be impacted, but it is also recognized that some fishing could occur within the boundaries of OSW developments. It is also acknowledged that some fisheries may need to shift locations as species adapt and relocate in response to climate change.
Coastal construction and infrastructure	North Sea, Scotland, US	This type of project can include electricity landing stations, liquid natural gas terminals, port development, onshore electricity grids, and construction in general. Coastal construction projects can negatively	All of Nova Scotia's municipalities contain at least one section of coastline. Currently, Nova Scotian coastal communities are under pressure from a variety of natural hazards, most commonly coastal erosion, high winds, storm surges/flooding and sea level rise. Coastal locations are also in

		affect birds, marine mammals, and prey species, while also creating added visual disturbance for nearby communities.	demand as sites for new development, e.g., housing and tourist facilities as well as industrial developments that need wharf space, e.g., proposed hydrogen facilities. The proposed buffer serves to distance proposed OSW development from coastal developments.
Maritime transport	North Sea, US, Canada	Vessel traffic in the RA Study Area is diverse; it includes commercial fishing, cruise ships, cargo vessels, barges, liquid tankers, military vessels, research vessels, dredging ships, search and rescue, ecotourism (ex. whale watching), and recreational boats (see section 4). Vessel traffic contributes to anthropogenic noise in the marine environment, as well as increased greenhouse gas emissions and risk of chemical discharge.	The Port of Halifax is an active military and commercial port, while also acting as the headquarters for the Canadian government research and Coast Guard vessels. International, inter-provincial and regional ferries also operate in and around the province. Highest vessel traffic densities occur around the Halifax port, the South shore region, the Bay of Fundy, and Cape Breton Many small craft harbours in NS are used by pleasure boaters, kayakers and swimmers, particularly for berthage, use of adjacent beaches and launch space. This usage is most common during the summer months, which is the off season for much of the commercial fishing in the province. In terms of tourism, the provincial coastlines are a big draw for tourists; coastal sightseeing was the most common tourist activity in NS in 2022. Shipping movements were taken into consideration in the definition of the PDAs and the recommendation of a 25 km. buffer. Note was made of the ferry route that crosses the Sydney Bight PDA.

Oil and gas activities (exploration and extraction)	North Sea, Scotland, Canada	These activities have the potential to cumulatively interact with other projects which disturb marine mammals and seabirds, contribute to artificial noise and increase greenhouse gas emissions. This sector may not be applicable to the North Atlantic; BOEM (2019) removed oil and gas operations from their OSW CEA in the US North Atlantic due to minimal oil and gas interest and development in this area since the 1970s.	There are currently no active exploration or extraction projects in the province. Non-profit organizations are currently pressuring the provincial government to transition from offshore oil and gas activities to funding the OSW sector.
Military activities	North Sea, US, Canada	Military uses of coastal waters include training, testing and operational missions, which can be conducted either within/on the sea or in the air. These missions may involve vessel traffic, weapons use, as well as radar and sonar. Military vessels use and exercise in the waters off the western and northern coasts of Scotland and in the North Sea, areas with a dense build-up of OSW farms.	The Atlantic headquarters of the Canadian Armed Forces fleet are in Halifax, NS. Within the RA Study Area, the military regularly assists DFO officers in fishery patrols using both warships and aircraft. As depicted in Figure 4.15, DND has identified large areas within the RA Study Area that are identified for training of various kinds.
Other OSW farms	North Sea, US, Scotland	An exponential increase in OSW farms is expected by 2050 in the North Sea, meaning these types of projects will form a large part of future marine activities in this area. OSW farms also necessitate the laying of subsea transmission cables to transport electricity onshore, which can have additional impacts beyond the main project area. OSW	There are currently no active OSW projects in NS. The provincial government has set the target of installing 5 GW of OSW energy generation capacity by 2030. The PDAs as proposed provide locational options for more than the 5 GW proposed by the province in areas, given the modelling and data available to the Committee, that would have minimal conflict with other marine users. The Committee has also developed scenarios to tentatively

		farms can also increase visual impacts to coastal communities. The construction and decommissioning phases of OSW projects were found by Guşatu *et al.* (2021) to have the highest potential for environmental damage.	explore the potential socio-economic impacts of 5GWs and more (see section 8). The provincial intentions of advancing OSW development in its 'internal waters' are unknown at this time.
Port operation	US	Ports are relied on by many commercial shipping operations and are needed for both OSW farm project construction and operational activities. As such, an increase in OSW projects in an area could increase pressures on nearby ports.	The Port of Halifax is the third-busiest port in Canada. Other commercial shipping ports in NS include those in Sydney and the Strait of Canso; Table 4.16 identifies the ports along the coast of NS that may have the capacity to accommodate one or more facet of the OSW industry's need for port infrastructure. These requirements are further explored in section 8.
Other marine renewables	Scotland	Other types of marine renewable energy, such as tidal or wave energy, may interact with other projects. However, BOEM (2019) notes that these types of projects are currently still in early development within Atlantic US waters; for this reason, they were not deemed to be reasonably foreseeable future projects in this area. BOEM (2019) explained that they would only consider these projects as reasonably foreseeable when an action that promotes installation is taken, such as permitting or approval for a proposed construction plan.	NS has focused on developing tidal energy generation projects in the Bay of Fundy. Previous projects have not come to completion, but the province is currently renewing commitments with operators to move new projects forward. Development of such initiatives in the Bay of Fundy will not have a bearing on OSW development in the identified PDAs within the RA Study Area except in so far as any proposed major construction could impact labour availability or supply chain capacity.
Marine minerals	US	The harvesting of marine minerals is mainly composed of survey and dredging activities.	Beach nourishment is described in the Government of Canada's guide to land use planning in the Maritimes to prevent erosion of

		Harvested marine minerals in the US are typically used for beach nourishment projects, which are implemented as forms of coastal storm risk management. Activities like this increased in the US after the effects of hurricanes Katrina and Sandy and are expected to increase in the future.	beaches in the province. No descriptions of specific beach nourishment or marine mineral extraction projects were found in NS during the research undertaken for the RA. Aggregate is coastally quarried and shipped out of several locations. This issue was raised as contributing additional shipping movements through an area intensively used by fishers. The identification of the PDAs serves to keep OSW development out of these waters though the increased marine traffic associated with an OSW farm would increase traffic movements across the coastal buffer.
Dredged material ocean disposal	US	Most dredged material disposed of in the ocean is currently uncontaminated sediment in the US. However, legacy sites that do contain contaminated materials also exist. Dredged material disposal is predicted to continue throughout Atlantic US waters but is projected to either decrease in intensity or remain stable.	Yarmouth Harbour was first used as a dredged material ocean disposal site in 1976. Sediments are subject to dispersal from this site, but they do not show signs of contamination and are not physically proximate to any of the PDAs. No more recent information on the Yarmouth Harbour disposal site was found during this research. Ocean dumping of uncontaminated material is a closely regulated activity in Canada requiring permitting (refer to disposal at sea legislation and regulations under the *Canadian Environmental Protection Act*). If dredge material disposal is to be considered at or near an OSW area, the selection of dredge equipment and sediment transport models can be used to mitigate any cumulative effects from sediment resuspension and/or smothering.
Liquid natural gas (LNG) terminals	US	These terminals are used to either export or import LNG, and often consist of	There are no current plans to construct an LNG terminal in or adjacent to the RA Study Area. The

		both a transmission pipeline and a storage facility. They can be situated onshore or offshore, and are associated with increased vessel traffic, noise and risk of chemical discharge.	Bear Head site on the Strait of Canso has been repurposed from an LNG terminal to a proposed hydrogen and ammonia production facility. A second proposed site at Goldboro has been abandoned by proponent Pieridae with the sale of its Goldboro assets to the Simply Blue Group which plans to produce sustainable marine and aviation fuels at the site utilizing green energy.
Transmission lines, pipelines and cables	US	These types of projects are constantly being upgraded and enhanced, so their ongoing maintenance is expected in the future.	The routing of decommissioned LNG pipelines that previously transported natural gas from production fields near Sable Island to Goldboro could be used as OSW transmission cable pathways. Active and abandoned submarine transmission cables also pass through Nova Scotian waters.
Aquaculture	Germany	Aquaculture competes for space with other human marine activities, including OSW development. Siting aquaculture and OSW sites near each other may have a positive effect, such as the logistic benefit of overlapping fisheries exclusion zones.	NS is an ideal site for Atlantic salmon aquaculture due to its geographic conditions and accessibility to international markets; interest in this type of farming has been renewed in the province since 2017. Shellfish and macroalgae are also farmed in NS, but at a much smaller scale than salmon and other finfish. At present aquaculture occurs in the nearshore waters of the province, i.e., within the recommended coastal buffer. If the OSW industry develops, there may, as has occurred in the North Sea, be opportunities afforded for aquacultural development as a planned facet of project design.

Sources: Breeze and Horsman, 2005; BOEM, 2019; CNSOPB, n.d.; Environment Canada, 2005; Gimpel *et al.,* 2015; Gordon, 2022; Government of Canada, 2017; Government of Nova Scotia, 2020; Guşatu *et al.,* 2021; Hannah *et al.*, 2020; Heim and Charles, 2024; Logan, 2023; Nunami Stantec Ltd., 2018; NYSERDA, 2017a, 2017b; Ragan *et al.,* 2022; Rogers Consulting Inc., 2007; Scottish Government,

2018, 2019; Simply Blue Group, 2024; Stewart *et al.,* 2003; Tourism Nova Scotia, 2022; Weitzman *et al.*, 2023; Willsteed *et al.,* 2018; Withers, 2022, 2023, 2024.

7.4 Cumulative Environmental Effects

The RA Study Area is large, i.e., 300,000 km^2, but the identified PDAs cover an area of 31,200 km^2. As the PDAs have been identified to minimize conflict with other marine users and valued ecological areas, significant cumulative environmental effects are not predicted. Each proposed OSW development will be subject to a project environmental assessment that will, at a minimum, address the consequences of all the IPFs identified in section 5. After addressing through mitigation the impacts identified, the cumulative effects of a single OSW farm in a PDA are likely to be limited to the displacement of commercial fishing activities during construction and possibly for certain fisheries during the operating phase. It is expected that pre-development discussions among fishers, developers and regulators will result in wind farm designs that can accommodate fixed gear and potentially some types of mobile bottom trawl gear fisheries. Regardless, where avoidance and mitigation are unable to prevent a loss of access, some form of financial compensation program may assist to offset any residual loss. The potential benefits associated with the introduction of physical wind farm infrastructure and its capacity to host hard substrate or sedentary organisms, i.e., the reef effect and its positive net benefits have been discussed in (section 5.5.8).

That there will be physical, ecological and socio-economic consequences from the development of a single turbine, or of numerous turbines in a wind farm, is not in dispute. If such development occurs in accordance with all regulatory requirements and best practices, the impacts are likely to be mitigable and minimal. Yet there remain unknowns. Under what circumstances do “minor impacts” coalesce to produce a more serious cumulative impact? There is no easy answer. Research and monitoring are fundamental. The scale of a single project, or the presence of two or more OSW projects in a single PDA might trigger more concern for a cumulative impact and the need for more rigorous consideration of the physical, ecological and socio-economic cumulative consequences. Spatially, for example, such circumstances could include, in addition to the greater displacement of commercial fishing activities, greater:

- sensory disturbance to fish, marine mammals, sea turtles, birds and bats;
- the displacement, disturbance, or loss of habitat for marine mammals and sea turtles;
- the displacement, disturbance or loss of foraging area for birds and bats;
- cumulative disturbance to sediments/sea states; and
- cumulative disturbance to benthic regimes.

An important requirement of any project environmental assessment is the execution of a Traditional Ecological Knowledge Study (TEKS). The execution of a TEKS for this RA was considered by the Committee, but given the available resources and time, this proved to be impractical. In its absence, attempts have been made to obtain the types of information usually contained in a TEKS analysis

through other means, including discussions with subject matter experts at KMKNO. The need for TEKS input, however, remains. The underlying questions are when it should occur and over what area. These are questions that the Committee has given much thought to and have concluded that given the nature of the marine environment, the activities that take place within it and Indigenous historical interests, a TEKS be undertaken on a WEA basis as opposed to a project basis. The Terms of Reference should be prepared by the OER in conjunction with KMKNO and the Unama'ki Institute of Natural Resources (UINR). The results should be available to potential developers to augment as required through further engagement with Indigenous interests as deemed appropriate in advancing their project assessment.

7.5 Going Forward

7.5.1 Tiered and Shared Responsibilities

OSW development is being embraced in many jurisdictions because of its potential to reduce GHG emissions and therefore mitigate what the Committee has referred to as the IPF of our time, climate change. NS has experienced severe weather events over the past decade, is experiencing the consequences not only of sea level rise in coastal areas, but also temperature changes in the waters of the RA Study Area causing changes in abundance and types of fish. Ice frequency and thickness are abating with unknown consequences. The sum of these changes could be significant to Canada, the Atlantic provinces and NS. Given the geographic and temporal scale of such changes, there must be reliance on the predictive modelling and research efforts of international agencies such as NOAA and the IPCC to inform consequences for the RA Study Area and the implications for OSW development.

NRCan, DFO, ECCC, TC and other federal and provincial departments will continue to frame and execute research and modelling to meet their respective mandates and to address the federal and provincial objectives with respect to attaining net zero. This work must become better coordinated and must more fully engage with academia and the users of the waters in the RA Study Area including fishers and Indigenous interests.

In light of the above, the Committee believes that responsibility for the data and research necessary for effective project and cumulative effects assessments resides not with one party, but with many. It is of necessity a tiered process, but the efforts and results must be better integrated and shared. It is in the best interest of all. The relevant data gaps identified by the Committee are discussed in section 9.

Preparing an effective CEA framework ahead of PDA development will help to ensure that all stakeholders including Indigenous peoples, fishers and local municipalities know what the consequences of OSW development may be and are informed as to how those consequences will be addressed. The preparation of this RA is one of many required steps. The Committee has, based on the work undertaken and within the limitations of the available data, identified PDAs that appear to avoid many potential marine conflicts. Project proponents are required by the IAA to include a discussion in their environmental assessment a section that addresses cumulative effects. While the literature suggests that:

- project-level CEAs tend to be associated with stronger decision-making processes than those undertaken at a regional scale (Willsteed *et al*., 2018), the Committee is of the opinion that an effective overarching approach to CEA is multi-tiered;
- the work being undertaken by NOAA and the IPCC are representative examples of the international research effort that needs to be accessed and incorporated as first tier inputs into related national modelling and research activity;
- the second-tier national level of responsibility is shared in Canada between the federal and provincial governments, and some of the federal departmental effort has been referenced with a plea for systematic inter-departmental integration that will more effectively share information and bridge departmental objectives and boundaries; and
- the third tier or responsibility in the context of OSW activity, exists between the developer and the OER. The developer will take direction and guidance from the OER, and through that process will draw on the departmental expertise that exists within DFO, ECCC, TC and other departments. A description of the steps typically involved in this process is outlined in section 7.5.2.

7.5.2 Project Related Cumulative Assessment

Given the tiered reality of cumulative assessment, the following summarizes the primary responsibilities of an OSW developer:

i) Before beginning the CEA

- establish relationships to build trust with Indigenous groups, fishers and key municipalities early in the planning process and develop a communications plan for information sharing and providing updates (Adams *et al.,* 2023; Pickard *et al.,* 2021);
- identify base line environmental and socio-economic conditions with reference to IAA guidance documents and to be developed OER Best Practice Guidelines, and determine spatial and temporal boundaries (Willsteed *et al.,* 2018);
- the scoping phase of a CEA should begin during the planning phase of an impact assessment so that it can be used to inform the Tailored Impact Statement Guidelines (Government of Canada, 2024);
- integrate other levels of CEA, both environmental and socio-economic, that have relevance to the project being assessed (Gill and Hein, 2022, Pickard *et al.*, 2021);
- design CEA monitoring programs, e.g., on scouring and sediment movements, to be implemented throughout all stages of the project and to enable adaptive management change as appropriate (Guşatu *et al.,* 2021, Leopold *et al.,* 2015, Pickard *et al.,* 2021); and
- conduct a gap analysis to identify missing baseline information that could be necessary for the CEA (Pickard *et al.,* 2021).

ii) Identify stressors, valued components and baseline

- identify and communicate with a wide variety of experts from various stakeholder groups, i.e. Indigenous communities, fishers, municipalities, academic researchers and representatives from key federal and provincial government departments (Adams *et al.,* 2023);

- select VCs and meaningful indicators that can be representative of the many diverse parts of the ecosystem and socio-economic context (Adams *et al.,* 2023; Jones, 2016; Willsteed *et al.,* 2018);
    - Identify and use regional monitoring programs to identify trends and the baseline context for a particular VC and build upon it (Jones, 2016, Pickard *et al.,* 2021),
- liaise with DFO and ECCC to determine spatial and temporal boundaries while accounting for the high degree of connectivity and organism mobility within the marine environment (Guşatu *et al.,* 2021; Willsteed *et al.,* 2018);
    - To address the added uncertainty that comes with larger spatial and temporal boundaries, implement, where possible, a shared regional baseline (perhaps the WEA) (Willsteed *et al.,* 2018),
    - Incorporate marine spatial planning to assist with this (Pickard *et al.,* 2021), and
- identify, in conjunction with DFO and ECCC, the most sensitive receptors to reduce assessment bulk and focus in on meaningful monitoring data (Willsteed *et al.,* 2018).

iii) <u>Analysis</u>

- clearly rationalize and present the CEA predictions against defined criteria (magnitude, geographical extent, timing, frequency, duration and reversibility, as well as any other important factors, such as Indigenous Knowledge) (Government of Canada, 2024);
- when evaluating cumulative effects, consider evidence-, scientific- or value-based information, as well as ecological benchmarks (Government of Canada, 2024);
- to make the analysis process more inclusive, predict the consequences of cumulative effects on VCs and indicator species using visual cues; present these on a visual sliding scale to participants (Adams *et al.,* 2023);
- explicitly address uncertainties in the analysis to allow decision-makers to determine where there might be the potential for increased risk to the environment (Willsteed *et al.,* 2018; Stelzenmüller *et al.,* 2018);
    - Report uncertainties in terms of nature, location and level to increase transparency (Stelzenmüller *et al.,* 2018),
- facilitate collaboration and deliberation using working groups, communities of practice and accessible internal communication (Jones, 2016; Pickard *et al.,* 2021); and
- incorporate an ecosystem service lens by evaluating how human activities affect the capacity of the whole system to provide services to support human well-being as supposed to only looking at effects on species and habitats (Simeoni *et al.,* 2023).

iv) <u>Identification of mitigation measures</u>

- work with the OER to identify follow-up programs to evaluate the accuracy and effectiveness of the CEA (Government of Canada, 2024);
- examples of OSW-specific mitigation measures:
    - avoid placing OSW projects in biological hotspots (Goodale *et al.,* 2019),
    - widely space farms to create corridors for species that are vulnerable to collision and displacement (Goodale *et al.,* 2019),
    - implement noise reduction technologies during underwater activities, such as pile driving (NYSERDA, 2017b), and

- establish engagement protocols with Indigenous groups, fishers and key government departments to facilitate the sharing of monitoring results and how best to minimize adverse effects on the marine environment (NYSERDA, 2017b).

v) Design Engagement Program

- recognize Indigenous authority to steward their lands and waters (Adams *et al.,* 2023);
- consider the level of concern expressed by Indigenous communities, fishers, local communities and the public (Government of Canada, 2024);
- recognize Indigenous participation in the CEA, and prioritize recognition of Indigenous contributions, i.e., hand-written invitations and follow-up notes, food during sessions, honorariums, updates post-engagement (Adams *et al.,* 2023);
- during engagement, increase inclusivity by offering multiple ways to share knowledge, i.e., oral, written, images, numeric, synchronous or asynchronous (Adams *et al.,* 2023); and
- when engaging with Indigenous groups, adopt a trauma-informed approach and recognize that it may be difficult to discuss the history of impacts to a VC (Adams *et al.,* 2023).

vi) After completing the CEA

- provide open access to the results and related guidance from the CEA, so that it can be used universally (Durning and Broderick, 2019); and
- provide metadata with any shared data so that it can be used by others (Pickard *et al.,* 2021).

CEA is an integral part of a project environmental assessment, but the work done by a proponent with respect to any OSW farm, is only one part of a larger picture. It is a challenging task, but any proponent must be encouraged to access and use the data bases prepared by others in support of the OSW industry, recognize the data deficiencies that exist and contribute to the resolution of the challenges and data deficits.

8.0 Socio-economic Impacts

8.1 The Challenges

As noted above in section 3.3.1, the Committee has struggled throughout the engagement process to adequately address a question on the minds of many: what does OSW development mean for the province as a whole and the average Nova Scotian? It is a question that the Committee has spent much time discussing and contemplating in the context of the Agreement and the TOR, which require it to provide information on "economic conditions" (Agreement, s.1.2(a)), the "…health, social and economic components and the systems that may be affected by future offshore wind development activities within the Study Area" (Agreement, s.1.5), and "communities" and "economy" when "…identifying and considering potential positive and adverse effects…" (TOR, A1.6(m)).

There are several overarching challenges in framing a response to the questions being asked of the Committee. These include:

- The lack of predictability on the scale the industry is likely to achieve and over what timeframe. In some jurisdictions, the demand for clean energy is so great that the "pathways to market" issue isn't a matter of conjecture. The market exists. Not so for NS. The Committee has noted the limited domestic demand for electricity (notwithstanding expected population growth as discussed above in section 4.6.1), the uncertainty around the timing, economic viability and scale of H_2 and other potential green fuel production that may look to OSW for electricity supply at scale, and the current lack of an existing NS grid export capability. Multi-billion-dollar OSW investments are not built on speculation. They require certainty of markets and power purchase agreements to secure financing.

- Even on the assumption that development will happen at some level, there is a clear perception by many that NS will not be the principal beneficiary of OSW development. Some have questioned the reason why NS should take the "risk" of developing its offshore resources if the electricity will be used to produce green fuels for export. These concerns have been voiced very recently with respect to the investments being made in onshore wind turbines for the production of hydrogen (CBC, 2024).

- Related to the above is the question of NS economic benefits capture: what can our supply chain and labour market realistically support even if we assume market demand and that OSW development will occur? The Committee notes the attention being paid to better understand the NS supply chain in Module 2 of the Nova Scotia Offshore Wind Roadmap (Province of NS, 2024) and the work commissioned by Marine Renewables Canada to explore Atlantic Canda's supply chain readiness (MRC, 2024) (results due in 2025), which in time will add valuable additional information to this part of the equation. To assist our understanding of this area, the Committee contracted a high-level socio-economic impact analysis through benchmarking international case examples and adjusting them to a NS context and modeling the impacts through use of the

NS government's Input Output Model. The report, "*Initial Socio-Economic Impact Analysis (SEIA) of Offshore Wind Development in Nova Scotia"* (21FSP, 2024), is currently in final draft form, is referenced throughout the balance of this section and will be posted to the Registry when finalized.

There is a long list of uncertainties and variables in trying to conceive a 5+ GW future for NS, including questions around:

- The number and types of turbine foundations required which is important in terms of the economic opportunity for NS. For example, on the assumption that monopiles are imported to NS, offloaded, stored and reloaded for installation (as is the current case for turbines destined for the US market), that activity generates approximately 15 person days of employment benefit. In contrast, a gravity-based caisson foundation, which could potentially be constructed alongside a dock in the province, requires 3,360 person days of employment (DMDE, 2024);
- The size, location and timing of projects: in collaboration with its contractors, the Committee made assumptions that produced scenarios to reach the provincial 5 GW target and beyond, (see section 8.2);
- The location of the ports likely to be involved and the costs of necessary upgrades (in the case of existing ports) or new facilities (see section 8.2);
- The grid integration locations and costs including what would be required for the province to become an exporter of power (see section 8.6.4);
- Nova Scotia's available labor force: according to a 2024 report by BuildForce Canada, and as reported by the Construction Association of Nova Scotia, as many as 8,200 workers – over 20% of the current NS construction labour force - are expected to retire by 2033 (BuildForce, 2024); and
- The percentage of the capital expenditure for OSW projects that will be captured by NS: the local content percentages being achieved in places like North Carolina and Virginia for OSW projects are 10% and 12% respectively, states with much larger economies than NS. Virginia, as an example, has a GDP in excess of $700 billion USD (2023) with highly evolved manufacturing and construction industries, compared to Nova Scotia's GDP of $45.6 billion CAD (2024). NS also has limited capacity in the critical Tier 1 supply category (see section 3.3.1) and relies heavily on imports of steel and cement, both of which are primary inputs to much of the anticipated construction activity. The comparison at the national scale puts things into further perspective: at 5 GW the provincial target is 17% of the US 30 GW target, but the Nova Scotia's economy is less than 0.5% of the US GDP. The NREL study (see above in section 3.3) on the US supply chain has warned of capacity issues, high leakage rates in the early development phases and the need to build domestic capacity over time to reach the 30 GW goal (discussed further in section 8.6) (NREL, 2024).

It is perhaps unsurprising that to date the Committee is unaware of any attempt to dive into this economic maze and attempt to provide a framework for a discussion on what it may mean for NS. Notwithstanding the enormous levels of uncertainty around how OSW will play out, the Committee felt an obligation to at least try to examine the topic. Despite the admitted unknowns and uncertainties, there are important reasons to do so. The social license that this industry needs to gain a successful foothold demands that the potential benefits to NS and what it will take to capture them become better understood. That is obvious to the Committee based on engagement feedback received throughout the RA process. Some of the decisions required to successfully realize even a 5 GW OSW future demand it. This is no more apparent than in regard to port infrastructure.

8.2 Port Infrastructure

The Committee has seen hundreds of studies over the course of the past 18 months, few of which have resonated like the 2022 Wind Energy Ireland National Port Study (WEI). Not only has Ireland established GHG reduction targets directionally similar to Nova Scotia's (their Climate Action Plan sets a target of 80% of electricity from renewables by 2030, 5 GW from OSW (O'Donoghue, 2024)) but its port infrastructure needs substantial upgrading. Central to the question of starting up an OSW industry is the availability of suitable port infrastructure. As highlighted in section 3.3.1.2, ports and surrounding areas are where the majority of the activity will take place. Here is how WEI explained the issue, and it is suggested that "Ireland" could easily be substituted for "Nova Scotia" (WEI, 2022):

> "With the offshore wind industry in Ireland gaining momentum, consideration is needed for the practical aspects of how these large-scale offshore installations will be delivered. Port infrastructure is widely recognised as an area requiring attention. Ports and suitable port infrastructure are key to the successful delivery of offshore wind projects, with all turbine components and foundations transported through these gateways. Port locations serve as a link between marine and landside activities and often become a hub for supply chain activity. Whilst it is well recognized that ports perform several critical functions within the offshore wind industry, there is a significant lack of suitable port infrastructure across Europe and particularly within Ireland at present." [emphasis added]

The WEI study outlined the same conundrum that is at the core of the Committee's effort to better understand the issues and explore the benefits for Nova Scotians. Noting the lack of clarity around project development timing, the study concluded that investment decisions on port infrastructure development "require action now". It went on to reference the ports that had developed OSW-specific upgrade plans and concluded that some level of government funding would be required, with each of the respective plans estimated to cost in excess of $100 million Euro ($150 million CAD).

In September 2024, the Irish Department of Transport and the European Investment Bank (EIB) entered into a cooperation agreement designed to facilitate access to infrastructure funding. The joint statement announcing the initiative noted that the EIB was committed to supporting Ireland's transition to a low carbon economy, and that "no Irish port has the facilities and capabilities required to support large-scale

offshore wind projects at present" (EIB, 2024). Experts from EIB and the Department of Transport will work together to assess both the expected costs of the necessary port infrastructure upgrades and the most viable financing strategies to achieve these investments. The list of ports is to be reduced to five through an exploration of the complementary roles of different ports and, significantly, "ensuring that the benefits of this significant investment are felt across the country."

In its attempt to better understand the issue in Nova Scotia's context, the Committee looked to DMDE, one of the consultants involved in a recent analysis of Nova Scotian ports undertaken by Invest Nova Scotia (not publicly available). Similar to the WEI study results, DMDE concluded "that existing ports in Nova Scotia do not have the capacity to completely service the requirements that may be generated by the offshore wind industry for wharf space and marshalling capacity" (DMDE, 2024). The report summarizes the current state of the existing ports which are primary candidates for upgrading and identified cost estimates for these facilities as well as the costs for new facilities in Sydney and the Strait of Canso.

Table 8.1. Summary of Capital Costs

Port	Capital Cost
Atlantic Canada Bulk Terminal	$38,000,000
Novaporte Terminal	$266,000,000
Strait of Canso New Terminal	$266,000,000
Sheet Harbour	$166,000,000
Woodside	$58,000,000
Shelburne	$93,000,000
Total	**$887,000,000**

Source: DMDE, 2024.

The report goes on to note that there are several smaller facilities such as the Sydney Marine Terminal, Mulgrave Marine Terminal and Liverpool that could be upgraded to accommodate the handling of smaller items such as cable reels, anchors, chains and possibly host operation and maintenance vessels. Adding in an estimate for these smaller upgrades, the total capital spend on NS ports could approach $1 billion CAD.

As earlier discussed, the port demand equation depends on the OSW project construction timelines, and the type and number of foundations that must be constructed or marshalled within those timelines. The DMDE study looked at three scenarios: all involved an initial step-stone project of 600 MW destined for

the NS grid, followed by projects of various sizes staged five years apart to meet the 5 GW target based on anticipated demand for hydrogen production. This circa 15-year period (2028-2045) involved approximately 390 turbines in various combinations of monopiles, gravity-based caissons and floating foundations. The third scenario went further, based on an assumed grid export capability permitting a build out of an additional 10 GW. This would involve an additional 667 turbines installed over another decade. The justification for expanding the discussion beyond the initial 5 GW provincial target has several dimensions. The provincial OSW Roadmap speaks to the potential for "sustainable growth beyond 5 GW". And the potential scale of the industry based on the size of the proposed Tier 1 and Tier 2 PDAs at an assumed production density of circa 5 MW/km^2 suggests a theoretical development capacity far exceeding 5 GW. Others have also taken note of this potential, notably economist Peter Nicholson, Chair of the Canadian Climate Institute. In his study 'Catching the Wind: How Atlantic Canada Can Become an Energy Superpower', Nicholson makes an impassioned and reasoned case for acknowledging and developing Nova Scotia's wind resource as a national treasure that can be unlocked to the benefit of governments (in meeting GHG emissions targets and fighting climate change) and consumers in NS, Atlantic Canada, Quebec and Ontario, at a proposed scale of 15 GW (Nicholson, 2023). The Committee has adopted this provocative nation building target as a reasonable long-term objective if not imperative for Scenario 3, noting that recent press reports confirm the idea has been acknowledged by the provinces of NS and Quebec (Rankin, 2024).

Similar to the challenge faced in Ireland and other jurisdictions introducing a new industry with specific port infrastructure requirements and installed OSW capacity targets, the question ultimately becomes which ports should be upgraded and over what timeframe? The DMDE study concluded — based on its assumptions on turbine numbers, types and installation timeframes — that a substantial proportion of the $1 billion of capital could be required to meet the 5 GW demand (DMDE, 2024). The Committee notes that the increasing level of OSW activity in the US east coast continues to provide immediate monopile marshalling opportunities for Nova Scotian ports, and this may attract some of the investment capital required to upgrade local capacity — capacity which might then be available to support NS projects. The US 30 GW by 2030 target is aggressive, and turbine foundations (at the time of writing) continue to be marshalled in NS ports. The US Department of Energy sees a 110 GW future for OSW in the US by 2050 (US DoE, 2023). Until sufficient port capacity is constructed in the US and the *Jones Act* restrictions no longer work in Nova Scotia's favour, it is reasonable to think that some industry support may help offset the cost of necessary port upgrades here. The recent announcement of funding in the Port of Argentia is likely instructive when considering what the funding pathway may look like for NS ports. A provincial investment of $15 million leveraged an additional $72 million from a combination of the applicant, industry and the Government of Canada's National Trade Corridor Program (Government of NL, 2023).

It is suggested that the questions of which ports, over what time frame and how the necessary upgrades will be financed requires the adoption of an approach similar to Ireland's: a working group that can

provide seed funding to facilitate the process of creating robust (Class C)[36] cost estimates for upgrades, determining which ports fit within the proposed provincial development strategy and timeline based on the potential for complementary roles and synergies and how best to secure the necessary financing. In keeping with what will be discussed further in relation to the Nicholson hypothesis of the need of regional if not national strategy for OSW development in NS, the leveraging of existing regional assets like the Port of Argentia is an opportunity that should be explored.

8.3 The Benefits Associated with Port Investment

Obviously, some portion of the estimated $1 billion noted in the DMDE report (DMDE, 2024) needs to be spent. The table below shows the economic impacts of a $1 billion CAD port construction and upgrade program.

Table 8.2. Impact of Harbour Construction and Upgrade on Average per Year, 2023 Dollars

	Direct	Indirect	Induced	Total
Nominal GDP ($ millions)	$120.00	$20.80	$27.65	$168.45
Labour Income ($ millions)	$91.61	$13.02	$11.26	$115.89
Employment (FTEs)	1,305	202	225	1,732
Provincial Revenue ($ millions)	$11.72	$1.66	$1.44	$14.82

Source: 21FSP, 2024.

This table is the result of an analysis performed by the NS Department of Finance using the provincial Input/Output (IO) model.[37] The results indicate a nominal GDP (the spend on goods and services) as $120 million and a direct employment requirement of over 1,300 full time equivalent positions on average per year over five years to carry out the work. Where the activity was far removed from urban centres, the challenge of finding available workers would be exacerbated by the need to accommodate those needing to commute. Even if half of the expenditure occurred, this is a significant number in the context of today's construction labour force realities where large scale construction projects are either struggling to find people, their completion timeframes are delayed or are on hold due to perceived construction related bottlenecks. On the assumption that there would be some overlap between this port related work and the construction phase for the first OSW project, the significant labour

[36] Class C cost estimate is a planning level estimate usually based on a schematic design and presented in elemental format, i.e., at the definition phase of a project taking into account the major elements of a project (Treasury Board of Canada, 2019).
[37] A detailed interpretation of the results will be provided in the 21FSP draft report (21FSP, 2024 draft).

requirements for the latter undertaking (considered below in section 8.6.3) would also need to be considered.

Upon completion of the port improvements, there will be an ongoing operations and maintenance requirement; this is reflected in the table below.

Table 8.3. Impact of Harbour Operations and Maintenance in One Year, 2023 Dollars

Direct		Indirect	Induced	Total
Nominal GDP ($ millions)	$7.91	$3.33	$2.16	$13.40
Labour Income ($ millions)	$4.63	$2.02	$0.88	$7.53
Employment (FTEs)	70	37	18	124
Prov Revenue ($ millions)	$0.59	$0.26	$0.11	$0.96

Source: 21FSP, 2024.

While the economic impacts related to construction and operating/maintenance of the port assets are not insignificant, the real economic benefit derived through port infrastructure investment accrues through OSW related activity generated on the dock. The longer-term economic benefits that can be expected from this type of investment is demonstrated through case study analysis. The Cuxhaven experience has been discussed above, echoed in the examples studied in the 21FSP (draft) report (21FSP, 2024):

> "The case studies of port towns in Scotland, England, and Germany show that having port infrastructure capable of supporting offshore wind servicing has tangible economic benefits, including attraction of offshore wind equipment manufacturers and becoming homebases for operation and maintenance supports, leading to the creation of hundreds of local high-skilled jobs in coastal port towns with other social benefits such as local training and entrepreneurship opportunities. There are several port towns in Nova Scotia that are in similar situations to the ones now thriving in Scotland, England and Germany before offshore wind entered the regional economy. While port requirements are outside of the scope of this report, our findings suggest investing in either upgrading existing ports or in constructing new ports in rural areas that are capable of handling the large pieces of equipment and deep-sea vessels required for offshore wind would have tangible economic benefits for port towns in Nova Scotia, particularly in rural areas that have experienced economic decline due to industry and demographic shifts."

As noted in the discussion above regarding Ireland's process of determining the location of port investment, the criteria employed can and should include the desire to distribute benefits more equitably across a region and, where appropriate, mitigate the incremental dislocation that would be

caused to any particular port community already engaged in other parallel large scale development activities that are taxing its social infrastructure (see the discussion in section 8.6.4).

8.4 Capital Expenditure per Offshore Wind Development and Construction Phase

Determining even order of magnitude cost estimates for either of the 5 GW scenarios presented in the DMDE 2024 study is a complex exercise requiring consideration of many, many variables. While the Committee is recommending that this be done at some point when more certainty exists in terms of the timing and location of projects, for the purpose of this exercise a benchmarking approach was adopted examining the projected costs of delivering OSW projects in other jurisdictions (21FSP, 2024). The methodology used is described in the 21FSP (draft) report. The summary results are presented below (Capex: development and construction costs, OPEX: total operating costs for a 25-year operating life). Note that these costs do not include the cost of shipbuilding for specialized wind turbine installation vessels, feeder vessels, barges and other vessels required in support of OSW operations referenced in section 3.3.1.1.

Table 8.4. Costs per GW for Select OSW Projects (USD)

Cost	New York Bight	Carolinas	Gulf of Maine	California	Kitty Hawk	Denmark
CAPEX	$4.0 billion	$4.0 billion	$4.8 billion	$4.8 billion	$4.36 billion	$3.02 billion
OPEX	$1.7 billion	$1.7 billion	$1.5 billion	$1.5 billion	$1.029 billion	$1.8 billion
Total	$5.7 billion	$5.7 billion	$6.3 billion	$6.3 billion	$5.389 billion	$4.82 billion

Source: 21FSP, 2024.

Converting these CAPEX numbers to CAD produces an average of $5.7 billion with a low of $4.14 billion and a high of $6.58 billion. These figures are higher than the 1 GW equivalent delivered costs of circa $4 billion CAD reported for the recently completed Hornsea 2 project completed in the UK and referenced earlier in the report (section 3.3). The lower numbers recorded for Hornsea likely reflect the relative maturity of the supply chain compared to the emerging US States and the fact that Hornsea's foundations are monopiles whereas Maine's numbers contemplate more expensive floating foundations.

Given the fact that NS has an untested supply chain, will likely require some combination of fixed bottom foundations other than monopiles and floating technology, and that there will be challenges connecting into dated grid infrastructure, the decision was taken to reference the higher CAPEX estimates to establish a theoretical CAPEX target for NS. The provincial I/O analysis for CAPEX will be based on an input of $7 billion CAD/GW and included in the 21FSP (draft) report.

Interpreting the breakdown of the costs and employment numbers from the case studies is challenging (21FSP, 2024). For the purpose of illustrating the indicative results and highlighting some of the issues for NS, the table below is the breakdown from the Denmark case study. Although these figures represent the lowest capital expenditure estimates per GW of any of the case studies considered, the information was presented on a per GW basis without any need to manipulate the data and arguably represents an understatement rather than an exaggeration of what could be expected for a NS. For the sake of convenience to the reader, the explanatory notes for the footnote references are included at the bottom of the Table. Note that development costs associated with the capital expenditures (DEVEX) are presented separately.

Table 8.5. Summary of Socio-economic Impacts of Offshore Wind Development in Denmark: USD/millions

Denmark Model (2020)[1]	Impacts	Direct (Total)[2]	Direct (Local Content)	Local Content (%)
DEVEX	Cost per GW	$165.3	$88.65	54%
	Jobs per GW (FTE)	574	314	55%
	Household income per GW			
	GDP[3] per GW		$104.4	
	Taxes per GW			
CAPEX[4]	Cost per GW	$2,852	$1,328	47%
	Jobs per GW (FTE)	6,256	3,000	48%
	Household income per GW[5]			
	GDP per GW		$1,493	
	Taxes per GW			
OPEX (25 years)	Cost per GW	$1,354	$898.05	66%
	Jobs per GW	1,907	1,287	67%
	Household income per GW			
	GDP per GW		$1,189	
	Taxes per GW			

Source: 21FSP, 2024.

[1] The data in this table is based on the model results conducted for Denmark, rather than on the application of that model for specific and in-development wind farms, such as the Thor Wind Farm. The results for the model, i.e. prior to their application, were more detailed and broken down into Development as well as Construction and Operation phases. Costs used were "average," rather than the minimum or maximum values. The report itself it entitled "Socio-economic impact study of offshore wind," by Thomas Sylvest. The report was released in July 2020.

[2] Costs and labour inputs outlined in this column represent total project costs and inputs, not only total supplier contract costs, which are marginally lower, e.g. total DEVEX costs related to supplier contracts is listed in the report as $154.3 million USD. The percentage of local content listed in the right-most column represents the Danish market share of the total cost, not of total supplier contracts.

[3] Figures for GDP were converted to USD from DKK based on a 2020 exchange rate (the year of the report).

[4] CAPEX in the report (excluding Development, which is designated as DEVEX) is split into three phases: 2A Production Wind Turbines, 2B Production Balance of Plant, and 3 Installation and Grid Connection.

[5] Much like the Kitty Hawk study, the report on OSW in Denmark offers aggregate figures for salaries earned by Danish employees during the lifespan of the project. However, the Denmark model includes induced as well as direct and indirect workers. In the Danish case, the average annual salary is $85,171 USD.

There are several important points derived from the benchmarking exercise that need closer examination within the provincial evaluation of its supply chain. For example, the share, i.e., capture rate, of projected local construction contracts ranges from 10% (North Carolina) to 12% (Virginia) with Maine achieving similar rates of 10% in most areas with higher numbers in areas related to ports, staging and vessels. The Danish rates were much higher across the board and although likely ambitious, reflective of the country's significant industrial capacity built up through decades of offshore experience with the oil and gas sector (reported to have produced $544 billion DKK (circa CAD $100 billion CAD) in revenue to the State in the period 1972-2020) (Nordsøfonden, n.d.). The 21FSP (draft) report concluded that Nova Scotia would likely struggle to initially achieve even the 10% numbers, in part because of the relative sizes of the respective economies reflected in the massive GDP differential, but also because of the labour challenges (including the pending retirement of over 8,000 workers by 2033) impacting the construction sector in NS. The direct labour requirements for the design, construction and installation phases of the Danish example of 6,830 FTEs (6,256 CAPEX plus 574 DEVEX) are in line with the range of 5600-6500 FTEs from the other examples. Referencing these numbers and the perceived gaps in Nova Scotia's ability to supply, the 21FSP (draft) report concluded that (21FSP, 2024):

> "Nova Scotia cannot undertake an OSW project of this magnitude on its own. *It is unlikely even the combined resources of Atlantic Canada will be sufficient.* Rather, leveraging this opportunity will require *a national-level consolidation of resources* and industry development strategy, as

well as an innovative international trade agreement on OSW with the United States to facilitate resource sharing along the east coast of North America, from the Chesapeake up through the Gulf of Maine and the Atlantic shores of Nova Scotia." [emphasis added]

8.5 Offshore Wind Operations Phase

The alarm raised in the above section is only reinforced when considering the breakdown of labour requirements during the operating phase. The table below is the provincial analysis based on total estimated operating costs at $87 million per GW of installed floating capacity and $108 million per GW of installed fixed turbine capacity. The output is portrayed in the table below, the scenario numbers 1 to 5 coincide with DMDE's A1 (600 MW), A2 (4.5 GW), B1 (600 MW), B2 (5 GW) and C3 (10 GW) scenarios. Note that in some cases, the available FTEs in the entire province as derived from Statistics Canada sources are utilized by the installation of the first 600 MW project.

Table 8.6. Direct FTEs Required for OPEX by Industry vs. FTEs Currently Employed in 2023

Scenarios	1 (A1)	2 (A2)	3 (B1)	4 (B2)	5 (C3)	FTEs 2023
NAICS 2371 - Utility System Construction BS23C3	733	3,608	638	5,406	4,009	547
NAICS 237 - Heavy and Civil Engineering Construction BS23C5	51	252	45	378	280	1,780
NAICS 3353 - Electrical Equipment Manufacturing	40	197	35	296	219	40
NAICS 3366 - Ship and Boat Building	14	71	12	106	78	2,597
NAICS 4883 - Support Activities for Water Transportation	168	828	146	1,240	920	3,451

Source: 21FSP, 2024.

Note: 2023 FTEs estimated from hours worked from Statistics Canada, Source: Table 36-10-0480-01; Labour productivity and related measures by business sector industry and by non-commercial activity consistent with the industry accounts.

8.6 Implications for Nova Scotia

8.6.1 The Potential Economic Benefits to Nova Scotia

The inherent limitations involved in this comparative benchmarking exercise are acknowledged and referenced in the 21FSP (draft) report (21FSP, 2024). That said, if we look at the projected expenditures on the cost of constructing 1 GW of offshore wind in NS at circa $7 billion and assume a local capture

rate of even 5% that would result in $350 million of expenditures in the province, a number which would likely increase over time as the supply chain developed and more was manufactured and sourced in the province. Even at this assumed 5% rate over 5GW of projects the number would be getting close to $2 billion. When you add on top of that some percentage of the estimated $1 billion projected for port upgrades, and the wages earned by Nova Scotians throughout the various phases of project planning, construction and operations, then account for the ripple effect of these numbers throughout the economy, it paints a picture of a generational opportunity that is likely unparalleled with anything else on the provincial horizon. To quote the provincial Minister of Natural Resources and Renewables as reported in The Chronicle Herald on October 10th, 2024, “Offshore wind is Nova Scotia's greatest opportunity since the Age of Sail” (Rankin, 2024).

With respect to the question of what is in this for Nova Scotia, asked of the Committee throughout its public engagement, the answer from an economic perspective is that the opportunity is immense, regardless of whether the electricity is used to produce hydrogen, some portion of it fed into the grid for domestic consumption or exported into Canada and/or the United States. However, this would not be the first time NS pursued a large-scale opportunity with huge promise, and history would tell us that the dream is never easily achieved and that the devil is always in the details.

Assuming the “pathways to market” materialize and the 5 GW+ future becomes clearer, how does the province, in relatively short order, help prepare its supply chain, ensure that port infrastructure is upgraded and recruit and train the people that will make it all happen?

8.6.2 Supply Chain

The supply chain includes the skills, services, supplies, technologies and infrastructure required to support the entire lifecycle of an offshore wind project through the following phases:

1. Development and Project Planning
2. Design and Engineering
3. Manufacturing/Acquisition/Assembly
4. Transportation and Logistics
5. Construction and Installation
6. Commissioning
7. Operations and Maintenance
8. Decommissioning and Next Phase Development (21FSP, 2024 draft)

Using a 15 MW turbine as a benchmark, a 5 GW target involves the construction and assembly of 333 foundations, turbines and nacelles, a thousand turbine blades, a number of offshore substations, thousands of kilometers of cabling and large quantities of steel and cement and the specialized vessels

and equipment related to installation and maintenance activities. The overall supply requirements are usually categorized in hierarchical "tiers" as follows (Province of NS, 2024):[38]

- **Tier 1 suppliers:** Companies contracted as primary suppliers for offshore wind projects by the developer, covering items such as wind turbines, foundations, towers, offshore substations, cables, transmission, environmental services, data collection, monitoring, engagement with interested parties, and operation and maintenance.
- **Tier 2 suppliers:** Principal suppliers to Tier 1 suppliers, offering services like crane operations, civil engineering for onshore electricity infrastructure, subsea cable protection, electrical components, tower manufacturing, yaw and pitch motors, barges, tugboats, and fall-arrest systems.
- **Tier 3 suppliers:** Providers of specialized services and products to Tier 2 suppliers, including secondary steel fabrication for foundations or towers, specialized tools, fuel services, dive and survey operations, rubber, concrete, railings and ladders, castings, and hydraulics.

The lack of Tier 1 fabrication capability has been mentioned. This is a new industry with specialized requirements, and developing capacity in this area is critical to increasing Nova Scotia's overall benefit's capture rate but will take time. The DMDE report highlights the importance of becoming a Tier 1 supplier in its comparison of the anticipated NS content between imported monopile foundations and the local construction of gravity base foundations (DMDE, 2024). Increased domestic participation across all categories of supply will be achieved through partnerships and knowledge transfer with established national and international suppliers, fostered by license holders' leveraging their existing supply relationships. Many of the supply gaps, such as in the areas of steel and cement production can be ameliorated through regional/national collaboration.

Based on the examples studied in the 21FSP (draft) report, the jurisdictions that have invested in ports capable of servicing the OSW industry have successfully attracted private-sector investments that have grown domestic manufacturing capacity for the supply chain. Encouraging this type of "bottom-up" growth through public investment and subsidies is far more likely to produce sustainable results than through prescriptive local content requirements. The disastrous results in the Taiwan example have been mentioned above in section 2.6.6, and France is singled out as a European jurisdiction that attempted to start its industry with a high local content approach resulting in substantially inferior results compared to places like Scotland, England and Germany. Perhaps noteworthy here is the progressive change ushered in by the Accord Acts amendments as representative of the regional/national collaborative effort that will be required for NS to succeed; the "full and fair" opportunity to participate in the supply chain on a competitive basis is no longer focused on NS, but extended to Canadian companies and individuals residents in Canada.[39]

[38] For a further breakdown of the supply chain see the discussion at s.7.8 of the DMDE report (DMDE, 2024).
[39] NS Accord, s.98.7

NS certainly has strengths on which to build, summarized in the Nova Scotia OSW Roadmap (Province of NS, 2024). Notably, expertise in the ocean's technology sector and support services developed through a relatively short lived but important foray into the oil and gas industry. Also noteworthy is what the province has characterized as a "strong, supportive training, research and innovation ecosystem", that includes "ten universities and a comprehensive community college system, which have marine science, engineering, marine geomatics, geoscience, oceanography, or technology and trades programs".

The encouragement of an innovation ecosystem[40] approach is highlighted through multi-jurisdiction comparative analysis as a critical success factor to supply chain development (21FSP, 2024), and in addition to Nova Scotia's robust university and community college resource the OSW Roadmap identifies the considerable expertise embedded in organizations such as the Centre for Ocean Ventures and Entrepreneurship (COVE), the Bedford Institute of Oceanography, National Research Council Canada, Marine Renewables Canada, and Net Zero Atlantic. Additions to this list should include organizations like the Unama'ki Institute of Natural Resources (UINR), a forty-person strong organization that has for decades been the natural resource voice for many of Nova Scotia's Indigenous Communities promoting an environmental stewardship approach informed and guided by the principles of Two-Eyed Seeing. Finally, the Committee has been impressed by the significant marine ecosystem knowledge resident within fisheries organizations, many of which have been generous in their support of the Committee's work and whose ongoing engagement will be essential to the development of an innovation ecosystem that will underpin any successful OSW industry.

8.6.3 Labour

Nova Scotia's demographics have been discussed in section 4.6.1. Despite recent population growth, the province has an ageing and declining workforce due to low birth rates, age distributions and outmigration of young workers. The size of the challenge in terms of the sheer numbers of skilled workers has been discussed, and the impact of those numbers is further reinforced through examination of the construction sector in NS. At best, and based on current numbers theoretically available from a labour pool that is in steep decline, less than 2,700 FTEs of non-residential construction labour would be available from the entire sector (and likely representing the lower end of the experience scale in a high demand labour market), far less than the demand imposed by one OSW project and ignoring the considerable competing demand imposed by pending projects such as the Everwind H2 project and the QE 2 expansion. Stated another way, the total labour inputs required for the construction and installation phase for just one GW of offshore wind energy comprise between one quarter and one third of the total non-residential construction workforce in the province (21FSP, 2024).

There are things that can be done to help redress this skills gap. The opportunities to tap into the considerable resources of Nova Scotia's Indigenous communities have been mentioned, as has the need for engaging other equity deserving groups such as African Nova Scotians and people living with

[40] An innovation ecosystem refers to a loosely interconnected network of companies and other entities that coevolve capabilities around a shared set of technologies, knowledge, or skills, and work cooperatively and competitively to develop new products and services (Moore, 1993).

disabilities in workforce planning for the offshore wind industry. Education around the emerging opportunities is critical, and it is suggested that renewables education should be formally introduced into high school curriculum to build on the success of COVE's delivery of the OffshoreWind4Kids program.

The Nova Scotia Community College (NSCC) is introducing new renewables programming, and the general topic of Nova Scotia's labour crisis is receiving increasing levels of attention, evidenced by the January 2024 "clean energy" roundtable where industry leaders met in Halifax to discuss the imperative of attracting workers to the renewables sector and the means to accomplish it.[41] What seems apparent in all of this, in part based on the engagement the Committee has had with the provincial lead department NRR, is the need for the aggressive and visible participation of the Department of Education and Early Childhood Development in the provincial OSW planning effort. Given that in almost any conceivable scenario there will be a requirement to import labour into the province to meet the demand, the discussion needs to be elevated to a regional and national level and to involve the direct participation of OSW developers who can bring their collective experience of how other jurisdictions have attracted workers from the oil and gas sector and how apprenticeship programs and micro-credentialling initiatives can be successfully introduced to increase the size and competence of the available labor pool.

8.6.4 Grid Considerations

What is not reflected in the cost/GW estimates discussed in this section are the costs that would be required to effectively connect NS to the inter-provincial grid and potentially access the significant demand within eastern and central Canada or the US east coast. The 5 GW development scenarios identified in the DMDE report assumed that the first 600 MW would be destined for the NS grid and consumed within the province, with the balance of the demand coming from hydrogen/bio-fuels production. Should the latter not materialize, or should NS wish to pursue from the outset the broader vision articulated in the 15+ GW nation building scenario, then major investment in transmission infrastructure is required, presenting incremental challenges to the significant OSW demands that would already be severely stressing the supply chain and labour pool.

The protracted discussion on how the 'Atlantic Loop" would be achieved is illustrative of the existing grid deficiencies and the challenges of securing inter-regional cooperation on funding the initiative (Atlantica Centre for Energy, 2023). As pointed out by the Public Policy Forum, the decision to proceed with the consolation prize, a second 345 kv "reliability" tie-in providing a level of redundancy to the existing 345 kv connection between NS and New Brunswick, is no substitute for the circa $5 billion Atlantic Loop that would potentially enable Nova Scotia to develop its offshore wind resource at scale (PPF, 2023). It is suggested that the creation of an Atlantic Canada Independent Energy System Operator, mirrored on the recently introduced provincial proposal to create a Nova Scotia Independent Energy System Operator

[41] A summary discussion of that event is found in the ITCC' 'Strengthening Nova Scotia's Green Energy Economy', https://ictc-ctic.ca/reports/strengthening-nova-scotias-clean-energy-economy

would enable a more transparent and robust integrated planning approach on a topic that seems critical to the successful realization of regional green energy supply and provincial climate goals (Atlantica Centre for Energy, 2024). While supportive of the principle underpinning the Nova Scotian effort to reform its electricity planning governance structure, Det Norske Veritas asks a penetrating question (DNV, 2024):

> "How can the proposed changes to the Nova Scotia power system governance structure enable the optimal offshore transmission expansions needed to connect the offshore wind resource?"

There are two studies, one underway and one just initiated through Net Zero Atlantic that will shed further light on this enormously important topic that will play an important part in the ongoing discussion around the feasibility of OSW development. The first is 'Pathways to Market, Atlantic Supply Chain, Atlantic Canada Offshore Wind Grid Integration and Transmission Study' (NZA, 2024a), designed to "develop a thorough understanding of the opportunities and challenges for integrating OSW into the Atlantic Canadian grid, both provincially and regionally (from both a domestic and export lens)". This work builds on the earlier work of NZA that has developed an Atlantic Canadian Energy System Model that permits simulation of policy decisions (including the incorporation of the Atlantic Loop) to demonstrate impacts to the levelized cost of energy and climate change goals (NZA, n.d.). And on October 18th, 2024, NZA has on behalf of NRR released a request for proposals to study the socio-economic impacts of a subsea connection between NS and the US. The objectives of this study mirror the thinking contained in the Nicholson report and clearly demonstrate an awareness of the challenges that currently constrain the development of Nova Scotia's OSW resource (NZA, 2024a):

> "Nova Scotia's offshore wind (OSW) resource is a world-class asset due to its high average wind speed and consistency, attractive subsea geology, long coastline and numerous working ports. Nova Scotia is well positioned at the Eastern end of Canada on the Atlantic Ocean to produce OSW electricity on both national and global scales and can explore multiple pathways to market. One potential pathway to market can be an offshore transmission corridor that directly connects Canadian OSW resources with population centres and industrial users on the United States of America (USA) east coast. This transmission corridor could run from Nova Scotia to the northeastern states and carry electricity from OSW projects on both sides of the USA-Canadian border."[42]

8.6.5 Impacts to Communities and Social Infrastructure

Depending on the scale of OSW development and associated upgrades to ageing and increasingly outdated transmission infrastructure, there is the potential for major consequences to impacted

[42] The genesis of this study can likely be found in the New England - Maritimes Offshore Energy Corridor (NEMOEC) Coalition, a cross-border coalition of seven developers of offshore wind, green hydrogen, and power transmission solutions calling for greater collaboration between the United States and Canada and the exploration of a sub-sea transmission link; see https://www.newsfilecorp.com/release/164856/Seven-Developers-Unite-in-a-Coalition-Supporting-Subsea-Transmission-Corridor-Connecting-New-England-to-Atlantic-Canada-White-Paper-Identifies-Nearly-1-Billion-Annual-Benefit-to-Consumers.

communities. The importance Nova Scotian's attach to quality of life has been mentioned, and the cultural significance of the fishery to coastal communities has been well demonstrated through the Committee's engagement effort. Even the relatively modest population growth recently experienced in the province has presented challenges to social infrastructure including housing and medical services. NS has taken action to limit applications under the Nova Scotia Nominee Program which allows the province to nominate skilled workers to settle as permanent residents in NS (Wright, 2024). At a national level, population growth has also caused a retrenchment in the number of foreign student visas being issued, one of the immigration pathways that has shown levels of success and has been attributed to helping reverse generational population decline in places like Cape Breton (CBP, 2024a).

The feedback provided to the Committee, particularly in places like Guysborough and Richmond counties, expresses real and legitimate concerns about how OSW is going to impact their communities and way of life. The point has been made loud and clear that in these areas, OSW is just the latest of a long list of other potential large-scale projects e.g., hydrogen, bio-fuels, space launch that cumulatively represent a scale of activity that sounds alarm bells and challenges peoples' perceptions of the kind of communities they have chosen to live in. This feedback has been mirrored in that obtained by both NZA (NZA, 2024c) and the Cape Breton Partnership (CBP, 2024b) engagement efforts on renewable energy. Many of the people in these communities including fishers and representatives from industry fisheries associations, have given of their time to attend information sessions, participate in the RA process and become better informed on the impacts, including the social implications of OSW development. They want, and it is suggested are now prepared and deserving of a more in-depth conversation. As the province embarks on defining wind energy areas and issuing a call for bids that will define with more certainty the locations of the first project(s) and the required port infrastructure, it should undertake a parallel process of compiling detailed 'Community Profiles'. Through direct engagement with residents, these profiles would more clearly identify historical and cultural data, demographics, housing availability, municipal services including the capacity and cost of expanding water and sewer infrastructure, workforce and education profiles and opportunities for residents to become employed within the industry. This process will provide a necessary framework within which the next level of conversation can be accomplished, and direct community input can be factored into the kind of decision making that will assist the OSW planning process and facilitate acceptance of the OSW industry. You cannot plan for success with port upgrades or OSW development activities without at the same time engaging with and supporting the communities you are expecting to host.

9.0 Data and Knowledge Gaps

OSW represents an important new renewable energy source for Canada and potentially a critical contributor to the federal and provincial governments' stated intent of achieving net-zero emissions by 2050. To realize the potential of this industry, strategic decisions and investment must be made on many fronts. Of critical importance in these early days is a need:

i. to address knowledge gaps and the lack of reliable data about the physical and biological conditions in the RA Study Area;
ii. to initiate studies to better understand the socio-economic and cultural dynamic of those who use the waters of the RA Study Area, including the changes that are occurring in the fisheries as a consequence of climate change, the harvesting of new species and technological advances in equipment; and
iii. to support provincial NGOs, research facilities and engineers, ocean scientists and other others in the private sector to collaborate with research initiatives in other jurisdictions including with OSW industrial research initiatives.

Addressing knowledge gaps and becoming familiar with the needs of and trends associated with the new sector is essential for informed decision-making and sustainable development. The OSW industry faces many uncertainties with respect to environmental, social and economic effects, including cumulative effects, on the marine ecosystem and coastal communities. Equally important to the success of the industry in contributing to national energy goals is the need to redefine the collaborative working relationships between the province, the Atlantic region and the Federal government. As outlined in section 8, this is an enterprise that only is feasible if it is seen as a national – or at the very least – a regional undertaking. OSW development could contribute substantially to federal energy requirements and by identifying data gaps and raising issues that need to be addressed, regulators and stakeholders can better anticipate, monitor and mitigate risks to optimize the benefits of OSW.

Although the first OSW farm was operationalized over 30 years ago in the North Sea, the industry is still relatively new globally, and nonexistent at this time in Atlantic Canada. Knowledge of the effects and the complex interactions between wind farms and the marine ecosystem in the long-term remain largely unknown and are compounded by the increasing diversity and advancement of turbine and related technologies, turbine sizes and varying development footprints. Additionally, the variability of environmental conditions across large areas considered for project development, a lack of standardized and coordinated methodologies for data gathering, monitoring and assessment and the challenges involved in predicting cumulative effects make it difficult to fully understand and manage the broader ecological and socio-economic effects.

In this RA, consideration has also been given to the unique environment within the RA Study Area. This is an offshore area that is highly biologically productive, connected to a large portion of the globe through ocean currents and the movements of animals, and yet is inadequately known due to its vast, remote nature and the high costs and logistical challenges associated with data collection. There are few

baseline and impact studies for OSW development in Canada and the United States. Most information is sourced from European OSW studies where the industry is more established (Kaldellis *et al.,* 2016; SEER, 2022), but these data are only of modest relevance to the situation on the Scotian Shelf. Accurately assessing impacts to wildlife requires knowledge of species' presence and activity data based on long-term observational studies. In the absence of the latter, researchers do look to comparable circumstances and assess the data's relevance to the RA Study Area. As indicated, this is not ideal. Long-term observational studies on species' presence, distribution and behaviour are absolutely essential to understand how animals adjust to their natural environment, how they will adjust to the presence of OSW and how they will adjust in the future (Schradin, 2017)— including how they will respond to climate change.

Most data gaps cannot be easily addressed by individual proponents of OSW projects, but rather lend themselves to collaborative research and management on a broad scale and covering a large set of conditions. Model validation spanning various temporal and spatial scales is most effective when coupled with observation sets that span those same scales. While costly, if initiated early and planned to address priority concerns, research can provide a significant return on investment by facilitating investment decisions, project planning and the identification of conflicts and opportunities.

9.1 Environment

9.1.1 Physical and Biological Environment

From a technical feasibility standpoint, a large area offshore of NS could be developed for OSW. However, the present information is limited to specific locations: areas related to the development of oil and gas were surveyed years ago, and some of the PFDA sites identified in the Interim Report are now being further examined by NRCan. The results will be extremely important for future development in those locations. Nonetheless, there remain large areas in the PDAs where the information about sediment type and its thickness is sparse or non-existent. This gap in knowledge needs to be filled before any serious suggestion of development in these PDAs is initiated, in part because adjacent areas may also be traversed by cables or required for substation construction etc. Filling this key knowledge gap must be an essential objective of the collaborative research project proposed in section 10.

9.1.2 Pelagic Habitat

Almost a century of fishing activity and management has provided a basic knowledge of some of the pelagic species (especially fish) currently occurring in the RA Study Area. These data, however, are limited in many respects: they do not cover all species; they are often limited to seasonal information related to occurrence, fishing practices and commercial fishing priorities etc. and the studies/monitoring activities do not extend uniformly across the Scotian Shelf (see 9.2.1 below). Furthermore, there are ongoing changes taking place within the pelagic community that relate either to the effects of fishing pressure or to environmental changes – notably climate change.

In order to assess the potential effects of OSW development, these data need to be augmented in time, frequency of monitoring and spatial coverage. An approach is outlined in section 10.

9.1.3 Benthic Fauna and Habitat

OSW developments will primarily interact with the benthic habitat through construction activities and the installation of necessary infrastructure. This will vary depending on the type of technology used, e.g., fixed vs. floating, and the components of the electrical transmission system.

Since the collapse of the cod population and the shift towards a benthic-dominated ecosystem, a significant portion of the total fishery output of the RA Study Area has been comprised of benthic organisms, especially lobster, scallop, crab, shrimp and sea cucumber. Consequently, these are the species that are of primary concern from a socioeconomic point of view. Unfortunately, publicly available information about the production and harvesting of these species is limited. In the information provided to the RA Committee by DFO, landings of benthic organisms from large portions of the RA Study Area were excluded for privacy reasons. Requests for more details from some of the companies involved received limited responses.

A secondary level of interaction results from the potential creation of 'new' or different habitat, i.e., the 'reef effect'. In this case, new substrates provided by monopiles or other fixed structures, and related scour protection, will extend the benthic habitat in both a vertical and horizontal direction, and since the immediate vicinity of the turbine is likely to be unavailable to most types of fishery other than fixed or static techniques, e.g., lobster, crab or shrimp pots, the enhanced productivity is likely to be available to species that feed on or interact with attached organisms such as mussels, sponges etc. Understanding these new relationships will be crucial to forecast the need and scope of infrastructure renewal when the OSW farm is to be decommissioned.

Forecasting the likely consequences of change in the biological environment resulting from these two causes — climate change and development of OSW — requires a much more complete understanding of the ecological dynamics of the RA Study Area than currently exists (see recommendations in section 10).

9.1.4 Aerofauna: Birds, Bats and Insects

There is limited information available on bird and bat fatalities at OSW farms due to the limitations of available technologies to detect collision events in offshore environments. Remote detection technology, e.g., radar, thermal imagery and acoustic detection, is being developed to improve the assessment of collision risk, but there are limitations, and further improvements in bird and bat detection and species identification during periods of low visibility are needed.

Deterrence strategies have shown mixed results at terrestrial wind farm locations, and further testing, including field testing, to validate effectiveness in the offshore environment is required for both birds and bats. For example, audible cues have proven to be ineffective for birds that experience long-term exposure to OSW turbines — suggesting habituation — and there have been questions raised regarding the effectiveness of radar monitoring devices in the vicinity of OSW farms (Croll *et al.,* 2022). Ultrasonic

deterrents have been inconsistent in reducing mortality in different bat species in different settings (SEER, 2022).

Information on the distribution of marine bird species is available in the East Coast Seabirds at Sea Atlas. Similar to marine mammals, seabird data are derived from observers on board vessels or platforms and are rarely frequent enough to build an adequate picture of presence for any species. The absence of observations in certain areas does not necessarily mean that a given species is not present, as there may not be enough vessels and observers passing through the region to gather statistically relevant data. Other data products, such as those based on satellite/GPS tagging, provide more detail on some species' movements. Many of the relevant studies have been conducted by non-government organizations such as the Ocean Tracking Network, OCEARCH and CMAR, utilizing volunteers; the sampling sizes associated with such studies are usually small. Additional work needs to be undertaken to expand and validate the findings.

While there are data on the presence of marine bird species in coastal areas, there is a lack of an in-depth understanding of their ranges and, in some cases, foraging areas, movements and migratory paths away from the shore. The Canadian Wildlife Service (CWS) is working to fill some of these data gaps and is developing models to predict the potential risk of collision or displacement of sea birds associated with OSW structures. This work is ongoing, and preliminary research has been provided by CWS to help inform future OSW project design and project-specific impact assessments (see section 4.2).

Available research on avian collision risk suggests comparatively low mortality rates for OSW developments located further from shore and away from greater concentrations of birds (Petterson, 2005; Petersen *et al.,* 2006; Drewitt and Langston, 2006; Hill *et al.,* 2014; Garthe *et al*., 2023; Dahlström 2023). In contrast, studies at wind projects located in nearshore coastal areas have observed higher collision rates (Everaert and Stienen, 2006; Kerlinger and Curry, 2002). However, low numbers of collision events observed may not be an accurate representation of actual mortality rates for several reasons (Drewitt and Langston, 2006; Kaldellis *et al.,* 2016; SEER, 2022). Under reporting is likely higher at OSW farms compared to land-based farms as detecting collisions is more challenging in marine environments. Carcass searches are also only feasible at land-based sites, limiting post-construction monitoring at OSW farms to incidental observations and remote collision detection monitoring technologies, which are still developing. While some data are available for interactions between OSW farms and some marine bird species, the effects on songbirds, shorebirds (which in spite of their name undertake oceanic migrations) and long-lived species such as gannets and eiders, remains unknown (SEER, 2022). More behavioral observation data are required to better assess avoidance rates and collision risk for different species groups (Skov *et al.,* 2018).

Onshore wind turbines pose a significant risk to bats, but little is known about the impact on bats of operating OSW farms and on bat populations in the offshore area (Hein *et al.,* 2021). Understanding bat activity around operating OSW farms and quantifying mortality is essential to assess potential risk. Bats have been documented as far as 130 km off the Atlantic Coast of the United States (Stantec, 2016a, 2016b), and are known to interact with vessels and to appear on Sable Island (Broders *et al.*, 2003; Lucas

and Hebda, 2011; Doucette *et al.*, 2024). However, available studies clearly indicate that bat presence and activity is greater closer to shore than at offshore locations (Guest *et al.,* 2022; Pelletier *et al.,* 2013; Stantec, 2016a, 2016b).

There have been recorded sightings of the monarch butterfly, a Species at Risk (COSEWIC, 2023) on Sable Island, but little is known of their abundance, frequency or movement patterns within the RA Study Area.

9.1.5 Marine Mammals

It is difficult to map marine mammal information and data within the RA Study Area, due largely to the transient nature of these animals and the methods used to gather information. DFO maintains a marine mammal sightings database that includes data from multiple sources, including opportunistic observations from vessels and platforms and dedicated surveys. While there may be identified clusters of sightings in certain offshore areas, this may simply reflect the presence of more vessels (with wildlife observers) in some areas as compared to others, or during certain times of the year, e.g., many surveys take place in the summer months. In areas where fewer sightings are recorded, it cannot be assumed that no marine mammals are present; it may be that there was simply a lower survey effort in that area. The existing data need to be interpreted with a level of caution, and additional site-specific studies over all seasons need to be designed and conducted to gather information.

In addition to visual survey data, passive acoustic monitoring stations deployed offshore can detect the vocalizations of marine mammals. These offer the advantage of year-round, or near year-round, monitoring (Davis *et al.,* 2016). However, there are still challenges associated with identifying specific species of mammals and their exact location from a recording station based on detection range and the timing of the animal's vocalization.

A key data gap is understanding the present occurrence and movements of marine mammals in the RA Study Area, including seasonal and inter-annual variation in habitat use. Without this information, it will be extremely difficult to assess future changes in species distribution or habitat use that may occur due to OSW development, or to estimate the likelihood of exposure to various impacts. Van Parijs *et al.* (2021) recommend that a long-term passive acoustic monitoring (PAM) program be implemented, with baseline data ideally collected for 3-5 years prior to OSW development. Important considerations for PAM study design include selecting appropriate deployment locations, sampling rates and recording schedules for bottom-mounted recorders, with consideration of recorder capabilities and the calling behaviour of species of interest. It is known that several non-government organizations are engaged in the tracking of marine mammals, e.g., the Ocean Tracking Network (OTN), MEOPAR (Marine Environmental Observation Prediction and Response Network) and universities (Acadia, Dalhousie, St. Mary's, Cape Breton etc.), as well as naval interests such as DND. These efforts need to be expanded, coordinated and financed.

9.1.6 Climate Change

While OSW development is seen as playing an important role towards combatting climate change, climate change also poses a range of unknown potential effects on the marine environment that will require consideration as the OSW industry develops. These include rising sea temperatures, altered currents, salinity and mixing patterns, and related changes to species distribution and migration. Particular concerns relate to fisheries species and Species at Risk. In addition, changes in ecosystem dynamics may occur with cascading impacts on marine biodiversity and vulnerability, food security, sea bottom characterization and the environmental and socio-economic health of coastal communities. As the industry develops and projects expand, it will be crucial to address these gaps to understand how climate change alters the potential effects (positive, negative and cumulative) of OSW. The nature, timing and degree of the effects of climate are difficult to predict accurately and will have to be addressed through targeted research, long-term monitoring and adaptive management.

At the present time there is a greatly enhanced capacity in the NS community, together with researchers and individuals from other jurisdictions, for remote monitoring of important species, and larger scale, systemic surveys of occurrence, movements and water conditions over the Scotian Shelf. Use of remotely programmed autonomous vehicles equipped with sophisticated sensing systems is becoming more available, and offers the prospect of developing, within a few years, a much more thorough understanding of the ecosystem of the RA Study Area, the changes it is experiencing, and the potential implications of OSW development. This is the objective of Recommendation 1 (section 10 below).

9.2 Socio-economic Concerns

9.2.1 Commercial Fisheries

While DFO provides information related to commercial fish landings from the Eastern Canadian Commercial Fishing Dataset, there are limitations to their use when determining the use of the waters for OSW development and for coexistence between the fishery and the OSW industry; these limitations include:

- Only logbook data from 2012 up to and including the 2021 season are included, meaning that there is a 2-to-3-year lag before recent trends in the fishery are identified. This also applies to other datasets, such as the VMS recordings of vessel activity.
- Data do not include vessels under 35 ft that may be fishing in the region, which means that all data are not fully captured.
- Privacy screening measures are implemented for commercial fisheries data where there are less than five fisher IDs, license IDs or vessel IDs, so spatial information for those landings is screened out. This is particularly pertinent to data for the scallop, sea cucumber and whelk fisheries.
- Some data layers lack temporal and spatial precision. For example, landings are shown in a series of 10 km^2 grid cells over a 10-year period, but there is neither an indication of what years certain

landings have occurred, nor at what times of year. Grid cells may show high concentrations of landings for a specific species, but it may be that this occurred in a 3 to 4-year period only, or in the event of a seasonal fishery such as snow crab, only during a specific time within a year.

These gaps were identified by many fisheries representatives that participated in the RA process, demonstrating the importance of engaging directly with the fishing industry to understand the data gaps and deficiencies and to inform future research initiatives associated with OSW development.

In addition to the above, understanding other facets of the fisheries — including how the industry itself is adapting to new technologies, changing markets, the harvesting of new species and climate change — is important. The fishery is not static and has changed enormously over the past 20 years. It can be expected to change over the next twenty years, and the need to obtain through research an understanding of the many factors involved will better facilitate approaches to the industry's coexistence with the OSW industry. This includes an understanding of the fishing industry's socio-economic and cultural importance to coastal communities, to Indigenous communities and to the province. As stated in section 4.6.2, it is a diverse industry, and one that is of economic importance both provincially and nationally. The potential impacts of OSW development including possible displacement from fishing grounds and the related financial and cultural consequences need to be better documented and, to the extent possible, quantified. Not only is there a need for the changes that are and could take place in the fishery to be better understood, but DFO, as the primary regulator of the resource, should be required to review their management regimes and regulatory processes in light of the changes that have and are taking place, including the likelihood of a new industry competing for space in the rich waters of the RA Study Area.

9.2.2 Health Issues

OSW farms will have positive effects on human health by replacing GHG generating sources and thereby improving air quality and mitigating lung and related health consequences. However, there are several other health implications, including the potential health implications from exposure to noise and light pollution associated with the construction and operation of OSW farms, and, perhaps more indirectly, through the expansion of port facilities to accommodate OSW activities. Health effects depend on the proximity of the receptor to the source of the noise or light. As the industry is new to NS, addressing these unknowns on human health will require that OSW projects be assessed on a project-by-project basis; this will necessitate that studies be designed to consider the types of light and sound generated, e.g., impulsive, tonal, etc., and the location and type of human receptor locations related to project-specific activities during all development phases (Health Canada, 2024). Since it is recommended that a coastal buffer be respected, the focus should be on the attitudes and health concerns of those involved in the construction and operation of the initial wind farms. Appropriately designed surveys of occupational considerations would be of value not only to NS as this OSW industry develops, but to the industry in general.

Overall, the carbon footprint of wind power is significantly lower than that of fossil-based power and is comparable to other non-fossil power generation technologies. Air contaminant emissions of OSW are expected to be less than conventional power generation, however the magnitude of the difference over the lifetime of the project is uncertain (US EPA, n.d.). Though studies have been performed evaluating OSW, none are specific to Canada. Therefore, a data gap exists for exact emissions intensities for Canadian OSW power. Data from other countries indicate that the total emissions of onshore and offshore wind projects are generally comparable, and would be within the same order of magnitude, so it is likely that Canadian OSW power would be similar to that listed for onshore wind (ECCC, 2024). An appropriately designed study would validate this assumption.

9.2.3 Skilled Labour

That NS is experiencing shortages of skilled labour and a declining and aging workforce, despite recent population growth, is well documented (see sections 4.6 and section 8.4-8.6). Depending on the scale and timing of OSW development in combination with the anticipated retirement of a significant portion of the construction trades labour pool, the existing labour deficit will become larger and the consequences more acute. Recommendations as to the measures that may address some facets of the challenge are provided in section 10. While the Committee acknowledges that solutions to these issues will take time to address, they believe that a regional/national approach is necessary and is recommending that this be incorporated into the development of a revised version of the provincial OSW Roadmap Module 2.

9.2.4 Supply Chain Issues

The attributes that NS brings to the OSW industry are identified in section 4 and further detailed in section 8. The major deficiencies are identified, and reference is made both to the work being undertaken to examine and address the challenges. The Committee supports the recommendations made in the Initial Socio-Economic Impact Analysis (SEIA) of Offshore Wind Development in Nova Scotia (21FSP, 2024) with respect to the supply chain requirements (see section 10).

9.2.5 Ports and Related Infrastructure

The buildout of the OSW industry requires the use of port facilities with certain physical capacities, wharf prerequisites and marshalling capacity. As detailed in sections 4 and 8, much work has already been done to characterize the existing capacity of Nova Scotian ports in an OSW context, and a further study is underway (NZA, 2024). The Committee has drawn on the recent Irish experience in making its recommendation on the process required to achieve strategic investment decisions that will reflect the requirements of both the OSW industry and other marine users including the commercial fishery.

Much of the activity associated with OSW development will take place in and around selected ports, but its development will also place pressure on other modes of transportation, i.e., roads, rail and air (including helicopter usage). These matters will need to be addressed through the preparation of

strategic transportation plans and considered in the development of the 'Community Profiles' being recommended by the Committee.

9.2.6 Housing and Other Services

As the workforce expands, in large part through migration, to meet the needs of the OSW industry, and the specific location of port and OSW construction activity becomes more apparent, the demand for housing, education, medical, emergency services, recreational facilities and other social infrastructure will increase. These issues are discussed in sections 4 and 8 and need to be considered in the development of the 'Community Profiles' being recommended by the Committee.

9.3 Effects of Offshore Wind Technology

9.3.1 Turbine Technology

Despite ongoing research and development activities, the OSW industry is still in its infancy, which limits the scope and amount of research that has been conducted and is currently available. In addition, detailed data are insufficient due to the small number of completed projects and limitations in sharing intellectual properties (Hong *et al*., 2024). This lack of data makes it challenging to conduct an extensive review of specific factors that affect the efficiency and safety of OSW farm installation.

While spar foundations dominate current research due to their dominance in installed capacity worldwide, a more comprehensive understanding of all floating OSW foundation technologies is necessary, particularly as floating technologies are being considered for projects off NS. Comparative analyses and multi-disciplinary design approaches can guide informed decision-making for selecting the most suitable foundation type for specific site characteristics. This can lead to significant cost optimizations throughout the project lifecycle. Initial research often prioritizes wind resource assessment; however, a shift towards comparative studies focusing on optimal foundation selection based on cost, environmental impact and site suitability is critical for maximizing project viability. Similarly, although horizontal axis turbines are almost universal in the OSW industry, vertical axis devices, which generate less power but have much reduced construction and maintenance costs are still being considered by some (Ghigo *et al.,* 2024).

Information is particularly needed on marine species behaviour, movement and use of space around floating OSW turbines to better understand the risk for entanglement, vessel collisions and interactions with floating cables. Less information is available on the impacts of anchors and cables on benthic habitats for floating OSW seabed components compared to fixed-turbine structures.

Current floating OSW farm cost models also inadequately capture weather variability and its impact on project timelines (Hong *et al*., 2024) schedules and costs.

The limited capacity of existing OSW farm installation vessels and the slow pace of fleet expansion pose challenges for future large-scale deployments Research should explore innovative vessel designs capable of handling larger turbines and harsher environments (Hong *et al*., 2024). Upgrading existing vessels and

fostering strategic partnerships between project developers and vessel operators are also crucial considerations.

Direct effects of physical activity associated with decommissioning, e.g., removal of hard substrate, elevated turbidity, elevated underwater sound and/or increased risk of vessel strikes, are relatively well understood, but there are knowledge gaps related to effects associated both with the removal of an artificial reef, e.g., that created by the turbine infrastructure, and fisheries exclusion zones that resulted from the development. More research is needed regarding the artificial reef effect on the benthic environment on the Scotian Shelf. A better understanding of ecosystem structure and function, including community structure and distribution, food webs, productivity, biogeochemistry and biological connectivity (with other regions of the oceans) is needed (Degraer *et al.,* 2021; ICES, 2021).

Decommissioning approaches also need to be assessed for conservation of benthic communities. It may be that decommissioning should allow some remnant structures to remain if the created habitat continues to be seen as overall an asset to the ecosystem. The ecological effects of structure removal activities may harm any new ecosystem, without allowing restoration of the original natural habitat. To date, there are gaps in the knowledge base needed to support science-based decisions on this topic (ICES, 2021).

9.3.2 Reducing Technology Limitations

Although technologies for monitoring conditions in remote areas have been increasing rapidly in recent years, they are still a work in progress. It is recommended that the strategy should be to combine multiple technologies and monitoring methods to reduce limitations associated with individual systems (SEER, 2022). Among these technologies, common limitations include ineffective monitoring during periods of low visibility or heavy rain; limited detection and tracking of several targets simultaneously; blind sector of radar viewshed for systems mounted on turbine platforms due to proximity to tower; interference caused by moving blades or waves; and false positives or false negatives (ORJIP, 2022). Several of the technologies are not yet commercially available and are currently in the research and development phase. Available remote monitoring methods have primarily been tested at either onshore or offshore turbines with fixed foundations and there has been limited testing in connection with floating wind turbines; however, modifications can likely be made to mitigate for motion effects resulting from wave and swell action (ORJIP, 2022).

9.3.3 Noise

Further research is needed to understand potential effects of cumulative noise exposure on wildlife, to better inform predictions of physical and behavioural effects from underwater noise. The new Canada's Ocean Noise Strategy developed by DFO (2024) presents a series of recommendations intended to guide and support improved coordination of federal efforts in the areas covered by three themes and their associated objectives (DFO, 2024). The first theme is to gather and integrate evidence to address knowledge gaps and develop innovative methods, tools and technologies. The second theme is to enhance collaboration and application of evidence-based tools and technologies to develop and

implement clear guidance and management actions. The third theme is to strengthen communication, coordination and engagement to raise awareness and increase participation in the management of ocean noise. When this strategy is finalized, these recommendations will inform a Federal Action Plan on ocean noise (DFO, 2024).

9.3.4 Particle Motion

The sensitivity of fish to the change in particle motion and pressure in the water surrounding OSW structure is a current data gap. At present, there is little known about how particle motion impacts fish and other marine invertebrates, although current understanding suggests this might be similar to pressure waves.

9.3.5 Electromagnetic Fields

Effects from electromagnetic fields (EMF) on marine life have either not been studied or have contradictory results. Some studies (Taormina *et al.,* 2020) conclude that marine species have behavioral, physiological, developmental and/or genetic level changes resulting from EMF, but all studies have been conducted on short-term, in-situ scales, and require further study. For that there is a great need to improve methods of monitoring (Copping and Hemery, 2020). Impacts at a community and ecological level present longer-term consideration as do cumulative effects from continuous exposure to EMF as the industry develops (Copping *et al.,* 2016; Taormina *et al.,* 2020).

9.3.6 Lighting

Lighting from OSW projects could have impacts to various species (birds, bats, fish etc.), particularly those sensitive to changes in light conditions. Data from onshore wind farms, oil and gas installations and shipping has shown that artificial lighting can attract or disorient sea birds, bats, fish and invertebrates, altering natural behaviours such as foraging, migration and avoidance. These effects may lead to increased mortality, changes in species distribution and disruptions at an ecosystem level. However, substantial gaps remain regarding the extent and variability of light impacts at OSW farms across different species, and the effectiveness of mitigative measures (Gulka *et al.,* 2024; BOEM, 2013, 2016).

9.3.7 Heat Effects

Thermal energy is generated when an electric current passes through a cable, even when protected by various metallic and plastic materials (Taormina *et al.,* 2020). For unburied subsea cables, the constant flow of seawater effectively dissipates this heat, while in the case of buried subsea cables, this thermal radiation can heat the sediments in the immediate vicinity; this is particularly the case for cohesive sediments, e.g., compacted silt, due to their lower thermal conductivity (Taormina *et al.,* 2020). Marine organisms are not usually at risk of experiencing thermal impacts from buried cables because cables have a negligible capacity to heat the water column; however, by heating seafloor sediments, buried cables might modify chemical and physical properties of the substrate (NYSERDA, 2021). While the subsea power cables that are associated with OSW farms, i.e., inter-array and export cables, can transmit

high levels of electric power, there are very few data in the literature on the potential temperature increase on and around both unburied and buried cables (Taormina *et al.,* 2020).

9.3.8 Accidents and Malfunctions

Lack of resources for consistent reporting on accidents and malfunctions across the OSW industry impedes the implementation of effective mitigation and monitoring measures. There are important data and knowledge gaps in jurisdictional and industry-wide understandings of these events, causes and repercussions, and potential solutions for risk management and safety performance assessments (Arvidsson and Molander, 2010; Blake *et al.,* 2022; G+, 2023; Rowell *et al*., 2024; Uadiale *et al*., 2014; You *et al*., 2023).

9.4 Summary

The foregoing outlines briefly the numerous areas of present knowledge that are inadequate as a basis for commitment to such a large enterprise. Although there is considerable experience with OSW in Europe, and a growing experience in Asia, it is a totally new enterprise for Canada's east coast, and the suite of environmental, economic and social implications will inevitably be different in this RA Study Area. Nonetheless, the primary driving force – finding ways to decrease our GHG emissions – demands that we explore our natural offshore wind resources for the future.

To do that, it is essential that both our knowledge base and our ability to augment that knowledge be vastly improved over the next few years. Such a challenge can only be met by an extensive, coordinated approach using the combined expertise available within government departments, research organizations, marine knowledge-holders such as Indigenous peoples and fishers, technology and resource developers, and the community at large. The existing silos of expertise will not be sufficient.

10.0 Recommendations

The Committee, based on the work undertaken, the insights gained from the engagement process, the materials received from federal and provincial government departments and submissions from other interested parties, respectfully make the following recommendations as important actions to support and facilitate the development of an OSW industry in the RA Study Area. Nova Scotia has a world class wind regime suitable for this purpose, but the costs to take advantage of it are substantial and need to be thoroughly understood before major commitments are made. As a nascent sector with significant potential to contribute both to national and provincial renewable energy goals and to economic growth, the Committee believes it is important to establish a foundation that addresses environmental sustainability, stakeholder engagement, regulatory compliance and technological innovation. The recommendations that follow address the key challenges and opportunities identified during the RA and aim to enable the development of the OSW industry while safeguarding marine ecosystems, accommodating other ocean users and recognizing the strategic planning that needs to be undertaken to address supply chain needs and onshore infrastructural requirements.

The Committee is cognizant that many parties, both federally and provincially, are working diligently to address some of the challenges that the development of OSW poses. All involved also know that much about the physical and ecological character of the RA Study Area remains unknown. There is, it is suggested, a window of opportunity between the release of this RA in early 2025 and the physical installation of OSW for collaborative action among all interests— i.e., federal and provincial government departments, industry, academia, fishers, Indigenous communities, municipalities and other stakeholders — to consider the essential data deficiencies, to establish research priorities and to identify funding sources to instigate essential research and monitoring programs.

New policy development and implementation by governments must be done under an “umbrella” approach that involves all levels of government and impacted parties. This industry cannot succeed if policy is developed by single departments in silos. Legislation requires consultation with Indigenous communities, fisheries groups and local communities, which the Committee supports and recommends be initiated as early as possible to provide the greatest chance of success for all those involved.

Collaborative action to identify research priorities will provide data and the development of proactive measures to guide the industry toward sustainable and equitable growth from the outset. Consideration and the implementation of the following recommendations will facilitate the establishment of the necessary regulatory frameworks, environmental understanding and protections, infrastructure investments and community engagement necessary to shape the industry’s long-term success.

The Committee has identified several key themes, i.e., areas of focus for groups of recommendations. These are:

1. existing knowledge gaps and necessary research;
2. socio-economic feasibility and consequences;
3. project development;

4. coexistence and compensation;
5. cumulative effects;
6. governance; and
7. education and training.

These themes are discussed in the sections that follow, and recommendations related to each identified. A full list of recommendations can be found in Appendix 10.1.

10.1 Theme 1: Existing Knowledge, Gaps and Necessary Research

Knowledge of the offshore ecosystem is fragmented, derived largely from disconnected monitoring and research programs conducted by separate entities, and this constitutes a barrier to effective OSW development in the region. At the same time, Canada and NS have substantial, although somewhat scattered, expertise within government agencies, e.g., DFO, National Research Council (NRC), NRCan, ECCC, DND and NS NRR, as well as academia, Indigenous communities and organizations, among fishers and other marine users, innovative technology companies and in several non-government agencies, e.g., OCEARCH, Marine Animal Response Society (MARS), Ocean Tracking Network (OTN) etc., that could together provide collaborative guidance on a research agenda to support OSW development in the region. An enhanced data base and cooperation among knowledge holders will also support regional conservation and management objectives.

It is recognized that the RA Study Area is large and its systems complex. Climate change and other factors will continue to influence those systems, and both monitoring and research will always be necessary. The Committee, however, has identified several recommendations that if acted upon will serve to move the research and management agenda forward to address the more pressing data gaps with respect to OSW development. Table 10.1 lists these recommendations.

Table 10.1. Recommendations: Knowledge, Gaps and Necessary Research

Theme	Recommendations
T1-1	Develop a Scotian Shelf Collaborative Research Initiative (SSCRI)
T1-2	Fund *Mi'kmaw Ecological Knowledge Studies* (MEKS)
T1-3	Create a shared repository of data and sources
T1-4	Provide support for ongoing research in federal departments on modelling and marine spatial planning
T1-5	Provide funding to Mi’kmaw organizations for research on adaptive management
T1-6	Prioritize and expand the general collection of environmental data, especially in the vicinity of the PDAs, including the bathymetric and substrate characteristics, bird behaviour and habitat use, and marine mammal behaviour and habitat use within the RA Study Area
T1-7	Open discussions with the State of Maine to contribute to and develop a mutually supportive research agenda associated with their proposed floating OSW test site
T1-8	Establish Participant Funding to last at least five years

T1-1 Develop a Scotian Shelf Collaborative Research Initiative (SSCRI)

It is recommended that a Scotian Shelf Collaborative Research Initiative (SSCRI) be established that benefits from the combined contributions of the scientific community (*sensu lato*) existing in the region. The initiative will require not only the involvement of experts and researchers, but also the collaboration of stakeholders and other users of the marine environment to ensure a thorough understanding of the environment in the RA Study Area, its fauna, resources and changes. The establishment of this SSCRI will enable both the more accurate assessment of the potential impacts of OSW developments and a reference from which to track the effects of climate change and will enhance understanding of cumulative effects. In order to succeed, the SSCRI needs to be provided with core funding for at least five years, as indicated in recommendation T1-8.

The SSCRI will identify research priorities, ensure collaboration and the sharing of results, and facilitate the involvement of necessary expertise in the research and/or its oversight. The consortium would take account of current and planned research programs and help coordinate the efforts of several individual (and somewhat independent) organizations. The latter include government departments, e.g., DFO, NRC, NRCan, ECCC, DND, NS NRR, etc., academic researchers and their institutions, Indigenous organizations, fishers' organizations, etc. For example, DFO is planning an expanded Marine Spatial Plan for the Fundy-Scotian Shelf region which aims to provide a valid foundation for any new initiative within the region and to embrace contributions from other departments and stakeholders. This is an important initiative that is in line with the Committee's recommendation for collaborative research. Similarly, ECCC, CWS, NRCan and other agencies utilize different numerical models to describe and investigate their subjects; these should be incorporated within the SSCRI's activities.

SSCRI could provide the framework for assessing any future developments in the marine area (not just OSW) and should be well supported with information and funds by all interested parties. Specific actions include:

- Prioritize research and identify pathways to funding;
- Establish research objectives and timelines that can accommodate the expected timing of OSW development activity;
- Use the collective output from this initiative to inform the regulatory approval process to guide and support OSW development; and
- Address local and offshore data gaps by defined and efficient data collection with the intent to identify and mitigate risks.

The results could provide an important framework for assessing the effects of OSW development. This initiative should therefore be supported through the free exchange of information by all parties involved and by appropriate levels of funding (see Recommendation T1-8).

The concept of a collaborative research initiative is not entirely new. In the 1980s, a collaborative project was established to address the lack of knowledge and the potential effects of tidal power

development in the Bay of Fundy. Nominally led by NRC, it combined the expertise and resources of major government departments, i.e., DFO, NRCan and ECCC, and several universities. Within eight years its results enabled Canada to avoid committing to a method of tidal energy extraction (based on coastal barrages) that would have had major damaging effects on the environment and resources of the Bay of Fundy.

Collaborative research and engagement is also exemplified by programs such as ESSIM, ESRF, and NZA. At the present time there are, in addition to government departments and universities, a growing number of non-government organizations that conduct research and monitoring in the RA Study Area and have additional expertise, including: Birds Canada, OCEARCH, MARS, COVE in Dartmouth (which focuses on marine innovation), the Oceans Innovations Hub in the Strait of Canso (which focuses on marine based training), and the Pier in Halifax (which focuses on ports, supply chain matters, logistics and marine policy). The expertise embedded in each needs to be corralled and contributed to the overall collaboration to minimize duplication of effort while ensuring priorities are addressed. Figure 10.1 presents the recommendation strategy to address OSW environmental issues, focusing on collaboration and associated outcomes of the SSCRI.

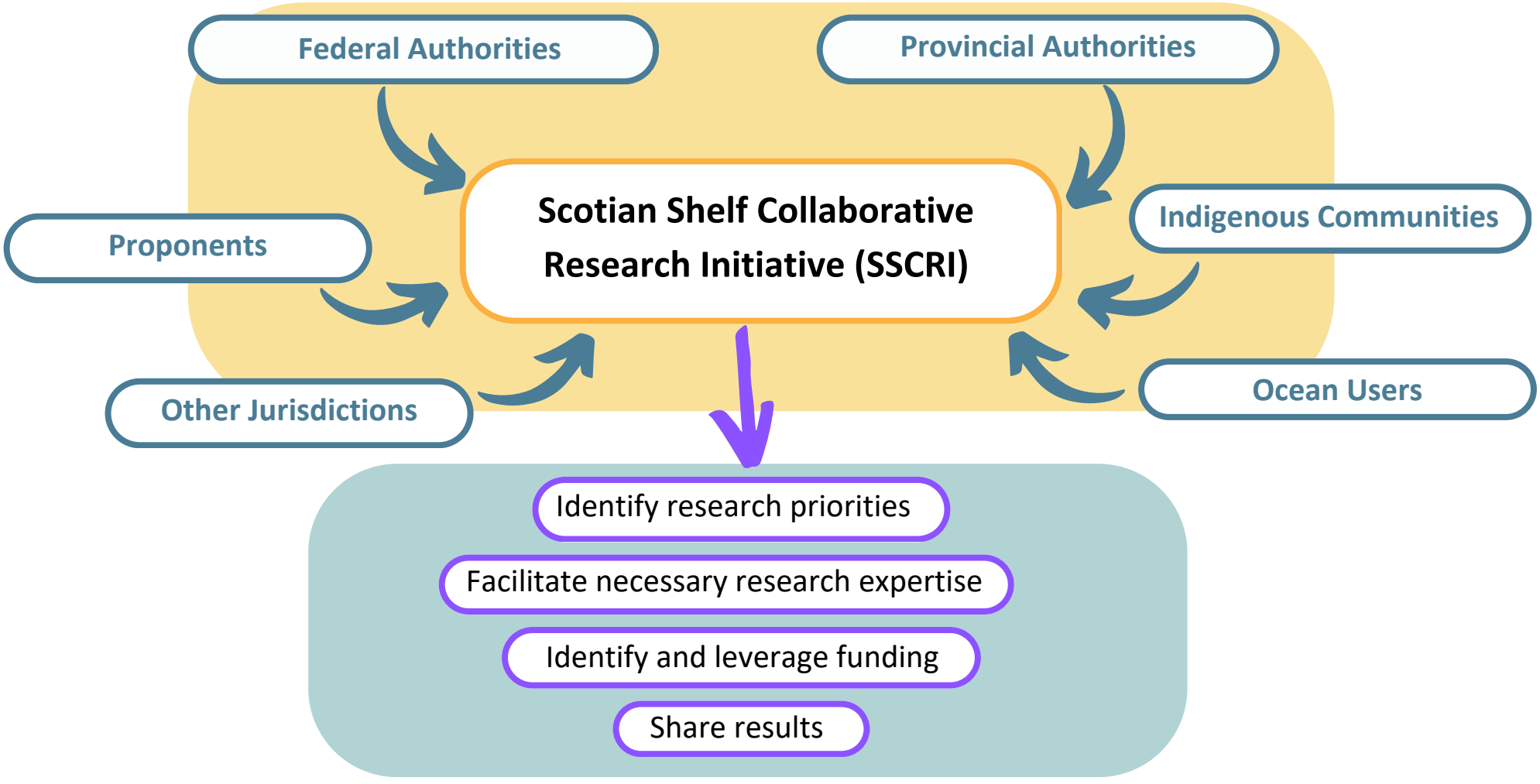


Figure 10.1. Recommendation Strategy to address OSW Environmental Issues

T1-2 Fund *Mi'kmaw Ecological Knowledge Studies (MEKS)*

The *Impact Assessment Act* (IAA) requires developers to undertake a project specific MEKS. The experience from oil and gas project development suggests both limited availability of relevant expertise to conduct multiple MEKS and some level of unnecessary duplication of effort. The Committee recommends that CNSOER be tasked with organizing the proactive execution of a MEKS for each Wind Energy Area (WEA). The associated costs should be recoverable from the successful bidders receiving submerged land licenses. Developers can then use the results to inform the assessment of specific OSW farm projects.

This approach would better enable broad consultation with Indigenous marine harvesters and would reduce repetition. Such studies should be carried out in accordance with the Mi'kmaq Ecological Knowledge Study Protocol and should be executed in association with key Indigenous organizations such as Unama'ki Institute of Natural Resources (UINR), the Confederacy of Mainland Mi'kmaq (CMM), the Atlantic Policy Congress and KMKNO.

The results of these studies are important to the planning and development of OSW in NS and should therefore be part of the pre-commitment phase of research. Although reliance should be placed on the referenced protocol in framing the Terms of Reference for each study, CNSOER should consult the above referenced Indigenous organizations in the preparation of the Terms of Reference for the work being sought.

While the Committee has engaged with Indigenous communities and organizations throughout the execution of this RA and advocate that they should be active participants in the SSCRI, there is also a need to address through research specific issues that are of immediate concern to them. This may relate to key species such as Atlantic salmon and American eel that have cultural significance, Indigenous archeology or to other matters identified by them. It is recommended that the OSW Collaborative Research Initiative seek input from the Aboriginal Aquatic Resource and Oceans Management (AAROM) Program, CMM and UINR to identify, prioritize and identify funding requirements for Indigenous research topics.

T1-3 Create a shared repository of data and sources

There are many data gaps that will need to be addressed if OSW is to succeed in the waters off NS. Data are being and will be compiled by many parties as government departments, developers and other interests prepare for OSW development. These data will be diverse in subject matter and will be compiled at different geographic scales. Some of the research will be aimed at identifying natural processes on the Shelf, tracking and understanding change (long-term, cyclical, climate change related etc.); other research will focus on the movements of marine mammals, birds and species of interest as they migrate and use the waters of the RA Study Area and beyond. Some research, such as data on bathymetry and substrate information may in the first instance focus on identified WEAs. At the project level a developer will compile more detailed data in preparation for regulatory submissions pertinent to

the proposed project footprint. Given the diversity of data involved, it is unlikely that a single repository is feasible, but to facilitate the sharing of data, the Committee considers it important that a “knowledge keeper” be identified.

As CNSOER has been identified as the primary link to the developer and will be receiving project specific data, it is recommended that CNSOER be identified and funded not only to be the repository of project specific data, but maintain through liaison with the SSCRI, a record of the research being undertaken more broadly and details of the results that are publicly available.

T1-4 Provide support for ongoing research in federal departments on modelling and marine spatial planning

Several federal departments, e.g., ECCC, DFO, NRCan, Transport Canada etc., are already using complex numerical models to describe and analyze information about the natural environment of the Scotian Shelf and to explore potential future changes caused by climate change or new anthropogenic activities within the region. These models are important tools to enhance our understanding and forecast future conditions. They are time consuming and represent significant financial and human resource commitments by each department from relatively limited budgets. The results, however, will represent a major contribution to the initiative outlined in T1-1 above. They will also support and amplify DFO’s continuing initiative to create a more comprehensive and adaptable Marine Spatial Plan for the region. Funded support for these activities needs to be more effectively provided than at present.

T1-5 Provide funding to Mi'kmaw organizations for research on adaptive management

The acceptance of a new industry in the waters of the RA Study Area involves a certain risk, one that in part is justified by the intent to meet GHG emissions targets. The Committee has, as stated in section 1.5, embraced both the precautionary principle and the concept of Two-Eyed Seeing. Both are in essence risk averse. The Committee has also referenced the use of adaptive management as a tool that may enable decision making authorities to take into consideration new data and new technologies. Adaptive management is not a random approach to decision making, but rather a hypothesis-based approach to meet objectives agreed to by all interested parties (industry, regulators, fishers, Indigenous communities and others). It is an approach that uses qualitative and quantitative models to provide alternative approaches to issues.

The Committee recommends that funding be provided to one or more Mi’kmaw organization, such as UINR or CMM, for research on adaptive management. For example, for 25 years UINR has been working to strengthen the management of Nova Scotian natural resources while maintaining the Mi’kmaq worldview through the application of Two-Eyed Seeing. The Committee recommends that CNSOER in collaboration with UINR and CMM in association with one or more universities, develop a research program in advance of the first OSW installation in the RA Study Area to determine and illustrate how Two-Eyed Seeing might best be deployed through the decision making process and how it might contribute should circumstances require that adaptive management be employed in the making of

decisions. It is recommended that CNSOER fund the development of the research program which should then be submitted to a national agency for research approval and funding for its execution.

T1-6 Prioritize and expand the general collection of environmental data, especially in the vicinity of the PDAs, including the bathymetric and substrate characteristics, bird behaviour and habitat use, and marine mammal behaviour and habitat use within the RA Study Area

Moving forward under the oversight of the SSCRI the objective will be to expand the environmental data that exist in an efficient and cost-effective manner. The SSCRI will in the future provide guidance on priorities but, based on the work undertaken by the Committee this will include in the near term, but not necessarily be limited to, the following: the further definition of the bathymetric and substrate characteristics of the PDAs, a program to attain a better understanding of bird behaviour and habitat use in and adjacent to the PDAs and the development of a multi-year plan to increase the knowledge of marine mammal behaviour and habitat use in the RA Study Area.

Bathymetric and substrate characteristics

NRCan in collaboration with NS NRR have initiated work on further defining the bathymetry and substrate characteristics in selected PDAs. As this information is required by the OSW industry to inform decisions with respect to the location of OSW farms, the determination of foundation designs and technology choices, e.g., floating versus fixed, the siting of individual turbines and the routing of cables to shore, it is important that this work continue, be further supported and that the findings be shared.

Other participants in the SSCRI, specifically those fisheries that conducted detailed surveys of the seafloor in support of the management of their resource, should be encouraged to explore how best to share their survey results to reduce the likelihood of locational conflict.

The results of this research enhance understanding of the origins and dynamics of the areas surveyed, provide data of practical use to the OSW industry and may also identify sites of cultural and historic interest. Its absence is an impediment to the efficient management of the areas involved.

Aerofauna behaviour and habitat use

The RA Study Area is used by large numbers of migratory and resident birds, but the data that is available is sparse and fragmented. The work currently being undertaken by ECCC with respect to species at risk in the RA Study Area should continue and where appropriate be augmented in light of any OSW development proposal. ECCC in collaboration with others participating in the SSCRI should also identify avian research priorities with respect to the PDAs and adjacent waters and in those parts of the proposed buffer that could be used for transmission corridors. Drawing upon research undertaken in other jurisdictions, ECCC, the CNSOER and industry should determine best practices to be deployed to survey and monitor in the field before, during and after construction of an OSW farm.

Marine Mammal behaviour and habitat use

The RA Study Area is home to at least 14 species of marine mammals including several identified species at risk. This richness and diversity differentiate the waters of the area from those of the North Sea and Baltic, areas accommodating much of the OSW development serving Europe. Yet because of the movement of marine mammals across large distances, the data base is fragmented. There is a need to learn more about:

- their seasonal abundance and distribution; and
- how different species react to the different technologies associated with OSW development, i.e., fixed of floating installations.

The challenge is enormous, but advances in underwater monitoring technologies and drawing upon the expertise that exists in NS should enable appropriate research protocols to be developed (see Recommendation T1-7). This includes utilising the collaboration that has been established between DFO and DND with respect to the monitoring of marine mammals and maximising the research capabilities of the oceanographic and marine research community, both in the universities and in the public and private sectors. The pertinent expertise within the SSCRI should be tasked with preparing research protocols to address the identified data gaps.

T1-7 Open discussions with the State of Maine to contribute to and develop a mutually supportive research agenda associated with their proposed floating OSW test site

As has been acknowledged there are significant concerns about the data gaps that exist with respect to the coastal shelf environment, the changes that are occurring because of climate change and the potential effects of OSW development on the marine environment. These are concerns that are shared by the State of Maine. The latter has announced the development of a floating OSW test site. It is therefore recommended that discussions with the State of Maine be initiated to enable elements of shared research to be undertaken at their test site. Canadian universities and research organizations, such as the Bedford Institute of Oceanography could contribute to a mutually beneficial research program associated with the SSCRI described above. The potential benefits of effective collaboration on a developing wind farm in this region are wide and valuable: e.g., the exchange of knowledge regarding monitoring and assessment of environmental change; and the testing and demonstration of new environmental monitoring technologies; enhancing field experience of potential employees in NS OSW development – including personnel from the Nautical Institute at the NSCC Strait Area Campus; etc. There may also be a fisheries/co-existence aspect to this that could be enormously beneficial for the development of the Guideline and project specific operating procedures referenced below, e.g. T2-3, T3-4.

T1-8 Establish Participant Funding to last at least five years

The Committee recommends that participant funding be established to enable the key stakeholder groups, e.g., fisheries groups, NGOs etc., to provide input into all development phases of the nascent OSW industry in the RA Study Area. This funding should last at least five years to provide the groups enough time to adequately develop the capacity and gather the resources necessary to provide fulsome and informed input to the SSCRI.

10.2 Theme 2: Socio-economic Feasibility and Consequences

Many of the challenges addressed in section 10.1 speak to a level of uncertainty in an environmental context. Similarly, levels of uncertainty apply to social and economic consequences, derived from a lack of knowledge of the scale the OSW industry is likely to achieve. In its desire to better understand the issues, attempt to address many of the questions being asked of it during the engagement process, make recommendations and — it is hoped — elevate the conversation on important topics, the Committee commissioned two studies: a port study that analyzed the capacity of NS ports and estimated costs of upgrades (DMDE, 2024), and a social-economic assessment of the provincial target of 5 GWs, benchmarked against the estimated per GW costs of development in other jurisdictions and further analyzed in the Nova Scotian context by modeling the costs within the provincial Department of Finance Input-Output Model (21FSP, 2024).

The results of the studies now offer a platform for a more structured debate and further analysis. In summary, the OSW sector is challenged by a lack of port capacity, Tier 1 supply capacity, skilled labour and, it is suggested, by a lack of provincial financial capacity for NS to go it alone. Getting this industry positioned for success is a considerable lift. Some excellent preparatory work is underway, but more needs to be done on multiple fronts; from the perspective of being able to finance what will be required in the areas of ports and social infrastructure, to ensuring that the province achieves good outcomes in terms of economic benefits capture and labor force engagement, and in helping communities better understand what it all means and engendering the kind of support and social license that will ultimately be a strong indicator of a successful outcome. As noted in section 8.6.4 and throughout the report, the Committee has been supported in its work by many individuals and organizations, including fishers and their representative industry associations, and is firmly of the opinion that the community writ large is ready for the next level of conversation. Specific issues related to potential co-existence between the OSW and fishing industry and compensation to fishers are discussed below in a separate section. Figure 10.2 presents anticipated socio-economic issues that a Federal-Provincial Working Group would have to address to support development of the OSW industry.

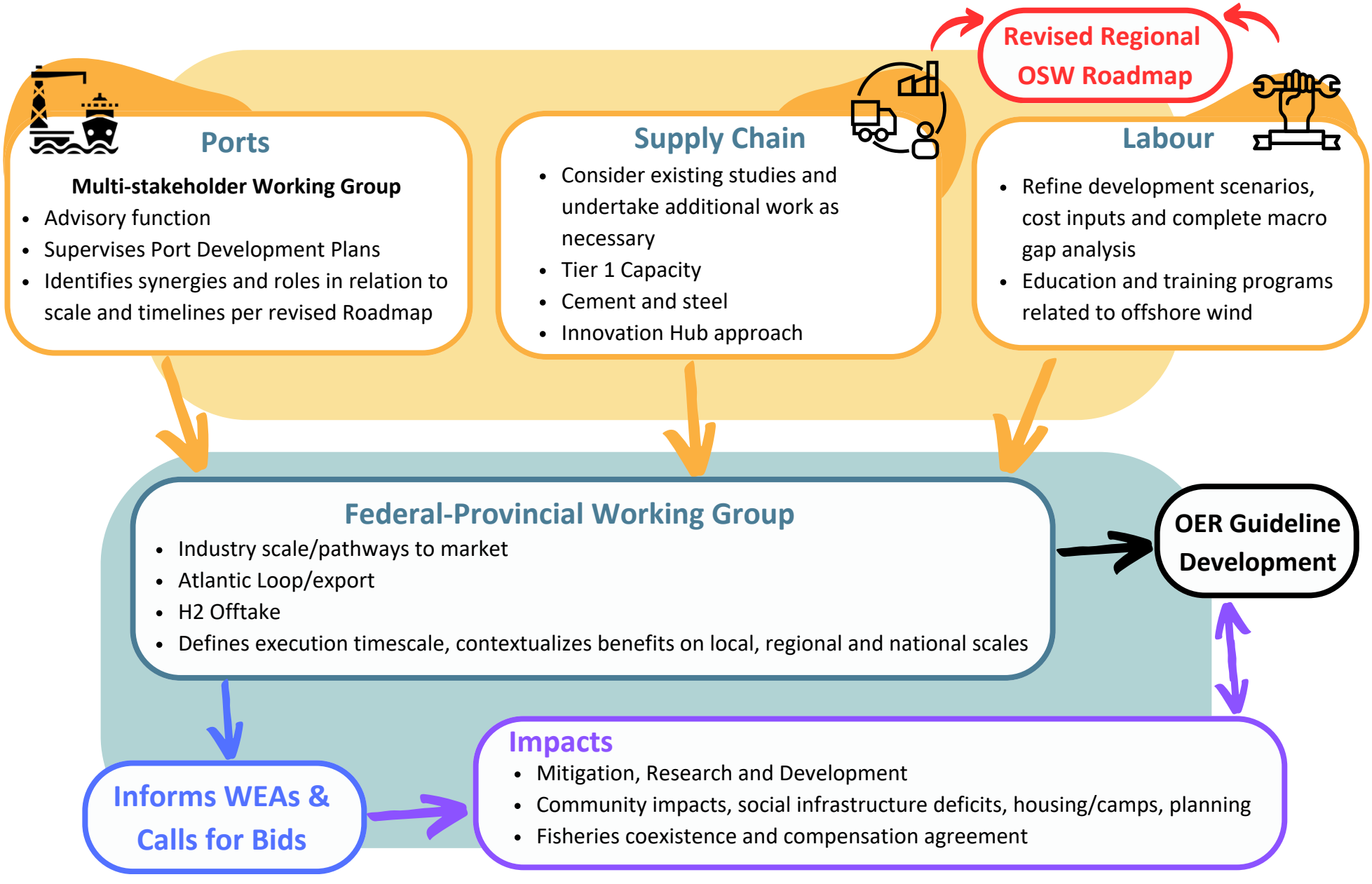


Figure 10.2. Recommendation Scheme for Offshore Wind Energy Development Infrastructure and Governance Requirements

Table 10.2. Recommendations: Socio-Economic Feasibility and Consequences

Theme	Recommendations
T2-1	Establish a Port Advisory Group
T2-2	Undertake Class D (conceptual design) cost estimate and model impacts
T2-3	Adopt a regional/national planning approach for the provincial OSW Roadmap
T2-4	Initiate socio-economic studies for key communities
T2-5	Engage the Departments of Education and Early Childhood Development and Skills, Labour and Immigration in the evolution of the OSW Roadmap
T2-6	Establish targeted immigration and recruitment programs to attract foreign specialists
T2-7	Compile a database on GBA+ research specific to the OSW industry

T2-1 Establish a Port Advisory Group

The capacity of NS ports to support the OSW industry has been studied: Invest Nova Scotia, the DMDE study commissioned by the Committee (DMDE, 2024) and the pending NZA Assessment of Atlantic Canadian Ports to Support Offshore Wind study (NZA, 2024). Section 8.2 of this report considered the process adopted by Ireland in circumstances broadly similar to Nova Scotia's; Ireland's port capacity was insufficient to accommodate its 5 GW target, multiple ports were in the process of evaluating how they might be prepared to participate and a framework was required to oversee the decision making process to ensure that sufficient capacity would be available when required. Recognizing that some level of government assistance was likely, a port advisory group was established and the state entered into an arrangement with the European Investment Bank to provide an advisory service and assist in guiding the process (as discussed in section 8.2).

The Committee sees merit in the Irish approach and recommends that an OSW Port Coordination Group modelled on the Irish example be established, including representatives from the Independent Marine Ports of Atlantic Canada, the OSW industry, Invest Nova Scotia and the Canada Infrastructure Bank's Advisory Service to:

- Review the port studies completed (and about to be completed);
- Undertake an expression of interest process to better understand the current OSW port related activity in Atlantic Canada and individual port plans related to future participation;
- As required, provide seed funding for the creation of infrastructure investment plans and accompanying Class C or Class D cost estimates for individual port plans;
- Evaluate the existing and planned port capacity options in the context of the provincial OSW targets and expected development timelines; the likely build out scenarios that may be staged at various ports including the type of turbine foundations; the complementary roles and synergies among the ports and the desire for equitable distribution of benefits; and
- Narrow the list of ports, create a port development action plan and assist with securing the required financing.

T2-2 Undertake Class D (conceptual design) cost estimate and model impacts

The benchmarking exercise completed in the 21FSP (draft) report provided an entry point into the provincial Input-Output model and a baseline understanding of the potential economic impacts to the province. Once one or more WEAs have been established (see section 6.5), and in conjunction with recommendation T2-3, the province should instigate a follow up study that would better define the estimated costs and impacts of a prototypical, NS based 1 GW project and how these would change if scaled.

T2-3 Adopt a regional/national planning approach for the provincial OSW Roadmap

The Committee's review of the socio-economic impacts of OSW development confirms the need for a regional/national approach to planning, informed by the 21FSP (draft) report, the output from Recommendation T2-2, and a detailed supply chain readiness study (informed by the MRC Atlantic Canada supply chain analysis). The current provincial capacity and near-term opportunities to expand need to be better understood in the context of a demand that will far outstrip the provincial ability to respond. Some of the issues related to the lack of Tier 1 component manufacturing capability or the challenges of meeting the demand for steel and concrete have been briefly reviewed in section 8, as have some of the significant projected labour gaps.

NS has much to bring to the table, but to successfully develop an OSW wind industry at any scale, to strategically increase NS capture rates over time and to supplement local labour supply as required will mean partnerships and collaborative working arrangements in other parts of the region, country and world. This is similar to the approach being taken by the province in studying potential transmission solutions that would require partnerships with other provinces, i.e., the Atlantic Loop, the United States (sub-sea transmission corridor to New England), or attempting to unlock Nova Scotia's hydrogen production aspirations through its MOU with Germany.

The 21FSP (draft) report provides a short-, medium- and long-term approach to supply chain development that may assist with implementation of this recommendation.

T2-4 Initiate socio-economic studies for key communities

The identification of WEAs and the anticipated 2025 provincial call for bids will provide the next level of clarity on which ports and associated communities will be the most significantly impacted in the first round of development. The social impacts associated with OSW wind have been reviewed in section 5 and section 8.6.4 of this report. The OSW related engagement efforts of NZA, the Cape Breton Partnership, CMM, UINR and the Committee demonstrate an increasing level of understanding among citizens of what the OSW might mean for their communities and a significant desire to now be engaged at a different level. To facilitate these conversations and to better prepare residents of the identified communities most likely to be impacted for pending environmental assessments and discussions with project proponents, the Committee recommends that the Nova Scotia Department of Housing and

Municipal Affairs in partnership with the relevant municipal governments commission locally-focused planning and socio-economic studies to better understand the challenges that may be associated with OSW development; these should include:

- The design of a communications and engagement program enabling effective participation of residents.
- The development of comprehensive profiles of the port communities to include:
    - mapping of the existing land use and identified areas for growth;
    - demographic data, labour characteristics, detail of the housing stock, educational capacity (grade schools, college or higher training opportunities etc.), proximity and capacity of hospital, and medical, social and emergency services and other community services;
    - gaps in skills, training and resources with identified educational program needs at the elementary, junior high, high school and post-secondary levels; and
    - involvement of Indigenous and other rural communities within commuting distance of development areas and, where appropriate, preparation of comparable profiles in these communities.
- In the context of possible growth scenarios, conduct a gap analysis, update existing municipal planning strategies as required and plan to address identified deficiencies.

It is recommended that this work should be broader in scope than that normally undertaken in a land use planning context. It needs to be interdisciplinary and collaborative between pertinent provincial departments, with the municipal authorities, with representative Indigenous groups and other equity deserving groups. This will allow for targeted investments in social infrastructure, local workforce development and will help ensure that local benefits are maximized. It will also prepare communities and developers in advance for project impact assessments.

Engaging early with municipalities, Indigenous communities and the smaller towns and villages that may be either directly or indirectly impacted promotes equitable development, strengthening of local economies and promotes social license for the OSW industry. This proposed work program can be dovetailed with or expanded from the long-term OSW capacity building program that is currently being implemented within the Smart Renewables and Electrification Pathways Program (SREP) by NZA and its partners CMM and UINR.

T2-5 Engage the Departments of Education and Early Childhood Development and Skills, Labour and Immigration in the evolution of the OSW Roadmap

Phase 2 of the Provincial OSW Roadmap includes the following reference:

> **“Shortage of skilled workforce**: Workforce and labour shortages are creating challenges for industries across Canada. It is likely that Nova Scotia could experience this obstacle as it

develops the offshore wind industry, which if not addressed proactively and early, could lead to project delays and missed offshore wind targets." [emphasis added]

As discussed in the preamble to this section, the need to focus on recruitment, education and training to address labour gaps is becoming increasingly apparent. The 21FSP findings suggest that it would be appropriate to substitute "could" in the above Roadmap reference by "will".

In a letter dated June 18, 2024, the Committee issued an Information Request to the provincial lead agency, NRR, identifying its understanding of the various provincial OSW related education and training initiatives and requesting confirmation on the initiatives underway. In an email response dated July 18th, the province noted its funding support and participation in the MRC supply chain analysis (currently underway) and advised that "training, and labour considerations are a key pillar of Nova Scotia's "Regional Energy and Resource Table", referencing a pending Collaboration Framework.

The Committee recommends that the provincial Departments of Education and Early Childhood Development and Labour, Skills and Immigration become key and visible participants in the overall OSW provincial planning effort to include:

- participation in the work involved with Recommendations T2-2 and T2-5;
- a gap analysis that will build on the 21FSP work, the results of Recommendations of T2-2 and T2-5 and the pending MRC report on the Atlantic Canadian Supply Chain to provide better definition of the size of the expected labor and skills deficiency by occupation code;
- exploration of partnerships with provincial and national counterparts to define pathways that will assist NS in meeting the expected labour shortfalls (see T2-7 below);
- targeting Indigenous communities and other underrepresented and equity deserving groups to ensure that the supports are in place to enable participation in the opportunities presented by OSW development; and
- working with industry to understand how OSW apprenticeship programs, upskilling and micro-credentialling activities have been successfully employed in other jurisdictions.

Additional recommendations around Education and Training appear in section T7 below.

T2-6 Establishment of targeted immigration and recruitment programs to attract foreign specialists

As discussed in sections 4 and 8 and highlighted in the preceding Recommendations, the lack of required skilled labour in NS to meet and sustain the potential growth that could be generated by the OSW industry is a critical issue. The Committee recommends that in conjunction with the other Recommendations in the section, governments work with the OSW industry to identify the range of skills required and, in addition to addressing educational requirements provincially, instigate policies and international recruitment initiatives to attract overseas specialists. This is not a problem unique to NS; there are many places offering incentives to the young and talented. Luxembourg's strategy, for example, includes a package of generous tax breaks and rent subsidies favouring those under 30; they

also offer free international school education, free public transport and subsidized daycares. Other incentives often considered include easier work visa options, travel and accommodation support and financial incentives and benefits. By way of an example, Nova Scotia's current International Community of Healthcare Workers Engagement Program (NICHE) provides funding to support the process of recruiting internationally educated health professionals to join the health workforce in NS. This support ensures that skilled newcomers can contribute to sectors that Canadians need most and is an approach the Committee believes could be adopted for the future OSW industry.

Attracting foreign specialists to fill gaps in the workforce and to act as advisors in the development of training curriculum and programs and as instructors in OSW education and training programs is an option that the Committee feel is warranted. Not only does this help bring knowledge and specialization from experienced workers to kickstart the industry, but it also provides an opportunity to train Nova Scotians to become experts in the OSW industry, keep jobs within the province and support the future growth of the industry.

T2-7 Compile a database on *Gender Based Analysis Plus* specific to the OSW industry

OSW developers pursuant to the IAA are required to address gender-based analysis plus (GBA+) issues as part of their regulatory submissions. As emphasised in the work conducted on the topic for the Committee (Fusco *et al.*, 2024), GBA+ challenges exist and pose problems across the country, including to communities in NS. The apprehension is that rapid development of a new industry will aggravate existing situations. The subject matter covers diverse topics including, but not limited to, the availability of shelters for those subjected to gender-based violence, employment opportunities for equity deserving groups and the availability of support in impacted communities for substance abuse. Not only are the data pertaining to the GBA+ problems fragmented, but there is no single source responsible for its collection. There is a considerable literature on GBA+ analysis emanating from resource developments, often mines in remote northern locations, but the Committee is of the opinion that this material is not immediately transferable to the OSW industry and the latter's possible impact on coastal, primarily port, communities, where the development pressures may be greatest.

The Committee recommends that the CNSOER, as an integral part of its responsibilities as a source of information and data (see T1-3 above), maintain a record of OSW studies that address GBA+ (at the present these would be from other jurisdictions) and compile an inventory of data sources, federal, provincial and Indigenous, including contact details, that would enable developers to assemble pertinent information to inform their analysis of the topic for the required regulatory submissions.

10.3 Theme 3: Project Development

Section 6.0 provides a detailed account of the approach taken by the Committee to identify Potential Development Areas (PDAs), the rationale that led to the identification of the 25 km coastal buffer and the 25 km buffer around Sable Island, plus detail of each of the PDAs. The following section provides a succinct summary of the recommendations that may influence the location of OSW development in the

RA Study Area, suggestions for non-monetary bid criteria and several project specific issues for CNSOER consideration.

Table 10.3. Recommendations: Project Development

Theme	Recommendations
T3-1	The establishment of a 25 km coastal buffer zone
T3-2	The adoption of Tier 1 and Tier 2 Proposed Development Areas (PDAs)
T3-3(a)-(f)	Development of Bid criteria and bidder pre-qualification
T3-4	Development of guidelines regarding in-field personnel transfers
T3-5	Requirement for adequate security related to abandonment and decommissioning activities
T3-6	The potential reduction of existing abandoned pipeline corridor exclusion zone

T3-1 The establishment of a 25 km coastal buffer zone

The nearshore/coastal area of Nova Scotia has been identified by many RA participants as being of great importance to the fishery, wildlife (particularly bird sanctuaries and foraging areas), Indigenous culture, marine transportation, recreation and the coastline integrity of the province. The Committee's recommendation is that, subject to the process described below, no development take place within a 25 km buffer from the coast and 25 km around Sable Island.

The buffer zone boundary takes into consideration:

- the information received through the engagement process;
- presence of nearshore fisheries, e.g., lobster fishery, and the Indigenous FSC fisheries;
- potential (unidentified) coastal underwater Indigenous archeological sites;
- protection of viewscapes particularly from coastal national parks and heritage areas;
- established marine shipping routes and areas of heavy vessel traffic;
- the presence of bats within approximately 25 km of shore, three species of which are listed as Endangered provincially and federally (see section 4.3.5) and
- protection of migratory and breeding habitat for birds.

This recommendation reflects a precautionary approach and serves as a proactive protection measure for sensitive areas in the early stages of a new industry where environmental and socio-economic impacts may not be fully understood.

The Committee understands that there will be circumstances where an incursion into the recommended coastal buffer may be either necessary or sought. The circumstances requiring an incursion, as in the case of a pipeline corridor associated with an approved OSW development plan, or desired by an industry participant, are discussed in section 6.4. The Committee supports the adoption of the principles of adaptive management to enable an evaluation of a request for an incursion into, or a modification of

the buffer. In practice, this would require that the regulatory authorities, in conjunction with key interests but always including fishers and Indigenous communities, develop hypotheses that the party seeking the incursion or modification to a boundary (coastal buffer or PDA) would have to address through planned engagement and a defined research program. Adaptive management allows for changes to the Committee's recommendations through engagement and analysis. This approach to adaptive management is addressed in section 7.1.2.

T3-2 The adoption of Tier 1 and Tier 2 Proposed Development Areas (PDAs)

The method adopted by the Committee to identify potential development areas (PDAs) is detailed in section 6. The selection process involved a significant portion of the Committee's time, was based on the information made available by various government departments, several of which have undertaken similar exercises which were considered in detail, submissions from fisheries organizations, Indigenous communities' interests, NGOs, industry representatives and feedback received at the Open Houses. The Committee has attempted to strike a balance and minimize potential conflicts and adverse interactions on a large scale. It understands that the federal and provincial governments will consider the recommendations in the identification of WEAs that will inform future calls for proposals. The WEA selection process may result in changes to the Committee's recommendations.

Section 6.5 summarizes the primary considerations influencing the Committee's selection process since the issuance of the Interim Report. Table 6.4 identifies the eight PDAs separated into two categories: 'Tier 1' areas are located at Sydney Bight, French Bank, Middle Bank, Sable Bank and Emerald Bank and are recommended for immediate WEA consideration. 'Tier 2' areas are located at Canso Bank, Misaine Bank and LaHave Basin, considered plausible candidates demonstrating development potential, but requiring that additional work be undertaken in advance of a decision to place them in the Tier 1 category.

T3-3 Development of Bid Criteria and bidder pre-qualification

The discussion in section 2.6.6 has highlighted the extent to which qualitative bid criteria have been employed in other jurisdictions. The governing NS legislation now contemplates a multi-criteria bid process, and the provincial government has expressed a desire to look beyond purely financial criteria in the issuance of submerged land licenses. The Committee endorses this approach, noting it will allow specific government policy goals and objectives to be addressed at the bid stage and by extension should help to ensure that the successful bidder represents the best overall "value" for the province. NS is at the beginning of what could well be a long relationship with OSW, and whom it chooses for 25+ year relationships will be of enormous consequence to the province and the overall success of the industry. Important considerations include the following:

- How has its prospective partner demonstrated a culture of safety and an appreciation for environmental stewardship?
- What types of relationships has it nurtured with the communities in which it operates?

- What is its understanding of the supply chain and labour challenges facing the industry globally and regionally?
- What will its approach be to technology transfer, local supply chain development, labour force preparation (education and training), fisheries co-existence and engagement with Indigenous communities, fishers, municipalities and equity deserving groups?
- Does it have an appreciation of, and a willingness to help address, gaps in our collective understanding of the physical environment in which it will be operating?

One of the useful features of a multi-factor award system is that the criteria can change over time. In the early stages of the industry where there are questions related to supply chain capacity and availability of skilled labour, these can be prioritized. Module 2 of the Provincial OSW Roadmap discusses the importance of supply chain and labour development and notes possible means to achieve this including "... mechanisms like local benefit plans, community funds, as well as local content requirements."[43]

The Committee recognizes that government policy and priorities will change over time with the relative maturity of the OSW industry. Based on what the Committee has learned and some of the reasonably anticipated near term challenges discussed in this report, its recommendations for bid criteria consideration in the early bidding rounds are:

a. Supply chain development that encourages the "bottom-up" approach discussed and recommended in the 21FSP (draft) report without prescriptive "top-down" local content requirements that have failed in other jurisdictions, such as Taiwan and France, and have been demonstrated to lead to slower and more costly development projects.
b. Labour capacity development including apprenticeships models, education and skills training initiatives and participation of disadvantaged and under-represented groups/individuals.
c. Support for the research and development gaps identified by the Committee in section 10.1;
d. Identification, where possible, for potential linkages to follow on projects, including opportunities for shared infrastructure that would tie into the provincial objectives on industry scale. The discussion in section 8 raises important questions about the provincial capacity to support the timely development of a multi-gigawatt OSW industry. In recommendation T2-3 the Committee addresses the need for an overarching regional and national approach to successfully steward the development vision for Nova Scotia's significant OSW resource. If, as is recommended and hoped, the province in cooperation with its regional and federal partners can agree on a strategic direction and investment pathway for the required infrastructure, supply chain and labour capability to enable Nova Scotia's considerable OSW resource to be developed at scale, then multi-lease bids with staggered in-service dates become possible as has become common in other jurisdictions. This approach would have significant benefits including:
    i. allowing for any initial smaller-scale (step-stone) project targeted for the domestic grid to be nested within a larger overall development framework;

[43] Provincial OSW Roadmap, Module 2, s.12, p.20.

ii. signalling a vision that will support the scaling of the industry and encourage participation from the widest range of OSW industry developers possible;
iii. focusing the decision-making on the offshore development locations that may best support the potential for shared infrastructure and minimizing overall impacts to the environment and fishery; and
iv. facilitating early decision-making on the location and sequencing of necessary port infrastructure upgrades and by extension the planning for the social infrastructure required to support the construction and operating development phases.

e. Community Development Plans in areas most heavily impacted by the OSW development plans (see also T2-4).
f. The Committee also recommends that bidders be pre-qualified against criteria that would include an evaluation of:
   i. financial capacity;
   ii. project track record (delivery time, cost, supply chain relationships);
   iii. health and safety performance including how their safety management system is reflected and embedded in the organization's culture and will be nurtured in its NS operations;
   iv. environmental performance;
   v. stakeholder/community engagement history;
   vi. understanding of the region's industrial and labour capacity as it relates to the scale and timing of its project;
   vii. understanding of the legislative framework around industrial benefits; and
   viii. understanding of the region's Indigenous and equity deserving communities.

T3-4 Development of guidelines regarding in-field personnel transfers

One of the areas that the Committee believes will require particular attention prior to the commencement of OSW activities as part of the CNSOER's development of best practice guidelines/guidance documents (see T6-1) relates to the safety of personnel being routinely transferred within an OSW farm installation. In contrast to the offshore O&G industry involving a limited number of structures between which personnel are transferred, the prospect of offshore wind farms having in excess of 100 turbines, all of which will require ongoing maintenance and repair suggests an order of magnitude additional health and safety risk. The Committee appreciates that this is a topic that will also receive detailed consideration in the development of operator's Health and Safety and Emergency Management Plans and references the attached guidance document for the CNSOER's consideration (G+, 2024).

T3-5 Requirement for adequate security related to abandonment and decommissioning activities

The Committee is aware of the CNSOER's authority to require adequate levels of security to guarantee the operator's abandonment and decommissioning obligations. The feedback provided to the

Committee throughout the engagement process highlighted peoples' concerns about the problems experienced within the Bay of Fundy marine renewables program where two abandoned projects have left infrastructure on the seafloor in Minas Passage with insufficient funds available to address removal and full decommissioning. This impacts the marine environment, creates safety issues for other marine users and undermines public confidence in and support for large scale marine renewables projects. The Committee recommends that the process used to establish the level and type of decommissioning and abandonment security for OSW projects be transparent and that the public be advised of the arrangements put in place.

T3-6 The potential reduction of existing abandoned pipeline corridor exclusion zone

During its engagement with representatives from sea cumber harvesters, the Committee was made aware of the 5 nautical mile (NM) exclusion zone (2.5 NM either side) currently in force to protect the abandoned but existing pipeline corridor that until recently supported offshore O&G activities. Portions of this exclusion zone run through active fishing areas. Given that certain types of fishing activity can successfully take place within operating wind farms, and that the Committee is recommending a significant effort be undertaken to define appropriate operating guidelines designed to promote co-existence between the fishery and the OSW industry (see section 10.4), it is recommending that this pipeline exclusion restriction be reviewed and potentially reduced.

10.4 Theme 4: Coexistence and Compensation

The importance of the fishery to the provincial economy, to coastal communities and to the overall cultural fabric of the province has been discussed throughout the Committee's report. One of the significant and recurring issues raised by participants in the RA engagement process was the need to compensate fishers for loss caused by OSW activities through temporary or permanent restrictions denying access to fishing grounds. The following recommendations strive to address this complicated topic.

Table 10.4. Recommendations: Coexistence and Compensation

Theme	Recommendations
T4-1	The establishment of a compensation regime to address economic loss caused by exclusion based on the principles set out in T4-1(a) to T4-1(d)
T4-2	The development of a compensation guideline based on the principles set out in T4-2(a) to T4-2(g)
T4-3	The establishment of an industry wide funding model based on equitable distribution of liability among OSW leaseholders
T4-4	The establishment of participation funding to support fishers in implementing these recommendations

T4-1. The establishment of a compensation regime to address economic loss caused by exclusion based on the principles set out in (a) to (d) below

Mitigation hierarchy theory (Poulton and Ray, 2023) in a regulatory context generally endorse a process where priority is placed on avoidance of conflict/impacts, and, where avoidance is not achievable, to apply economically practical mitigation techniques. The discussion in section 2.6.5 demonstrates that among jurisdictions there is no consensus on what to do in circumstances where, in spite of best efforts to avoid or mitigate, fishery exclusion or loss of access takes place. Compensation for "pure" economic loss, i.e., loss sustained through restricted access or exclusion as opposed to loss associated with physical loss or damage, in the context of a fishery impacted by the OSW industry is a poorly researched and complex issue (Chaji and Werner, 2023). However, the principle of providing some level of compensation in the absence of a legal obligation is increasingly acknowledged and supported in OSW jurisdictions, and it is a principle which the Committee endorses.

The recommendation to adopt a fisheries compensation scheme comes with the following additional recommendations and caveats:

a. Colocation of fishing activity within an OSW development context is, to the extent reasonably practicable, an objective to be acknowledged and endorsed by the fishery, the OSW industry and the provincial and federal governments.
b. Compensation for exclusion or displacement is to be considered as a last resort, separate and apart from avoidance or mitigation. It is viewed by the Committee as a potential consequence of a collective inability to avoid or mitigate.
c. Following the identification of any WEA leading to a call for bids, the Working Group that has been established pursuant to Interim Report Recommendation #3 (Working Group), or its successor, be tasked with completing a comprehensive description of the WEAs fishing activity by gear type and species to provide a more precise baseline understanding.
d. Compensation should not be addressed through bid criteria or become the subject of a non-monetary bid criterion as part of the competitive leasing process.

T4-2. The Working Group develop a compensation guideline (Guideline) based on the principles set out in (a) to (g) below.

A compensation Guideline can only be understood in the context of the fishing activity permitted (and therefore limited or excluded) within an OSW project. There is still much debate around the types of fishing, and under what operating conditions fishing activity can be undertaken safely within an operating wind farm. Some of the answers will be project specific, distance between turbines being an obvious example. The Committee fully endorses the objective of maximizing to the extent reasonably possible, the colocation of OSW and fishing, including consideration of non-traditional fishing activities as a possible offsetting mitigation step where existing fishing activities or methods are compromised or impractical.

a. Fisherman should be involved in simulated fishing activities in the types of wind farms and conditions to be expected offshore NS for all parties to gain a better understanding of the issues and limitations that can inform a comprehensive operating procedure (see (d) below).
b. In keeping with Recommendation T1-7, NS should attempt to become active participants in the State of Maine's proposed floating turbine demonstration project. The Committee believes that having local academic, regulatory and fishing industry representation integrated into the Maine project can inform Guideline development.
c. Fisherman must be directly involved with developers and regulators at the project design stage to determine what types of fishing activity can be facilitated by field layout.[44] This will require, among other things, discussions around setbacks from turbines, inter-array cables, substations, export cables and the creation of transit and/or fishing corridors. Fishers' input will be enhanced by the simulated operating experience gained through (a).
d. Once field layout is determined, project specific operating procedures will need to be established. The Committee sees this as primarily a safety issue and the responsibility of the CNSOER.[45] The experience gained through (a), (b) and (c) will be relevant. Weather criteria are an obvious and important consideration, as is emergency response.
e. If the objective is to encourage fishing, then insurance issues need to be considered and addressed. As discussed in section 2.6.5, an agreement needs to be reached on who carries the liability for fishing activities, what losses are to be insured and to what limits.
f. The Guideline, including the claims process and payments of claims, should be administered by a third party. The process undertaken by the New England states in that regard may be instructive.
g. The Guideline details will need to address challenging questions that include:
    - a determination of eligible claimants: whom, if anyone, beyond licensed commercial fishers may apply for compensation;
    - the categories of eligible loss, e.g., extra steaming time to access alternative fishing locations, loss of fishing income and increased insurance premiums;
    - the evidence required to support a claim, e.g., the documentation required to demonstrate historical use and frequency of fishing; and
    - the length of time for which compensation would be provided.

Section 2.6.5 discusses some of the approaches being taken to address these issues. NSFAEE's submission dated September 12th outlines its concerns and suggestions. Recommendation T4-1(c) is designed to establish a better baseline understanding of current fishing activity and serve as a starting point against which to evaluate future claims. In some cases, the cause of a loss may be difficult to demonstrate with any certainty, or a claim may to too remote or impossible to quantify with any level of

[44] See for reference the discussion in BOEM's 'Guidelines for Mitigating Impacts to Commercial and Recreational Fisheries' (2022), section B Project Siting, Design, Navigation, and Access.
[45] See for reference the discussion in BOEM's 'Guidelines for Mitigating Impacts to Commercial and Recreational Fisheries' (2022), section C Safety Measures.

precision — challenges well known to those who have attempted to define and quantify economic loss in other contexts. It is hoped that broad consensus can be achieved on a framework that can inform the development and application of the Guideline.

T4-3. The establishment of an industry wide funding model based on equitable distribution of liability among OSW leaseholders

As with any compensation scheme, it needs to be funded. What the Committee hopes to achieve through these recommendations is a framework that would ensure uniform treatment of the issues from project to project and eliminate one-off and possibly non-transparent bi-lateral negotiations and agreements between a project proponent and the potentially impacted fishery. The Committee has noted in section 2.6 the various ways funding has been achieved to date and would prefer an industry-funded model based on revenues accumulated through leasing activity and/or some type of levy based on the volume of electricity produced. This money could be placed in trust with the Guideline administrator to respond to future eligible claims. This model would work much better with a flourishing, multi-lease/project industry that provided a consistent revenue stream to government, which Nova Scotia currently does not have. It is noted that early projects in many jurisdictions required some level of government subsidy, which, if it became the case here, may further complicate the funding process in the industry's early phase.

T4- 4. The establishment of participation funding to support fishers in implementing these recommendations.

The critical success factor in developing the tools, frameworks, operating practices and guidelines that will define a co-existence model is that it involves all the parties and over a considerable period of time. The Committee recognizes the significant amount of input that will be required from fishing industry representatives to accomplish the work described in these recommendations, and the limits of their engagement capacity. Participation funding needs to be established. In some cases, as with the activity described in T4-2(a) and (b), government support will be required and costs potentially recovered from successful bidders. In other cases, such as the detailed field layout covered under T4-2(c), the successful bidder/license holder is the logical source of participation funding.

10.5 Theme 5: Cumulative Effects

The Committee was charged by the Terms of Reference to consider the cumulative effects of introducing a new industry, namely OSW development, to the RA Study Area. In section 5, the Committee identified the IPFs associated with the development of an OSW project and some of the mitigation measures that may be deployed to address and minimise the resultant effects, for consideration by the CNSOER in its development of best practice guidelines. Regional effects, however, are not limited to a specific project, but require consideration of the consequences of multiple activities in a larger area and including the vicissitudes of climate change. Section 7 presents the steps taken by the Committee and the conclusions reached. That there will be physical, ecological and socio-economic

effects associated with the development of OSW is not in dispute. Mitigation is important, but perhaps of equal relevance are the recommendations identified in the proceeding sections, particularly those that address necessary research, monitoring and strategic preparation for the physical, ecological and socio-economic consequences that the development of the OSW industry will generate.

Table 10.5. Recommendations: Cumulative Effects

Theme	Recommendations
T5-1	Recognize that responsibility for cumulative effects is shared and tiered
T5-2	Prepare guidelines and data sources for developers

T5-1 Recognize that responsibility for cumulative effects assessment is shared and tiered

Cumulative effects assessment is complex and challenging whether undertaken at a project level or, as the Committee did, at a regional level. It is not a burden that can be passed to a single entity particularly when there is the need to address the changes and pressures being exerted on a large, physically diverse and ecologically rich marine environment, such as the RA Study Area, that is of importance to many players including the commercial fishery, Indigenous peoples, DND, and all others with ecological interests and sympathies. The Committee believes that it is important that the federal and provincial regulatory authorities recognize that cumulative effects assessment of its very nature must be a shared responsibility, drawing on the expertise of international bodies, such as NOAA, the federal authorities and provincial expertise.

T5-2 Prepare guidelines and data sources for developers

A project proponent is required pursuant to the *Impact Assessment Act* (IAA) to undertake a CEA. It is imperative that guidelines and direction to the proponent outline the proponent's responsibilities in regard to the effects of the specific project. An integral part of the requisite guidance will be to provide information on the spectrum of support that can contribute to the project CEA from other agencies such as DFO, ECCC and TC. To reemphasize, the Committee is of the opinion that cumulative effects assessment should be perceived as a tiered and shared responsibility.

10.6 Theme 6: Governance

Governance is a broad concept that covers how decisions are made. As the federal and provincial governments consider whether and, if yes, how best, to accommodate OSW development as a new industry to augment sources of green power in eastern Canada, the ramifications are many. Decisions have to be made by many parties. The Committee through the mandate provided in the Terms of Reference and the work that has been undertaken to inform this RA plays a small role in this complex process. The recommendations identified below aim in different ways to support the necessary decision-making processes that lie ahead and therefore the effective governance of the OSW industry.

Table 10.6. Recommendations: Governance

Theme	Recommendations
T6-1	CNSOER to prepare best practice guidelines and guidance documents for the OSW industry
T6-2	Recommend First Nation representation on CNSOER Board
T6-3	Recommend that project-specific impact assessments for OSW projects are required
T6-4	Consider requiring all vessels to have an approved vessel tracking system installed and operating while in the RA Study Area
T6-5	DFO to review their management and regulatory processes

T6-1 CNSOER to prepare best practice guidelines and guidance documents for the OSW industry

CNSOER's roles and responsibilities with respect to the OSW industry are discussed in section 5.2 and built upon the experience of the CNSOPB having regulated the activities of offshore O&G activities on the Scotian Shelf for over 30 years. The industries are different, but there are operational and safety programs, environmental management and protection plans and pertinent guidelines in place that can provide templates and direction to CNSOER as they further develop the regulatory framework for the OSW industry. The OSW industry is developed, operational and tested in other jurisdictions and best practices from these jurisdictions, including the best practices, standards and guidelines prepared by BOEM should be accessed and adapted to the circumstances. Section 5.6 references some of these established industry practices in the Committee's analysis of impact producing factors and mitigation opportunities prepared for the CNSOER's consideration.

There is a significant volume of work to be accomplished under this recommendation. Should a call for bids materialize in 2025 it is assumed that applications for work authorizations to undertake site evaluation will follow immediately thereafter. The CNSOER needs to be adequately resourced and financially supported in this important work that will guide the various phases of OSW development activity.

T6-2 Recommend First Nation representation on CNSOER Board

The Committee has engaged with Indigenous communities in NS, New Brunswick and PEI as well as with several representative organizations and has gained some appreciation of the economic significance of the commercial fishery to their well-being. The Committee is also aware that Indigenous peoples have certain rights that are protected by section 35 of the *Constitution Act 1982* to fish in the RA Study Area. Given the cultural and economic importance of the marine waters to the Mi'kmaq, the Committee recommend that a CNSOER Board position be reserved for a Mi'kmaq nominee.

T6-3 Recommend that project specific impact assessments for OSW projects are required

Throughout the Committee's engagement efforts many have raised concerns about the Ministerial discretion afforded under s.112(2) of the *Impact Assessment Act* to exempt proposed OSW development

projects from completing project-specific impact assessments. The Committee does not believe that given the emerging state of the OSW industry in Canada, and the lengthy research agenda required to properly characterize biophysical and socio-economic impacts, that the RA process is any substitute for a detailed site-specific project assessment. It is therefore recommended that project specific environmental assessment be required for all OSW projects until key data gaps are addressed. It is hoped that this will:

- Follow the principles of the precautionary approach and adaptive management;
- Incorporate the concept of *Netukulimk* which recognizes and guides beliefs and behaviours for resource protection, procurement, and management to ensure sustainability and prosperity for future generations; and
- Encourage ongoing research and addressing research and knowledge gaps.

T6-4 Consider requiring all vessels to have an approved vessel tracking system installed and operating while in the RA Study Area

DFO's National Vessel Monitoring System (VMS) is a satellite based, near real-time, positional tracking system that is used to monitor the location of vessels and their movement. The monitoring units consist of a Global Positioning System (GPS) and a satellite data transmitter that tracks the vessel's location (latitude and longitude), date and time with capability to monitor the vessel's course and speed. The VMS unit sends the data to a satellite which relays it to the communication service provider, who then sends the data to DFO. The system has been used primarily for regulatory compliance monitoring and enforcement and marine spatial planning with a related safety aspect. The benefits of the system, as summarized by DFO are:

- helps manage sustainable fisheries resources
- guides compliance program enforcement activities
- supports protected area establishment and management
- reveals positions of potential illegal activity and contributes to the prosecution of offenders
- shows the status of fish stocks and fish movement and contributes to increased accuracy and the timeliness of catch and effort information
- identifying geographical positions of vessels
- finding vessels in distress and identifying nearby vessels that could provide assistance
- reducing unnecessary search and rescue activities by providing the positions of overdue vessels (DFO, 2023).

Not all commercial fishing vessels, i.e., lobster and groundfish vessels less than 45 feet, are required to participate in this program, and currently there is some discrepancy in mandatory participation between DFO regions.

The 1974 Safety of Life at Sea Convention[46] introduced Automatic Identification System (AIS) tracking as a means to address navigation safety issues. In Canada, this program is managed by the Canadian Marine Advisory Council (CMAC) arm of Transport Canada (Transport Canada, 2024). The AIS provides publicly available information on vessel location and movements, but similar to the VMS program not all fishing vessels are required to use it despite international advocacy efforts demanding its mandatory adoption.[47]

Each of these systems has limitations and advantages i.e. reporting frequency, cost of installation and use (Iacarella *et al*., 2020). It appears to the Committee that the lack of mandatory fishing vessel participation in these programs needs to be addressed. These monitoring systems support conservation and ecosystem management, promote more effective marine spatial planning and significantly enhance marine safety by enabling timely incident response. In addition, the lack of a comprehensive data set identifying with precision fishing activity over time will potentially have implications for OSW development in the areas of conflict avoidance, mitigation and compensation. The Committee recommends that DFO and Transport Canada consider the issue, consult with the fishing community and jointly recommend a solution to include mandatory participation in one or both programs to effectively augment the existing data sets.

T6-5 DFO to review their management and regulatory processes

Work is in hand to designate new marine conservation areas. Federal and provincial regulators are considering the requirements of a new marine industry and at the same time climate change is resulting in both physical and ecological change in the RA Study Area. The demands on the marine resource are increasing while significant change is occurring. DFO through its marine planning initiative is making significant strides in recognizing the changing dynamics that necessitate more oversight of these waters. The marine planning initiative is to be commended and fully supported into the future. At the same time, however, the management and regulatory regimes currently implemented by DFO with respect to the commercial fisheries are limited by their resources and extremely challenged when it comes to addressing foreseeable change —especially in connection with the development of OSW projects. The Committee recommends that DFO take the challenges presented by the arrival of the OSW industry as a catalyst to review, and revise as necessary, current management practices and applicable regulations as they relate to the commercial fisheries.

[46] International Convention for the Safety of Life at Sea (SOLAS), 1974. https://www.imo.org/en/About/Conventions/Pages/International-Convention-for-the-Safety-of-Life-at-Sea-(SOLAS),-1974.aspx

[47] See for reference Oceana "AIS - What is it" at https://usa.oceana.org/wp-content/uploads/sites/4/4046/oceana_ais_fin_all_hr.pdf

10.7 Theme 7: Education and Training

Table 10.7. Recommendations: Education and Training

Theme	Recommendations
T7-1	Nova Scotia Department of Education to work with elementary, middle and high schools, colleges and universities to develop curriculum, educational and training programs related to OSW and other renewables
T7-2	Nova Scotia Department of Education to develop curriculum for new upskilling, retraining and micro-credential programs to enable the current marine workforce to transition into new roles in support of OSW development

T7-1 Work with schools, colleges and universities to develop educational and training programs related to OSW

The Committee has referenced a number of relevant activities that have come to its attention, including the OSW engagement efforts of NZA and partners to build capacity and understanding in rural and Indigenous communities, the OffshoreWind4Kids program being delivered by COVE in K-12 schools across the province and the NSCC's program development for turbine technicians modeled on the Holland College program. The Committee is also aware of a secondment from the NSCC to the province which it understands was designed to assist in provincial planning and assessment related to OSW issues.

The Committee recommends that in consultation with NZA, COVE, Ulnooweg Education Center, CMM and Mi'kmaw Kina'matnewey, the Province of Nova Scotia develop and implement renewables education in K-12 that includes an OSW module explaining its career opportunities and pathways, including its likely relationship to the evolving provincial hydrogen development.

The Committee encourages development of informational programs for all ages explaining the role of renewable energy and highlighting OSW's contribution in combating climate change. The OSW industry could have a substantial impact on and could play an important role in Nova Scotia's economy for many decades. These programs could introduce potential career opportunities and support young learners to make informed curriculum choices.

The Committee recognizes the contributions made through NSCC's Women Unlimited program, a free 14-week pathway program that empowers diverse women to explore a range of trades and technology programs, and COVE's work in classrooms to inform students of marine careers including OSW, both of which should continue to be supported.

Additionally, the New York Offshore Wind Training Institute was established at the State University of New York and is developing a plan to support organizations focussed on early training and skills development in disadvantaged communities and priority populations. The province of Nova Scotia could be the catalyst for launching a similar workforce development coalition in Nova Scotia.

T7-2 Development of new upskilling, retraining and micro-credential programs for current marine workforce

Nova Scotians have long been employed at sea, e.g., in the fishery, in the navy and in the O&G sector. More recently many have been employed as technicians in the onshore wind industry. The opportunity exists for individuals in one or other of these sectors, or with experience in another pertinent industry, to transition through upskilling and micro-credential programs to the OSW sector. The Committee recommend that NSCC in collaboration with the province, industry representation and in liaison with one or more technical colleges in the UK and/or the US to prepare such programs and to develop an outreach program to attract participants.

10.8 Concluding Statement

The findings and recommendations in this draft Final Report represent a significant milestone in the now 18-month-old RA process. They are available for public comment until December 20, 2024, with the Final Report scheduled for submission to the respective Ministers on or before January 23, 2025. The Committee would like to acknowledge with deep appreciation the assistance and support it has received from the Secretariat, and all of the government departments, Band Councils, organizations and members of the public throughout the process it has described in detail in section 2.1.

Glossary of Terms

Term	Definition
Aboriginal Communal Commercial Fishery	Fisheries that are Band owned and operated under Commercial Fishing licenses where the regulated catch is sold for economical gain.
Advisory Groups	A group of experts/knowledge holders who lend their skills, guidance, and knowledge to the Regional Assessment Committee related to Science and Community Knowledge, Indigenous Knowledge, and Fisheries.
Adaptive Management	A decision-making process that promotes decision making that can be adjusted in the face of uncertainties, technological advances, new data and as circumstances are better understood.
Allision	Involves an accident where only one of the objects is moving; for example, an accident where a moving boat runs into a stationary bridge fender. In comparison, a collision involves two moving objects striking each other; for example, two passing ships.
Alternating Current (AC)	Electricity generated by wind turbines is AC, which is the type of electricity used to power homes and businesses. Electricity can be changed from AC to DC and from DC to AC, which allows flexibility for transport and use.
Archaeological	The study of the ancient and recent human past through material remains.
Artificial lighting	Artificial lighting refers to the light that is produced from human-made sources (not naturally occurring).
Artificial Reef Effects	Introduced offshore wind turbine foundations and infrastructure providing substrates that become colonized or inhabited by communities of sessile or mobile species such as crustaceans, mollusks, and fish.
Atmospheric emissions	Gaseous or particulate pollutant substances emitted into the atmosphere by human and natural activities which can cause health and environmental problems such as acid rain, air quality degradation and global warming/climate change.
Autonomous vehicle (AV)	A vehicle that can operate itself and perform necessary functions without any human intervention, through the ability to sense its surroundings. An AV utilizes a fully automated driving system to allow the vehicle to respond to external conditions that a human driver would manage.
Benthic	Associated with or occurring on the bottom of a body of water.
Benthos	The flora and fauna found on the bottom, or in the bottom sediments, of a sea, lake, or other body of water.
Bubble curtain	Air bubble curtains provide an effective barrier to sound propagating through water, because of the difference in density between air and water.
Buffer	A specified zone around a map feature or features, measured in units of distance or time.
Carbon Payback Period	An estimate of how long it will take a renewable energy project to offset the greenhouse gases emitted as a result of its construction (the “carbon cost”) and

Term	Definition
	begin displacing grid-based electricity generated from non-renewable sources ("the carbon saving").
Cetacean	Marine mammals that have two front flippers. This group includes whales, dolphins and porpoises, animals that are completely aquatic.
Coastal/Inshore/ Nearshore Area	The area between the low tide shoreline and the point at which breakers (breaking waves) form.
Co-existence	Placement of multiple activities or uses within the same marine area, including safety zones where applicable.
Co-location	Two or more activities with overlapping footprints or occupying the same spatial footprint.
The Committee	A group of independent persons delegated to develop a Regional Assessment report summarizing the potential development locations and effects of offshore wind energy in Nova Scotia's offshore Study Area.
Compensation	Following avoidance and minimization measures for reducing negative impacts from development on other users of the marine space, such as the fishing industry, compensation may serve as a mitigation option to reduce the anticipated financial and environmental impacts that offshore wind development may have on the commercial and recreational fishing industries.
Conservation Area	Areas that safeguard biodiversity for present and future generations by reducing stresses from human activities. These areas also provide opportunities for people to connect with nature and include protected areas and other effective area-based conservation measures (OECMs).
Consultation	Consultation refers to the legal obligations of the Crown (Government) when Aboriginal interests (rights and title) may be adversely affected by a Crown decision. Consultation consists of information sharing between government and affected Indigenous Nations and seeks to resolve potential adverse impacts to Aboriginal interests.
Critical Habitat	The habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species critical habitat in the recovery strategy or in an action plan for the species.
Cumulative Effects	Changes to the environment, health, social and economic conditions from a project's residual effects combined with the existence of other past, present and reasonably foreseeable physical activities.
Curtailment (turbines)	Shutting down (curtailing) a wind turbine by adjusting the blades.
Demersal	Living or occurring on the bottom of a sea or a lake.
Diamict	A sediment resulting from dry-land erosion) that is unsorted to poorly sorted and contains particles ranging in size from clay to boulders, suspended in an unconsolidated matrix of mud or sand.
Diapir	An anticlinal fold in which a mobile core has broken through brittle overlying rocks.

Term	Definition
Direct Current (DC)	Power supplied from a battery source is DC. DC is primarily used for transmitting electricity over long distances. Electricity can be changed from AC to DC and from DC to AC, which allows flexibility for transport and use.
Ecologically and Biologically Significant Area	Area within Canada's oceans that have been identified through formal scientific assessments as having special biological or ecological significance when compared with the surrounding marine ecosystem.
El Niño	Refers to a warming of the ocean surface, or above-average sea surface temperatures, in the central and eastern tropical Pacific Ocean.
Electromagnetic Field (EMF)	A property of space caused by the motion of an electric charge.
Engagement	Engagement aims to build relationships by exchanging information in the absence of legal consultation obligations. The purpose of engagement is to build trust and create meaningful relationships. This includes information sharing regarding regulations, policy, legislation and procedures.
Environmental Impact Statement	Document prepared by proponent/developer that identifies and assesses the environmental effects of the project and the measures proposed to mitigate those effects.
Epifauna	Organisms living on the substrate, e.g., hard sea floor, surface of marine structures or on other organisms.
Etuaptmumk (Two-Eyed Seeing)	A concept introduced by Albert Marshall, a respected Mi'kmaq Elder, which recognizes the strength of Indigenous ways of knowing and the strength of Western ways of knowing and uses both competencies together.
Fisheries Area Closures	A marine area closed to fishing to protect coral and sponge concentrations in an area or provide indirect benefits for the species that use this habitat.
Food, Social and Ceremonial Fisheries	Fish that are caught by First Nations and must be consumed by the individual or community, can be used for the purpose of harvesting other species of food and is not sold, bartered or traded. This right is only limited or infringed if justified in specific circumstances (such as for conservation purposes). DFO issues these licenses to Indigenous communities for a variety of species, including lobster.
Food web	A natural interconnection of food chains and a representation of what-eats-what in an ecological community.
Fossil Fuels	These fuels are found in Earth's crust and contain carbon and hydrogen, which can be burned for energy. Coal, oil, and natural gas are examples of fossil fuels.
Gender-based Analysis Plus (GBA+)	A tool for assessing a proposed project's potential positive and negative impacts on people of different genders, identities and abilities.
Gigawatt (GW)	A unit of power equal to one billion watts or one thousand megawatts.
Glacial Till	Unsorted material deposited directly by glacial ice and showing no stratification. Till is sometimes called boulder clay because it is composed of clay, boulders of intermediate sizes, or a mixture of these. The rock fragments are usually angular and sharp rather than rounded, because they are deposited

Term	Definition
	from the ice and have undergone little water transport. The pebbles and boulders may be faceted and striated from grinding while lodged in the glacier.
Glaciation	The process, condition, or result of being covered by glaciers or ice sheets.
Glaciofluvial	Of, relating to, or coming from streams deriving much or all of their water from the melting of a glacier.
Glaciomarine	A glaciomarine deposit refers to sedimentary accumulations that occur when an ice margin terminates in water, resulting in the deposition of various gravel, sand, and mud facies through processes such as turbidity currents and ice-rafting debris.
Glauconite	A mineral that forms through the transition of clay minerals in the sea or by direct precipitation from seawater. It is commonly found in shallow marine environments and is characterized by its rounded shape, dark green color, and high potassium content.
Greenhouse gas (GHG)	Gases in the earth's atmosphere that trap heat.
Horizontal directional drilling (HDD)	A method of installing underground pipelines, cables and service conduit through trenchless methods.
Impact Producing Factor (IPF)	Impact Producing Factors (IPFs) identify the cause-and-effect relationships between actions (e.g., a specific action associated with the life cycle of an offshore wind project) and relevant physical, biological, socio-economic, or cultural valued components. They define the particular way(s) in which an action or activity affects a given valued component. It is common that multiple IPFs affect the same valued component.
Important Bird Area	Places of international significance for the conservation of birds and biodiversity.
Indigenous Knowledge	For the purposes of impact assessment, generally, Indigenous knowledge is considered as a body of knowledge built up by a group of Indigenous peoples through generations of living in close contact with the land. While the term 'traditional knowledge' is often used, the Impact Assessment Act uses the term 'Indigenous knowledge' to recognize that the knowledge system evolves and is not set in the past, as the word 'traditional' may imply.
Introduced Species	An organism that is not native to the place or area where it is considered introduced.
Invasive Species	An organism that causes ecological or economic harm in a new environment where it is not native.
Jet cable burial	Simultaneously laying and burying, or post-lay burying cables, in soft soils such as silt or loose/medium sand.
La Niña	The periodic cooling of ocean surface temperatures in the central and east-central equatorial Pacific.

Term	Definition
Levelized Cost of Energy	Levelized Cost of Energy is a measure of the average net cost of electricity generation of a facility over its lifetime that enables the comparison of different technologies, e.g., wind, solar, natural gas etc. on a consistent basis.
Marine Protected Area	Areas established for the long-term, and managed through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values.
Marine Refuge	Area-based fisheries closures under the federal *Fisheries Act* that contribute to the other ecosystem-based conservation measure (OECM) criteria and the conservation of biodiversity over the long-term.
Marine Spatial Planning	Process for managing ocean spaces to achieve ecological, economic, cultural and social objectives.
Metasediments	A metamorphic rock of sedimentary origin.
Megawatt (MW)	Standard measure of electric power generating capacity (e.g., 1,000 kilowatts (kW) or 1 million watts (W)). Large utility scale wind turbines usually produce 900 kW to <8 MW per turbine.
Memoranda of Understanding	An agreement between two or more parties outlined in a formal document. It is not necessarily legally binding but signals the willingness of the parties to move forward with a contract.
Metocean	Metocean is an acronym combining the words meteorological and oceanographic. Metocean concerns understanding meteorological and oceanographic conditions in offshore coastal engineering or renewable energy projects.
Migratory Bird Sanctuaries	Areas established under the *Migratory Birds Convention Act* (1994) and administered by the Canadian Wildlife Service to help protect migratory birds by conserving their habitat and making it illegal to hunt or disturb them.
Morphologically	Of, relating to, or concerned with form or structure.
National Marine Conservation Areas (NMCAs)	Areas established for the purpose of protecting and conserving representative marine areas for the benefit, education and enjoyment of the people of Canada and the world. They are managed and used in a sustainable manner that meets the needs of present and future generations without compromising the structure and function of their ecosystems.
Netukulimk	A Mi'kmaq term referring to the use of the natural bounty provided by the Creator for the self-support and well-being of the individual and the community.
North Atlantic Oscillation (NAO)	A large-scale alternation of atmospheric mass between subtropical high surface pressure, centered on the Azores, and subpolar low surface pressures, centered on Iceland. The NAO determines the speed and direction of the westerly winds across the North Atlantic and winter sea surface temperature.
Paleontological	A science dealing with the life of past geologic periods as known from fossil remains.

Term	Definition
Passive Acoustic Monitoring	Observation method where an acoustic device is deployed in the ocean to capture sounds from the surrounding environment (the instrument does not produce any sounds). The sounds received by the instrument are identified and classified. PAM has become an important tool in observing cetaceans, especially deep-diving species.
Pelagic	Relating to or living or occurring in the open sea.
Pinniped	Marine mammals that have front and rear flippers. This group includes seals, sea lions and walruses, animals that live in the ocean but are able to come on land for long periods of time.
Postglacial	Existing or occurring during the time following a glacial period.
Provincial Internal Waters	Those areas along the coastline of Nova Scotia that do not fall within the Limits of the Offshore Area as defined by Schedule I of the Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act (S.C. 1988, c. 28). Broadly speaking, the boundary between provincial internal waters and the jointly managed Offshore Area is the low water mark of Nova Scotia, except for the inner bays as defined in Schedule I (e.g., Chedabucto Bay, St. George's Bay, and St. Mary's Bay).
Red Ground	
Registry (i.e., The Canadian Impact Assessment Registry)	A website where the Impact Assessment Agency of Canada stores project files for public access. The Registry site for the Regional Assessment includes public notices, reports, scientific information, background documents, Committee updates and additional information relevant to the Regional Assessment.
Remote Operating Vehicle (ROV)	Unoccupied, highly maneuverable underwater machines that can be used to explore ocean depths while being operated by someone at the water surface.
Scour protection	Measures to prevent loss of seabed sediment around any structure placed in or on the seabed by use of protective mattresses or rock and gravel placement.
Sea Ice	Frozen seawater that floats on the ocean surface. Seasonal ice that forms and melts each year (called first-year ice) and ice present all-year round (multi-year ice).
Seven Generations	A philosophy of the Mi’kmaq people that ensures that decisions today are made with both current and future generations in mind.
Shadow Flicker	Shadow flicker is an effect of pulsating light and shadow caused by the sun as it shines through rotating wind turbine blades. Intensity of shadow flicker diminishes with increasing distance from a wind turbine and is less noticeable the farther away from the turbine.
Significant Benthic Area	According to DFO's Ecological Risk Assessment Framework (ERAF), these are significant areas of cold-water corals and sponge dominated communities.
Significant Wave Height	Significant wave height is an average measurement of the largest 33% of waves. It is measured because in many applications of wave data, larger waves are more "significant" (important) than smaller waves. For example, the larger waves in a storm cause the most erosion on a beach.

Term	Definition
Species at Risk	An extirpated, endangered, threatened species, or a species of special concern.
Stealth treatment (turbines)	Treatment for turbines made with radar-absorbing materials, which can almost entirely eliminate the reflection of radar waves off the turbine.
Substrate	The surface or material on or from which an organism lives, grows, or obtains its nourishment.
Surficial Geology	Material and area landforms found at the surface of the Earth.
2SLGBTQI+	Acronym used by the Government of Canada to refer to the Canadian community. 2S: recognizes Two-Spirit people as the first 2SLGBTQI+ communities; L: Lesbian; G: Gay; B: Bisexual; T: Transgender; Q: Queer; I: Intersex, considers sex characteristics beyond sexual orientation, gender identity and gender expression; +: is inclusive of people who identify as part of sexual and gender diverse communities, who use additional terminologies.
Terms of Reference	Guiding document that defines and summarizes the purpose, objectives, mandate, and activities of the Regional Assessment Committee.
Traditional Knowledge	Knowledge, know-how, skills and practices that are developed, sustained and passed on from generation to generation within a community, often forming part of its cultural or spiritual identity.
Two-Eyed Seeing	Refer to *Etuaptmumk*
Valued Component	Valued components (VCs) may be identified as having scientific, social, cultural, spiritual, economic, historical, archaeological or aesthetic importance. Once VCs are identified, they become the focus of the impact assessment, and an analysis of impacts to these components is carried throughout the assessment process.
Viewscape/ Viewshed	The geographical area that is visible from one or more viewing points.
Waterfowl	A bird that frequents water, especially when regarded as game.
Wskitqamu	Mother Earth in Mi’kmaw Language

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Appendices

Appendix 2.1. List of Indigenous Communities, Groups, and Organizations Contacted by the Committee During Early Engagement

Community/Group Name
Nova Scotia
Acadia First Nation
Annapolis Valley First Nation
Bear River First Nation
Eskasoni First Nation
Glooscap First Nation
Paqtnkek Mi'kmaw Nation
Pictou Landing First Nation
Potlotek First Nation
Waycobah First Nation
Wagmatcook First Nation
Membertou First Nation
Millbrook First Nation
Sipekne'katik First Nation
Prince Edward Island
Abegweit First Nation
Lennox Island First Nation
New Brunswick
Fort Folly First Nation
Eel Ground First Nation
Elsipogtog First Nation
Pabineau First Nation
Esgenoôpetitj First Nation

Buctouche First Nation
Indian Island First Nation
Eel River Bar First Nation
Metepenagiag Mi’kmaq Nation
Kingsclear First Nation
Madawaska Maliseet First Nation
Oromocto First Nation
Saint Mary’s First Nation
Tobique First Nation
Woodstock First Nation
Quebec
La Nation Micmac de Gespeg
Listuguj Mi’gmaq Government
Micmacs of Gesgapegiag
Conseil des Innus d’Unamen Shipu
Conseil des Innu de Ekuanitshit
Conseil des Innus de Pakua Shipu
Conseil des Innus de Pessamit
Conseil de la Première Nation des Innus Essipit
Innu Takuaikan Uashat mak Mani-Utenam
Première Nation des Innus de Nutashkuan
Indigenous Organizations
Kwilmu'kw Maw-Klusuaqn Negotiation Office (KMKNO)
Atlantic Policy Congress of First Nations Chiefs Secretariat
Confederacy of Mainland Mi’kmaq
Mi’kmaq Conservation Group
Native Council of Nova Scotia / Maritime Aboriginal Peoples Council
Nova Scotia Native Women’s Association

Union of Nova Scotia Mi’kmaq
Unama’ki Institute of Natural Resources
Wskijnu'k Mtmo'taqnuow Agency Ltd
Agence Mamu Innu Kaikusseht (AMIK)
Atlantic Policy Congress of First Nations Chiefs Secretariat

Appendix 4.1. Fish Species of Special Status Potentially Occurring in the RA Study Area

Common Name	SARA Schedule 1 Status	COSEWIC Designation	Life History Characteristics
Northern wolffish	Threatened	Threatened	• Northeast Newfoundland and across the North Atlantic Ocean with some occurrence on the Eastern Scotian Shelf off Cape Breton. • Most common at depths of 500-1,000 m and water temperatures between 2 and 5°C. • Non-migratory spawning occurs in the fall. • Eggs are probably deposited on the bottom, but larvae and juveniles are thought to occupy the upper layers of the water column before settling to the bottom.
Spotted wolffish	Threatened	Threatened	• West of Greenland to the Grand Banks with some occurrence on the Eastern Scotian Shelf off Cape Breton. • Most common at depths between 200 and 750 m on the continental shelf or in deep trenches and on the Scotian Shelf in temperatures ranging from 2 to 8°C. • Non-migratory spawning occurs in the summer. • Larvae are pelagic before settling to the bottom.
Atlantic/striped wolffish	Special Concern	Special Concern	• On the Scotian Shelf with a higher concentration around Browns Bank, along the edge of the Laurentian Channel and into the Gulf of Maine. • Commonly found inhabiting the seafloor in water depths between 100 and 350 m.

			• Occurs in temperature ranges from -1.5 to 13°C, but more abundant in a narrower range. Water temperature as a potential major factor determining habitat selection.
White shark	Endangered	Endangered	• Increased research and identification effort in recent years show white sharks are more frequent visitors to Canadian waters than previously thought. • Preliminary and published results indicate white sharks occur seasonally in Atlantic Canadian waters, ranging widely throughout the region. • Occupies depth from the surface to 1,300 m, are highly mobile and seasonally migrant. • Recently, white sharks of multiple ages and both sexes have been encountered and tagged off NS. This may indicate that there is a sub-population of white sharks that aggregate in Canadian waters. Five of the six white sharks tagged in NS in 2018 returned in 2019, suggesting that this is a true migration, indicating the importance of this area for white sharks. • In addition, white sharks tagged in US waters have been tracked into Atlantic Canadian waters. Over 30 acoustic-tagged sharks have been detected in Atlantic Canadian waters in recent years.
Acadian redfish (Atlantic population)	Not Listed	Threatened	• Occupies seafloor and is commonly found inhabiting waters 150 to 300 m in depth along the Scotian Shelf edge and slope. • Found in a wide range of habitats and known to use rocks and anemones as protection from predators. • Mature individuals are expected to occur in the RA Study Area year-round.

			• Migratory information for this species is lacking because they cannot be tagged. Mating occurs in fall. Larvae may be present in the water column from May to August.
American eel	Not Listed	Threatened	• Freshwater rivers (typically females) or coastal estuaries (mainly males) connected to the North Atlantic Ocean. • Spawning grounds of both North American and European species of eels have long been considered the deep waters of the Sargasso Sea (proposed by Schmidt (1923) based on the pattern of development of the larvae as they drift northwards in the Gulf Stream). • The coincidence of both American and European eels spawning in the same portion of the ocean gave rise to questions about their distinctiveness as species, but subsequent genetic studies indicate that cross-breeding is unlikely. • It is now thought that the two species spawn in different water masses associated with the Mid-Atlantic Ridge near the Sargasso Sea. Adults die after spawning. • When the eggs hatch, each releases a planktonic larva (the *leptocephalus*) that drifts in major ocean currents back to the general area from which the adults came. As they arrive to the area that the adults left, the larvae metamorphose – first to the *glass eel* and then to the *elver* stage as they move into rivers or estuaries. • In recent years the availability of satellite pop-up tags has provided insight into the first phase of the adults' sea migration. Importantly, when silver eels move to sea from NS rivers, they do not go directly south to the Sargasso, but initially head north-east across the Scotian Shelf and then turn south along the edge of the coastal shelf.

			• Consequently, all eels heading to spawn from NS will likely traverse the RA Study Area on their way. • Since they navigate using geomagnetic information and are sensitive to electromagnetic fields, the implications of transit through an OSW farm must be evaluated.
American plaice (Maritime population)	Not Listed	Threatened	• Demersal species commonly found in water depths of 100 to 300 m where soft/sandy sediments are present. • Within the RA Study Area, found along the banks and basins and along the shelf edge year-round. • Spawning occurs in April/May. Eggs and larvae are pelagic and may be present in the water column between May and June. Major spawning areas include Banquereau, Western and Browns Banks.
Atlantic bluefin tuna	Not Listed	Endangered	• Highly migratory species distributed throughout the North Atlantic Ocean, occupying waters up to 200 m deep although they are known to dive to 500 – 1,000 m. • Adults enter Canadian waters, including the Scotian Shelf, from June to December but tagging data and reports from fisherman indicate that they are present in every month of the year. • Distributed in high concentrations along the shelf edge and the Northeast Channel. The species forages on herring, mackerel, capelin, silver hake, white hake and squid.
Atlantic cod (Southern population)	Not Listed	Endangered	• Generally found in coastal, nearshore and offshore areas from depths of a few metres to 500 m. In 1993 a moratorium on northern cod fishing (Newfoundland and Labrador, Gulf of St. Lawrence, and Eastern Scotian Shelf [4VW]) was put in place on all directed fishing and remains in effect today.

			• Important commercial by-catch fishery on the southwest Scotian Shelf. • Southern Population inhabit waters from the Bay of Fundy and southern Nova Scotia including the Scotian Shelf to the southern extent of the Grand Banks and overwinters in the deeper waters of Browns and LaHave Banks as well as inshore waters near Nantucket (US). • Observed spawning in both offshore and inshore waters year-round. Peak spawning has been observed during the spring with pelagic eggs and larvae. • Juveniles prefer habitats that provide protection and cover such as nearshore waters with eelgrass or areas with rock and coral.
Atlantic salmon (Outer Bay of Fundy population)	Not Listed	Endangered	• Anadromous, returning to natal rivers to spawn after the completion of ocean scale migrations. • Adults are repeat spawners, i.e. are *iteroparous*, returning to their natal rivers for several successive years after a feeding stage at sea from May to November, with some fish returning as early as March. • Female salmon deposit eggs in gravel nests in October and November, usually in gravel riffle sections of streams. Spawned-out or spent adults (kelts) return to sea immediately after spawning or remain in fresh water until the following spring. Fertilized eggs incubate in nests over the winter and begin to hatch in April. • Hatchlings (alevins) remain in the gravel riverbed for several weeks while living off a large yolk sac. Once the yolk sac has been absorbed, free swimming parr begin to actively feed. • Young salmon (parr) will remain in fresh water for one to eight years before they begin a behavioral and physiological

			transformation and migrate to sea as smolts. After spawning, adults either return to sea following spawning or wait until the following spring in some river systems. • Most Atlantic salmon from the Outer Bay of Fundy overwinter in the Labrador Sea and Flemish Cap area. Inevitably, they must traverse the RA Study Area, but the transit is likely to be rapid.
Atlantic salmon (Inner Bay of Fundy population)	Endangered	Endangered	• Most stocks originating from the Inner Bay of Fundy have been extirpated by overfishing and habitat destruction. Present stocks are mainly sustained by hatchery production and Live Gene Bank additions. • Like other stocks the animals were repeat spawners, with males returning from sea usually after one year, and females after two or more years feeding at sea. • Their use of the RA Study Area was possibly limited, but some of the males, most of which were thought to overwinter in the Bay of Fundy/Gulf of Maine may have ventured further afield. The more extensive sea migrations of females might have included the Labrador Sea.
Atlantic salmon (Eastern Cape Breton population)	Not Listed	Endangered	• Extends from the northern tip of Cape Breton to northeastern NS involve crossing the RA Study Area.
Atlantic salmon (Nova Scotia Southern Upland pop.)	Not Listed	Endangered	• Extends from northeastern NS (mainland) along the Atlantic and Fundy coasts up to Cape Split. Migration between freshwater rivers and the North Atlantic means the population may pass through the RA Study Area with their presence being short-lived.
Atlantic sturgeon (Maritimes population)	Not Listed	Threatened	• This population is found throughout the coastal waters of the Maritimes and extends out onto the shelf.

			• Adults migrate into estuaries and rivers in the autumn (August-October) or in the spring (May-June) prior to reproduction. Adults overwinter in deep channels and pools in rivers and estuaries downstream of the spawning sites. • Adults and large juveniles move both inwards and seawards in response to season and salinity. They can be found in the Bay of Fundy, along the coast of NS and offshore as far as Banquereau and Sable Island banks.
Basking shark (Atlantic population)	Not Listed	Special Concern	• Found throughout the North Atlantic with concentrations in coastal waters of Newfoundland and near the mouth of the Bay of Fundy. They have also been observed on Georges Bank, Northwest Channel, and the LaHave and Emerald Banks. • During the summer months found in surface waters, particularly the LaHave and Emerald Basins, where they may mate. • During the winter months, they are thought to be on the Scotian Slope in deeper waters. • Lives primarily in oceanic front locations where their main food source, zooplankton, is found. They have been shown to be sensitive to low frequency (25 to 200 Hz) pulses.
Cusk	Not Listed	Endangered	• Commonly found between the Gulf of Maine and southern Scotian Shelf. Most common along the southwestern shelf but have frequently been noted on the shelf as far north as Sable Island. • Within the RA Study Area, cusk can be found along the Scotian Shelf and Slope and prefer water depths from 200 to 600 m. The species feeds on invertebrates and inhabits benthic areas with hard and rocky substrates. • They can sometimes be found over gravel and mud substrates as well. Cusk spawn from May to August and mature at 5 - 7 years of

			age. The eggs and larvae are buoyant and float in the surface layers until they reach a size of 50 to 60 mm. • Larvae can be found over Georges and Roseway Basin as well as from Browns Bank to Sable Island Bank and along shelf edges.
Deepwater redfish (Northern population)	Not Listed	Threatened	• Closely associated with the seafloor and commonly found inhabiting waters 350 to 500 m in depth from Sable Island to northern Labrador. • Similar life histories to the Acadian redfish.
Lumpfish	Not Listed	Threatened	• Broadly distributed across the northwest Atlantic, the highest abundance estimates in the western Atlantic are in the waters near Newfoundland. • Associated with diverse habitats, distributed demersally and pelagically in the North Atlantic during different life stages and seasons. • At all stages, often observed avoiding drift by adhering to stones, lobster pots, seaweed or other objects using a pelvic adhesive disk. • Temperature preferences vary with stage; 4 to 12°C for larvae and young of the year, and near bottom, from -1.9°C to 12°C for both juveniles and adults.
Porbeagle shark	Not Listed	Endangered	• A pelagic shark species commonly inhabiting continental shelves and ocean basins at depths from 1 to 2,800 m. • Immature porbeagle sharks inhabit the Scotian Shelf with mature individuals migrating along the shelf edge to mating grounds located on the Grand Banks, off the mouth of the Gulf of St. Lawrence, and on Georges Bank during September to November.

			• Females leave the continental shelf in December, travelling to the Sargasso Sea to give birth in March and April. • Young-of-the-year porbeagles begin to show up in Atlantic Canadian waters in June and July.
Roundnose grenadier	Not Listed	Endangered	• Continental slope species with the deeper part of its geographic range not well surveyed. It is closely associated with the seafloor and commonly found inhabiting waters 400 to 1,200 m in depth but has been found in water depths of up to 2,600 m. • Prefers areas of low currents and can be found in aggregations in troughs, gorges and lower parts of the Scotian Slope. • Aggregations found around the North Atlantic Seamounts. Spawning is believed to occur year-round with peaks at different times for different areas. • Feeds in the water column on various prey items including copepods, amphipods, squid and small fish.
Shortfin mako	Not Listed	Endangered	• Global distribution between 60°N in the northeast Atlantic and 50°S in the southern hemisphere. It was listed as Endangered by COSEWIC in 2019. • A large relative of the white shark that appears to be more associated with waters warmer than 8°C. • In Atlantic Canada they appear to be most abundant along the edge of the Scotian Shelf where they are taken as by-catch by the longline industry. • Being a slow maturing species (males become mature at ~8 years and females at ~18 years of age) and having relatively small numbers of pups (4-25 with an average of 10-16) over a ~3-year reproductive cycle, their recruitment rate is seen as limited.

			• There is no information at present on the effects of OSW development on this species. However, the sensitivity of many sharks to EMFs and the fact that juveniles appear to move into the shallower waters of the coastal shelves in the North Atlantic suggests that there is a need for more information.
Smooth skate (Laurentian-Scotian population)	Not Listed	Special Concern	• Found from the Grand Banks to South Carolina. In Canadian waters and common from the Grand Banks along the Scotian Shelf and into the Gulf of Maine area. • Occupies depths ranging from 70 to 480 m, up to depths of 1400 m at temperatures ranging from -1.3 to 15.7°C. • Prefers soft mud bottom substrate consisting of silts and clay, but they have also been found on sand, shell hash, gravel and pebble substrates. • Primarily feed on small crustaceans and will eat fish once they reach later (largest) stages of their life. • A slow-growing, late-maturing and long-lived species capable of spawning year-round with no known peak in spawning rates. • Females mature at an average age of 11 years and lay an egg-capsule on the benthic substrate. • A young juvenile is developed in the egg capsule for 1 to 2 years before hatching.
Spiny dogfish (Atlantic population)	Not Listed	Special Concern	• Commonly found from the intertidal zone to the continental slope in water depths up to 730 m. • Highest concentration in Canadian waters is along the Scotian Shelf. The species follows a general seasonal migration between inshore waters during the summer-fall and offshore waters during the winter-spring.

			• Females mature at 15 years and mating occurs during the spring. After a gestation period of 18 to 24 months an average of six pups are born which are approximately 25 cm in length. Both mating and pupping are believed to occur along the edge of the Scotian Shelf in the spring. • Like other sharks, the species might be susceptible to EMFs associated with OSW developments.
Thorny skate	Not Listed	Special Concern	• Common throughout the North Atlantic and concentrated on the Grand Banks with some occurrence on the Scotian Shelf. • On the Scotian Shelf, the species has the highest concentrations on the Eastern Banks and the lower Bay of Fundy. • Occupies depths ranging from 20 to 1,400 m on substrates including sand, shell hash, gravel, pebbles and soft muds. • A slow growing species with maturity reached at an age of 11 years. • Peak spawning occurs in the fall and winter months.
White hake (Atlantic and Northern Gulf of St. Lawrence population)	Not Listed	Threatened	• White hake can be found on the continental slopes, ranging from southern Labrador and the Grand Banks to the Gulf of Maine. • Within the RA Study Area, white hake can be found in the LaHave and Emerald Basins as well as along the Shelf edge. • Larger fish generally occur in deeper waters whereas juveniles typically occupy shallow areas close to shore or over shallow offshore banks. • On the Scotian Shelf, individuals of all sizes tend to move shoreward in summer and disperse to deeper water in winter. • Maturity is reached from two to five years of age.

			• Spawning occurs during the summer months.
Winter skate (Eastern Scotian Shelf-Newfoundland population)	Not Listed	Endangered	• High concentrations have been found on Georges Bank and the offshore banks of the Scotian Shelf. Non-migratory spawning has been observed in the fall. Eggs / larvae may be present up to 22 months after spawning and are attached to the seafloor. Female winter skate have been captured extruding egg cases in the late summer-early fall west of Sable Island, suggesting a spawning area.

Note: Adapted from "Middle Scotian Shelf and Slope Strategic Environmental Assessment", Stantec, 2022.

Sources: Beguér-Pon *et al.*, 2015; Bowlby *et al.*, 2022, Campana *et al.*, 2003; COSEWIC, 2006a, 2006b, 2008a, 2009a, 2009b, 2010a, 2010b, 2010c, 2010d, 2011a, 2012a, 2012b, 2012c, 2012d; DFO 2011a, 2012a, 2013a, 2018a, 2018b, 2023a, 2023b, 2023c; Maguire and Lester, 2012; NOAA, 2024; OCEARCH, 2019; SARA 2023a, 2023b, 2024; Schmidt, 1923; Scott and Scott, 1988; Skomal *et al.*, 2017; Tucker, 1959; Wilson and Block, 2009.

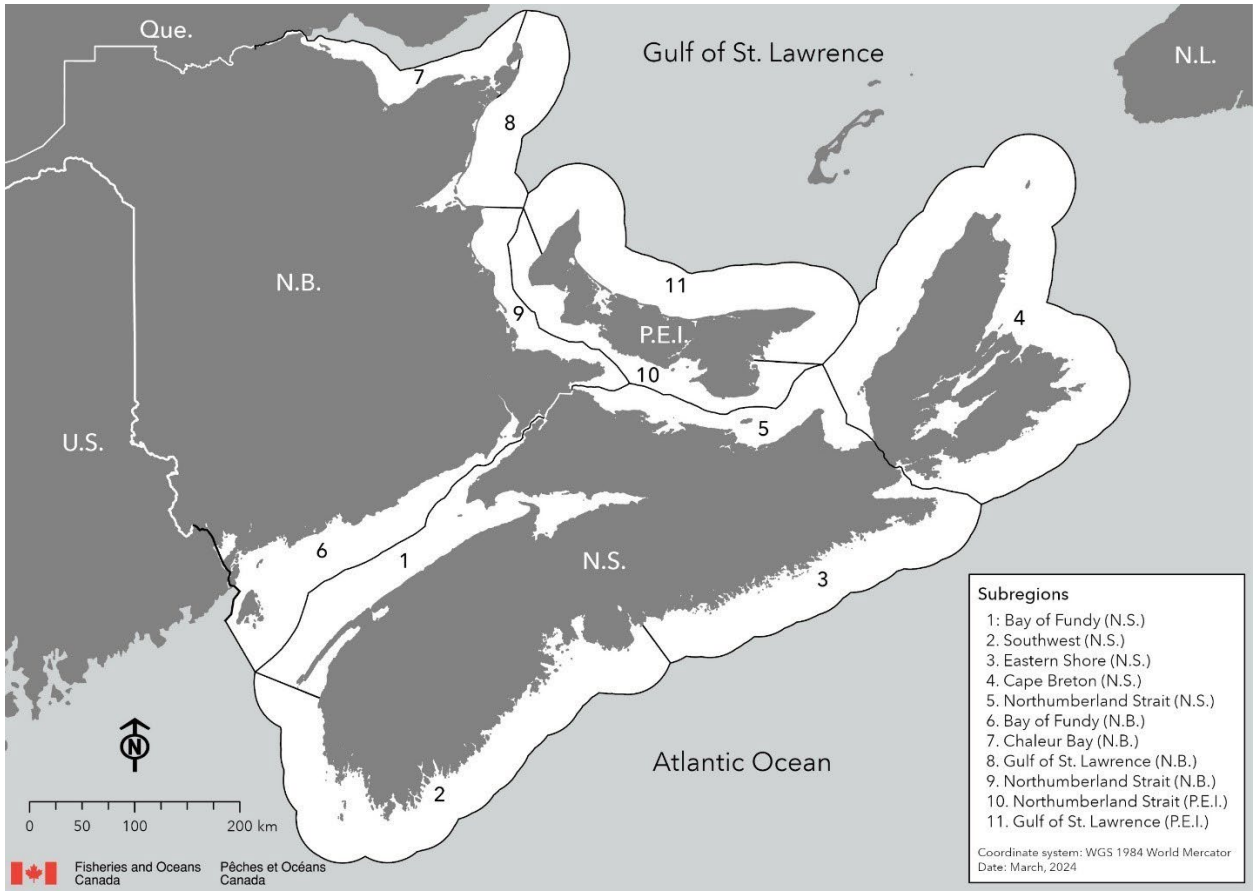
Appendix 4.2. Aquatic Invasive Species Observed in Nova Scotia

Species Name (Common)	Species Type	Known Locations in Nova Scotia
European mud scud	Amphipod	Bay of Fundy
Beach-flea	Amphipod	Bay of Fundy, Cape Breton, Southwest
Orange-striped green sea anemone	Anemone	Bay of Fundy, Southwest
European flat oyster	Bivalve shellfish	Southwest
Naval shipworm	Bivalve shellfish	Bay of Fundy, Cape Breton, Eastern Shore, Northumberland Strait, Southwest
Ribbed bryozoan	Bryozoan	Cape Breton, Eastern Shore, Northumberland Strait, Southwest
Coffin box bryozoan	Bryozoan	Bay of Fundy, Cape Breton, Eastern Shore, Northumberland Strait, Southwest
European green crab	Crab	Bay of Fundy, Cape Breton, Eastern Shore, Northumberland Strait, Southwest
Asian shore crab	Crab	Bay of Fundy, Southwest
Common sea slater	Isopod	Bay of Fundy, Southwest
Gribble	Isopod	Bay of Fundy, Cape Breton, Eastern Shore, Northumberland Strait, Southwest
Antithamnion sparsum	Seaweed	Eastern Shore, Southwest
Bonnemaison's hook weed	Seaweed	Bay of Fundy, Cape Breton, Eastern Shore, Northumberland Strait, Southwest
Dead man's fingers	Seaweed	Cape Breton, Eastern Shore, Northumberland Strait, Southwest
Oyster thief	Seaweed	Cape Breton, Eastern Shore, Southwest
Siphoned Japan weed	Seaweed	Cape Breton, Eastern Shore, Southwest

Dumont's tubular weed	Seaweed	Bay of Fundy, Cape Breton, Eastern Shore, Northumberland Strait, Southwest
Toothed wrack	Seaweed	Cape Breton, Eastern Shore, Northumberland Strait, Southwest
Clawed fork weed	Seaweed	Bay of Fundy, Cape Breton, Eastern Shore, Northumberland Strait, Southwest
Purple siphon weed	Seaweed	Northumberland Strait, Southwest
Orkney weed	Seaweed	Southwest
Twisted sea tubes	Seaweed	Bay of Fundy, Southwest
Japanese wireweed	Seaweed	Southwest
Japanese skeleton shrimp	Shrimp	Bay of Fundy, Cape Breton, Eastern Shore, Northumberland Strait, Southwest
Baltic prawn	Shrimp	Cape Breton, Eastern Shore, Southwest
Chameleon shrimp	Shrimp	Bay of Fundy, Southwest
Common periwinkle	Snail	Bay of Fundy, Cape Breton, Eastern Shore, Northumberland Strait, Southwest
Mouse ear snail	Snail	Bay of Fundy, Southwest
Yellow sun sponge	Sponge	Bay of Fundy, Eastern Shore, Southwest
European sea squirt	Tunicate	Bay of Fundy, Cape Breton, Southwest
Violet tunicate	Tunicate	Bay of Fundy, Cape Breton, Eastern Shore, Northumberland Strait, Southwest
Golden star tunicate	Tunicate	Bay of Fundy, Cape Breton, Eastern Shore, Northumberland Strait, Southwest
Vase tunicate	Tunicate	Bay of Fundy, Cape Breton, Eastern Shore, Northumberland Strait, Southwest
Pancake batter tunicate	Tunicate	Bay of Fundy, Southwest

Compound sea squirt	Tunicate	Bay of Fundy, Southwest, Cape Breton
Clubbed tunicate	Tunicate	Bay of Fundy, Cape Breton, Southwest
Convoluta convoluta	Worm	Southwest
Ragworm	Worm	Bay of Fundy, Cape Breton, Northumberland Strait
Limy tubeworm	Worm	Southwest
Source: DFO, 2024		

Appendix 4.3. Subregions of Atlantic Canada



Source: DFO.

Appendix 4.4. Summary of Marine Mammals Known to Occur in the RA Study Area

Species – Common Name	SARA Status (Canada, 2023)	COSEWIC Status (Canada, 2023)	Habitat and Distribution
Baleen whales			
Blue whale (Atlantic population)	Endangered	Endangered	• Coastal waters and open ocean: Eastern Scotian Shelf Canyons, particularly high sighting rates at The Gully/ The Emerald Basin. • They are frequently observed in waters with high abundance of krill. • Potential offshore foraging areas include the continental shelf edge. • Winter is the typical breeding period for blue whales in the western North Atlantic; the location of their breeding grounds is not well known. • Generally, undertake long, seasonal migrations from their wintering areas (equatorial latitudes) to summer feeding areas (temperate to subarctic latitudes), but some individuals remain in northern latitudes all year long. • Calving grounds are further south, possibly in the Mid-Atlantic Bight. • Present year-round (peak in spring, summer and fall).
Fin whale (Atlantic population)	Special Concern	Special Concern	• Present year-round (peak in summer). • Occurrence is associated with productive oceanic fronts and high densities of schooling fish and crustaceans (especially krill). • Present around a variety of bathymetric features from the continental shelf to deep canyons in the Gulf of St. Lawrence to shallow areas with high topographic relief in the Bay of Fundy; also common during the summer in the Gully canyon on the Scotian Shelf. • Prefer lower surface temperatures 6 - 8°C.

			• Present through the winter off the Atlantic coast of Canada, which suggests that courtship, mating and potentially calving occur here (a high number of fin whale mating calls heard in this area during the winter supports this). • Scotian Shelf suggested to be an important wintering area for this species; allowing for foraging outside of the typical feeding season.
Humpback whale (Western North Atlantic population)	Not on Schedule 1	Not at Risk	• Coastal with some observations offshore. • Movements regularly linked to prey availability (krill and small schooling fish). • Undertake a yearly migration from southern wintering/breeding/calving grounds (off the Caribbean coast of Venezuela) to northern feeding grounds in the summer (Gulf of Maine, Atlantic Canada, Greenland). • Singing and mating behavior has been observed in feeding grounds in the late summer, but most breeding happens near the Antilles. • Present seasonal (peak in summer).
Minke whale (North Atlantic subspecies)	N/A	Not at Risk	• Most abundant species of baleen whale in North Atlantic waters. • Feed on crustaceans (krill) and small schooling fish. • Mainly distributed over the continental shelf (especially Middle Bank), sometimes congregating in large groups. Also known to frequent the lower Bay of Fundy during the summer to feed. • Winter migration to southern Atlantic temperate and tropical waters in order to mate and have calves. • Present seasonal (summer and fall).
North Atlantic right whale	Endangered	Endangered	• This is a migratory species feeding primarily on dense aggregations of the copepod *Calanus finmarchicus.*

(CNSOPB Table)			• Mainly coastal waters: particularly Outer Bay of Fundy and Roseway Basin EBSA. • The adjacent Bay of Fundy (near Grand Manan Island) and Roseway Basin had been identified as critical habitat, but recently significant occurrences have been observed in the southern Gulf of St. Lawrence. These records studies suggest that North Atlantic right whales are going through a distribution shift, possibly because of changes in their preferred prey. Consequently, historical distribution may not be reflective of current and future distribution. • There is strong evidence that mating grounds for this species are the Gulf of Maine (November – January); possibly also in Roseway Basin (Sept-Oct). • Calving grounds are further south; near Florida, Georgia and possibly Carolinas. • There are transportation protections in place in the adjacent Laurentian Channel. • Present year-round (peak in summer and fall).
Sei whale (Atlantic population)	Under consideration for addition	Endangered	• Pelagic waters, while this species makes seasonal migrations from low to high latitudes, some individuals are found in Atlantic Canada year-round. • Sightings coincide with high concentrations of zooplankton (copepods) and small schooling fish (capelin and herring). • Calving occurs in warmer waters in winter; no clear breeding/calving aggregations have been identified for this species. • Common both along the Scotian Shelf and in the Bay of Fundy; Gulf of St. Lawrence does not appear to be a key habitat for this species. • Spatially associated with major mixing zones and eddies formed at oceanographic fronts, topographic features and major ocean currents. • Presence seasonal (peak in summer).

Toothed whales			
Beluga whale (St. Lawrence Estuary population)	Endangered	Endangered	• Mainly located in St. Lawrence Estuary (high site fidelity), though sometimes sighted close to NS and in the Bay of Fundy; mating and calving grounds are located in the St. Lawrence Estuary. • Eats a wide variety of fish and invertebrates. • Low genetic diversity. • Present seasonally (summer).
Blainville's beaked whale	N/A	Not at Risk	• Deep waters. • There has been one sighting by DFO in The Gully. • Distribution around Atlantic Canada is poorly understood; appear to reach their norther range limit in the Western North Atlantic. • Present seasonally.
Cuvier's beaked whale	N/A	Not at Risk	• Deep water. • Main prey species are squid and fish. • Distribution around Atlantic Canada is poorly understood; low but consistent presence in the deeper waters of the Gully, the Scotian Shelf, the Grand Banks and off eastern Newfoundland. • Present year-round.
False killer whale	N/A	Not at Risk	• Offshore tropical and subtropical deep waters (greater than 1000 m). • There is a Gulf of Mexico population that may occasionally follow the Gulf Stream north foraging for fish and squid. • This species routinely occurs in the western North Atlantic.

			• Present seasonally (summer).
Killer whale (Northwest Atlantic and Eastern Arctic population)	Not on Schedule 1, under consideration for addition	Special Concern	• Inshore waters. • Usually in mixed family groups. • The specific habitat requirements for the Northwest Atlantic population are not well known. • Feed on both fish and marine mammals, but dietary preferences and related movement patterns remain unknown. • Known to interact with fishing gear/boats; recorded entanglements. • Relatively few sightings on Scotian Shelf compared to Newfoundland and Labrador. • Present seasonally in summer.
Long-finned pilot whale	N/A	Not at Risk	• Can be found in both nearshore and pelagic waters. • Travel in large groups foraging for squid. • Typically eat squid, but also some fish (Atlantic cod, Greenland turbot, Atlantic mackerel, etc.). • Known to inhabit the shallower portions of the Gully and off the coast of northern Cape Breton. • Calves present in Cape Breton population; no information found on specific breeding/calving grounds. • Present year-round.
Northern bottlenose whale (Scotian shelf population)	Endangered	Endangered	• Only found in the North Atlantic.

			• Deep waters: the three canyons on the eastern Scotian Shelf, including The Gully, Shortland Canyon, and the Haldimand Canyon, have been designated Critical Habitat. • Can remain submerged for over an hour foraging for squid and small schooling fish. • Peak mating season is in July and August in the Gully; calves are also born in the Gully at around the same time (12-month gestation time). • Present year-round (peak in spring and summer).
Pygmy sperm whale	N/A	Not at Risk	• Deep water. • Main prey species are squid and octopus. • Prefers temperate and tropical waters. • Difficult to physically differentiate from the dwarf sperm whale.. • Present seasonally.
Short-finned pilot whale	N/A	Not at Risk	• Deep water preferred, specifically warmer tropical or temperate waters. • Northern-most range is New Jersey; rarely travel more northward. • Main prey species is squid • Important calving ground off the coast of Tenerife, which is predicted breeding ground as well. • Present seasonally.
Sperm whale	N/A	Not at Risk	• Deep water, mainly the shelf edge and Gully. • Main prey species are any size of squid. • Individuals seen around the Scotian Shelf region are almost exclusively males.

			• Present year-round.
Sowerby's beaked whale	Special Concern	Special Concern	• Deep waters along the continental shelf edge and slope, particularly the Eastern Scotian Shelf Canyons (Gully, Shortland and Haldimand canyons). • High sighting rates in the Gully and the Scotian Slope. • Sighting rates in Canadian waters have been increasing since the early 2000s; suggesting increased use of submarine canyons by this species. • Distribution around Atlantic Canada is poorly understood; breeding and calving areas are not known. • Known to frequent waters near southern NS, off Georges Bank and just south of the Fundian Channel. • Present year-round.
True's beaked whale	N/A	Not at Risk	• Temperate waters. • There have been two strandings in the Gulf of St. Lawrence and southern Newfoundland. • Virtually nothing is known about this species' natural history. • Distribution around Atlantic Canada is poorly understood; appear to reach their norther range limit in the Western North Atlantic. • Present seasonally.
Atlantic spotted dolphin	N/A	N/A	• Warm, temperate areas. • Main prey species are fish and squid. • Northernmost point of their range is off the coast of New England but can potentially move into the lower Bay of Fundy. • Present seasonally (summer and fall).

Atlantic white-sided dolphin	N/A	Not at Risk	• Outer continental shelf and slope. • Span from Georges Bank to the lower Bay of Fundy from June – September; may represent multiple genetically distinct populations. • Only found in the North Atlantic; known to inhabit the Gully and live almost exclusively in the canyon of the Gully, not the shelf around it. • Feed on squid and fish. • Often associate with other toothed and baleen whale species. • Present year-round.
Common bottlenose dolphin	N/A	Not at Risk	• Coastal waters and over continental shelves. • In areas with concentrations of fish and squid. • Occasionally sighted in Gully. • Individuals around NS are believed to be of the offshore morphotype. • Present seasonally.
Harbour porpoise (Northwest Atlantic population)	Not on Schedule 1	Special Concern	• Shallow coastal waters and continental shelves; occasionally in deeper waters. • Range from Bay of Fundy to Baffin Island. • In the Bay of Fundy, feed primarily on juvenile Atlantic herring, and some groundfish. • Breeding season occurs in late spring/early summer. • Present year-round.
Risso's dolphin	N/A	Not at Risk	• Found in deep waters, along the continental shelf and the continental slope. • In areas with concentrations of squid.

			• Present seasonally.
Short-beaked common dolphin	N/A	Not at Risk	• Range from nearshore to far offshore. • They are usually associated with warmer water temperatures. • They are found in areas with concentrated schools of small fish and squid. • Breeding and calving periods both occur in mid-summer. • Known to inhabit the Gully; mainly in deeper waters to the south of the canyon. • Can travel in large groups of 200+ individuals. • Present seasonally (summer and fall).
Striped dolphin	N/A	Not at Risk	• Offshore. • In areas with concentrations of fish and squid. • Occasionally sighted in Gully; prefer warmer and deeper waters. • Present seasonally (summer).
White-beaked dolphin	N/A	Not at Risk	• Inshore, offshore and along the continental shelf. • More northerly distribution than the closely related Atlantic white-sided dolphin but can be found from Bay of Fundy to northern Cape Breton. • Present year-round.
Seals (Pinnipeds)			
Hooded seal	N/A	Not at Risk	• Offshore, ice-breeding species • Not usually found south of the Gulf of St. Lawrence but more common on the Atlantic coast of NS (particularly Sable Island) in 1990s.

			• Typically, in poor health this far outside their main range. • Feed on a variety of prey, including pelagic fish; migrating more northward in search of food due to changes in water temperature due to climate change. • Breeding and pupping grounds in the Gulf of St. Lawrence and off Newfoundland; peak pupping period occurs in March. • Present seasonally (peak in winter).
Ringed seal	Not on Schedule 1, under consideration for addition	Special concern	• Circumpolar distribution, with occasional vagrant sightings south of the seasonal ice zone. • Its life cycle is closely linked to available sea ice. • Occasionally observed on Sable Island. • Prey on crustaceans and fish, predominantly Arctic cod. • Rely on sea ice for breeding, and specifically snow-covered sea ice for pupping; breeding occurs during spring and early summer. • Present seasonally.
Harp seal	N/A	N/A	• Not usually found south of the Gulf of St. Lawrence but more common along the Atlantic coast of NS (particularly Sable Island) in the 1990s. • Typically, in poor health this far outside their main range. • Diet of individuals around Newfoundland consists mainly of polar cod and capelin. • Present year-round.
Grey seal	N/A	Not at Risk	• Inhabit both coastal and offshore waters of the continental shelves. • Common around Sable Island; this island is a main breeding area for this species.

			• Also breed on nearshore islands off Cape Breton and along the Eastern Shore of NS. • Forage extensively on the offshore banks of the Scotian Shelf, particularly Sable/Western Bank. • Generalist predators: eat a wide variety of animals, but Sand Lance is most common. • Present year-round.
Harbour seal (Atlantic and Eastern Arctic subspecies)	N/A	Not at Risk	• Breeding ground is Sable Island. • Normally associated with coastal areas, isolated sandy beaches, small islets, rocks and reefs exposed at low tide; have been observed on Sable Island, along the coast of NS, Cape Breton, and in the Bay of Fundy. • Diet generalists; common prey species for individuals in Nova Scotian waters are Atlantic herring, squid, Atlantic cod, pollock and hake. • Present year-round.

Note: Adapted from "Middle Scotian Shelf and Slope Strategic Environmental Assessment", Stantec, 2022.

Sources: Bartha *et al.*, 2011; Beauchamp *et al.*, 2009; Bowen *et al.*, 2003; Bowen and Harrison, 2007; Breeze *et al.*, 2002; Cole *et al.*, 2013; COSEWIC, 2006c, 2008b, 2019b, 2019c, 2019d, 2019e; Davis *et al.*, 1998, DFO, 1998, 2011a, 2011b, 2012b, 2014, 2016, 2017, 2018c, 2019; Duengen *et al.* 2022; Feyrer *et al.*, 2024; Gowans and Whitehead, 1995; Hammill *et al.*, 2010; Ingram *et al.*, 2007; Jourdain *et al.*, 2019; Keller *et al.*, 2012; Kennedy *et al.*, 2013; Lawson and Stenson, 1995; Lawson and Stevens, 2013; Lesage *et al.*, 2017; Lucas *et al.*, 2003; McAlpine *et al.*, 2024; NOAA, 2007b, 2014, 2015, 2016a, 2016b, 2017, 2020a, 2020b, 2020c, 2020d, 2020e, 2022a, 2022b; Olson, 2009; Ottensmeyer and Whitehead, 2003; Ramp *et al.*, 2024; Servidio *et al.*, 2019; Vacquié-Garcia *et al.*, 2024; Waring *et al.*, 2011; Westgate and Read, 2007; Whitehead *et al.*, 1992; Wingfield *et al.*, 2022; Zwamborn and Whitehead, 2016.

Appendix 4.5. Sea Turtles Known to Occur in the RA Study Area

Species – Common Name	SARA Status (Canada, 2023)	COSEWIC Status (Canada, 2023)	Habitat and Distribution
Leatherback sea turtle (Atlantic population)	Endangered	Endangered	The Scotian Shelf is a high-use foraging area with important prey species (jellyfish and salp) concentrated along the slope. The Scotian Slope is an important migratory route, particularly the southwestern section and the slope off Georges Bank. St. Ann's Bank and Laurentian Channel are also important summer feeding habitats. Important habitat in the region is defined as the southeastern Gulf of St. Lawrence and waters south and east of the Burin Peninsula, Newfoundland. Present seasonally (June to December).
Loggerhead sea turtle	Endangered	Endangered	Offshore waters and along the shelf break. Distribution is thermally limited by available warm sea surface (> 18°C). Individuals migrate between their southern nesting areas (US and Mexico) to their northern foraging areas (Atlantic Canada). Juveniles are caught as bycatch in the surface longline fishery. Individuals spend most of their time in the top 5 m of the water column to feed mostly on sea jellies and salps. Present seasonally (June to December).
Kemp's Ridley sea turtle	N/A	N/A	Considered most endangered sea turtle species and only found in the Atlantic Ocean

			Adults are usually found in the Gulf of Mexico while juveniles forage on algae off NS in the summer months. Present seasonally (summer).
Green sea turtle	N/A	N/A	Found in warm waters in the Atlantic, Pacific and Indian Oceans. Adults usually found in tropics and generally forage in shallow, nearshore waters. Present seasonally (summer).

Note: Adapted from "Middle Scotian Shelf and Slope Strategic Environmental Assessment", Stantec, 2022.

Sources: COSEWIC, 2010e, 2012e; DFO, 2006b, 2011a, 2020b; James *et al*., 2004, 2005, 2006; NOAA, 2013a, 2013b; Shell Canada Limited, 2013.

Appendix. 4.6. Ecologically and Biologically Significant Areas within the RA Study Area

56 of the combined offshore and inshore EBSAs fall either fully or partially within the RA Study Area.

Appendix 4.6A. Ecologically and Biologically Significant Areas located offshore either partially or fully within the RA Study Area

Title of Offshore EBSA	**Summary of Area**
Jordan Basin and the Rock Garden	• At least three species of algae, e.g., *Eudesme virescens*, *Desmotrichium undulatum*, and *Myrionema strangulans,* have only been recorded here and nowhere else in Bay of Fundy.
Canadian portion of Georges Bank	• Supports high primary productivity and important spawning and nursery habitats for groundfish, e.g., Atlantic cod, haddock, cusk, Atlantic herring, and hosts high sea scallop abundance, high larval fish genus richness, unique benthic community, e.g., tube worm. It is also a porbeagle shark *(Lamna nasus)* mating ground and an important seabird habitat.
Northeast Channel	• Supports high densities of large and sensitive gorgonian corals in the region, high primary productivity, important seabird habitat and cusk habitat.
Browns Bank	• High primary productivity, unique and sensitive benthic community (Rock Garden), important for groundfish, e.g. cusk, white hake, redfish, spiny dogfish, high fish biomass, high fish species diversity, high invertebrate species diversity, high larval fish genus richness, high small invertebrate species richness and important seabird habitat.
Roseway Basin	• Supports endangered North Atlantic right whale Critical Habitat, high copepod biomass, important for groundfish, e.g., redfish nursery, smooth skate, American plaice, Atlantic cod, cusk, high fish biomass, high fish species diversity, important seabird habitat, moraine feature and pockmarks (possible chemosynthetic communities).

Emerald Basin and the Scotian Gulf	• Supports unique benthic community of Russian hat sponges, unique temperature and salinity regime, high zooplankton biomass in basin, important for groundfish, e.g. silver hake, pollock, white hake, high fish and invertebrate biomass, high fish species diversity, high invertebrate species diversity, important for Northern sandlance and shortfin squid, pockmarks in basin (possible chemosynthetic communities), important seabird habitat, very low natural disturbance.
Emerald Western Sable Island Bank Complex	• Supports important habitat for groundfish, e.g. haddock spawning and nursery area, Atlantic cod spawning area, winter skate, silver hake, Atlantic halibut. • Additionally, this complex supports Atlantic herring spawning, high larval fish abundance and diversity, commercial and non-commercial invertebrates, high fish and invertebrate biomass, high fish species diversity, high invertebrate species diversity, important seabird habitat and Western Gully area of potential significance to cetaceans.
Sable Island Shoals	• Supports unique coastal habitat in the offshore as well as the world's largest grey seal breeding colony, is a nursery area for many fishes, an area of high primary productivity, as well as an important seabird habitat, e.g., plunge diving piscivores, shallow diving piscivores, shallow pursuit generalists. • Supports high invertebrate biomass, high invertebrate species diversity, and high fish species diversity.
Eastern Scotian Shelf Canyons	• Supports unique submarine canyon ecosystems (The Gully is largest off eastern North America) which are critical habitat for Endangered northern bottlenose whale and is important for other cetaceans, e.g., blue whale, Sowerby's beaked whale. • Supports diverse and sensitive benthic communities (diverse and abundant coldwater corals), as well as high fish and invertebrate species diversity, high fish and invertebrate biomass, and is important for groundfish, e.g., Atlantic cod, Atlantic halibut, redfish, smooth skate, white hake, and seabird habitat.

Middle Bank	• Supports important habitat for groundfish, e.g., Atlantic cod spawning and nursery area, high larval fish genus richness, high invertebrate species diversity, high small fish species richness, high invertebrate biomass, and important seabird habitat.
Canso Bank and Canso Basin	• Supports high fish species diversity, high larval fish genus richness, high invertebrate species diversity and biomass including commercial species, e.g., northern shrimp, snow crab and non-commercial invertebrates. • Supports high primary productivity and is important habitat for groundfish, e.g., American plaice, and northern sandlance, as well as important seabird habitat.
Misaine Bank	• Supports high fish and invertebrate species diversity and biomass, and is important for commercial invertebrates, e.g., northern shrimp, snow crab, and groundfish, e.g., Atlantic cod, American plaice, thorny skate, as well as northern sandlance and provides important seabird habitat, e.g., pursuit diving piscivores.
Eastern Shoal	• Supports unique, large, shallow sand body important for groundfish, e.g., Atlantic cod, American plaice, winter skate, thorny skate, as well as northern sandlance and commercial invertebrates, e.g., Atlantic surf clams, sea scallops, quahogs, creating high fish species diversity, high invertebrate species diversity, and important seabird habitat.
Stone Fence	• Supports unique and sensitive benthic community, e.g., *Lophelia pertusa* reef.
Laurentian Channel	• Supports high zooplankton biomass and is important habitat for groundfish, e.g., overwintering area for Atlantic cod, redfish, white hake, abundant redfish larvae, high fish biomass, northern sandlance, and is a migratory route for groundfish, cetaceans and leatherback sea turtles. It also provides habitat for sensitive benthic communities, e.g., sea pen fields, and supports high invertebrate species diversity.
St. Anns Bank	• Supports high primary productivity, high larval fish genus richness, and provides important habitat for groundfish, e.g., Atlantic cod, Atlantic wolffish, creating high fish and invertebrate species

	diversity, high small fish species richness, and is located on a migratory route for groundfish, cetaceans and leatherback sea turtles. • Supports sensitive benthic communities, e.g., sea pen fields, and provides important habitat for seabirds, e.g., plunge diving piscivores.
Laurentian Channel Slope, including Fan Cold Seep Communities	• Supports high primary productivity, high zooplankton biomass, and provides important habitat for groundfish, e.g., overwintering area for Atlantic cod, redfish, white hake, as well as abundant redfish larvae, northern sandlance. It is also a migratory route for groundfish, cetaceans, leatherback sea turtles and supports sensitive benthic communities, e.g., sea pen fields, providing high invertebrate species diversity.
Scotian Slope	• Supports high primary productivity, high fish species diversity, high small fish and small invertebrate species richness, is important habitat for groundfish, e.g., cusk, redfish, white hake, thorny skate, Atlantic halibut, and is a migratory route for cetaceans and large pelagic fishes, as well as providing important habitat for seabirds and unique, sensitive benthic communities
Sources: Allard *et al.*, 2014; Breeze, 2004; Breeze *et al.*, 1997; BSC, 2013; Bundy *et al.* 2014; Buzeta, 2014; Davis and Browne, 1996; DFO, 2002, 2009, 2011c, 2011e, 2012c, 2013b; Doherty and Horsman, 2007; Environment Canada, 2012; Gibson and Bowlby, 2009; Green, 2011; Hastings *et al.*, 2014; Horsman *et al.*, 2011; Hudon, 1994; IBA Canada, 2014; King *et al.*, 2016; Koeller *et al.*, 2007; Lane and Associates, 1992; Lidgard, 2007; MacKinnon *et al.*, 1994; MacLean *et al.*, 2009; Mills and Laviolette, 2011; Nocera, 2000; Parks Canada, 2010; Schaefer *et al.* 2004; Tremblay *et al.*, 2009; Waters and Clark, 2005; Zwanenburg *et al.*, 2002.	

Appendix 4.6B. Ecologically and Biologically Significant Areas located inshore either partially or fully within the RA Study Area

Title of Inshore EBSA	Summary of Area
Southern fringe of the Laurentian Channel	• Important feeding, migration, shelter, and overwintering area for many fish species, e.g., Atlantic herring, Atlantic cod (Endangered – COSEWIC), capelin, white barracudina, spiny dogfish, pollock, and silver and white hake.
St. Georges Bay	• Contains the largest array and abundance of meroplanktonic species in the Gulf and high densities of several pelagic fish species, e.g., alewife, spiny dogfish, Atlantic herring, mackerel. • Supports the principal spawning, rearing, and feeding area for white hake as well as an important winter haul-out of grey seals.
Western Cape Breton	• Supports the largest array of meroplanktonic specie, e.g., witch flounder, Atlantic cod (Endangered – COSEWIC), winter flounder, American plaice, yellowtail flounder, decapod crustaceans, as well as the highest meroplankton abundance (eggs and larvae) in the Gulf. • Significant area for marine mammals, e.g., grey seal, hooded seal, harp seal, striped dolphin, Northern Atlantic right whale and pilot whale.
Aspy Bay	• Significant areas of salt marsh and eelgrass habitats, great blue heron colony, and at-sea aggregations of seabirds and is one of three main whale watching areas in Sydney Bight, suggesting frequent marine mammal sightings. • The northern headland (Cape North) hosts globally significant numbers of the terrestrial songbirds, e.g., Bicknell's thrush. • North Aspy River watershed supports spawning Atlantic salmon.

Big Glace Bay	• Important fall migration habitat for seabird species, e.g., American black duck, Canada geese, common goldeneye, bufflehead, and nesting habitat for common tern, willet and piping plover.
Bird Islands	• Important habitat for colonial marine birds, including the largest great cormorant colony in North America. • Highest concentrations of three provincially rare bird species in NS (black-legged kittiwake, razorbill and Atlantic puffin) as well as significant colonies of herring gull, great black-backed gull and terns. • Important nursery habitat for several fish and invertebrate species, e.g., juvenile Atlantic cod (Endangered – COSEWIC), white hake (Threatened – COSEWIC). • Grey seal haul-out zones in the Sydney Bight.
The Canso Ledges	• Habitat for a high abundance and diversity of fish species, e.g., Atlantic wolffish (Special Concern – SARA), thorny skate (Special Concern – COSEWIC), winter skate (Threatened – COSEWIC) and herring. • Once hosted the largest inshore stock of Atlantic cod (Endangered –COSEWIC) along the Eastern Shore of NS.
Mahone Bay	• Habitat for high abundances of sand lance species, Atlantic tomcod, northern pipefish and northern shrimp.
St. Margaret's Bay	• Supports significant populations of highly productive macroalgae and northern shrimp, representing one of three known coastal occurrences of this predominantly offshore shrimp species in NS.
Port Joli and Surrounding Areas	• Area of significance for migratory waterfowl. • Supports Piping Plover (Endangered – SARA) critical habitat beaches, such as Lockeport Harbour, Port Mouton, as well as lagoon areas behind the barrier beaches in St. Catherine’s River Bay and Little Port Joli.

Green Point to Ram Island	• Area of significance for common eider moulting season. • Supports significant at-sea aggregations of several seabird functional guilds.
Musquodoboit Harbour and Surrounding Areas	• Inlets support significant areas of salt marsh and eelgrass habitat and host significant aggregations of seabirds, e.g., Canada geese, American black duck, common eider, goldeneye spp., merganser spp., purple sandpiper and green-winged teal. • Martinique Beach is critical habitat for the piping plover (Endangered – SARA).
Outer Halifax Harbour	• Supports important wintering and staging area for migrating waterfowl and hosts significant aggregations of common eider, American black duck, goldeneye spp., scoter spp. and merganser spp., as well as herring gull and great black-backed gull colonies. • Mouth of the harbour provides important inshore habitat for bluefin tuna (Endangered – COSEWIC).
Sambro Ledges	• Major overwintering grounds for herring in NS and has been identified as an important feeding area for whales, e.g., fin whale (Special Concern – COSEWIC) and dolphins.
Indian Bay - Lingan Bay	• Highly productive coastal lagoon and salt marsh with extensive eelgrass beds of local, perhaps regional, significance that serves as a key nursery habitat for juvenile fish.
Ingonish Bays	• Supports globally significant number of great cormorant nests and significant aggregations of merganser spp., great black-backed gull and herring gull, as well as spawning Atlantic salmon (Endangered – COSEWIC) and areas for marine mammals to breed and feed.
Morien Bay	• Globally significant numbers of great cormorant nests and the fourth largest of the five known colonies of black-legged kittiwake in NS. • Port Morien Beach is one of the most important shorebird areas in Cape Breton, and within the Atlantic coast sub-region, in terms of numbers and species diversity, e.g., 23 shorebird species, including Endangered (SARA) Red Knot *rufa* ssp.

Cabot Strait (between Cape North and St. Paul Island)	• Supports one of the most species-rich areas across the region with significant seasonal migrations for fish, squid, turtles, whales, and other marine organisms.
Western Sydney Bight	• Supports one of the most species-rich areas across the region.
Southwest Scotian Shelf	• Supports the highest abundances of American lobster as well as a diverse array of invertebrate species, many of which would typically be found to thrive at more southerly latitudes. • Supports several Atlantic herring spawning areas, e.g., Trinity Ledge, Spectacle Buoy, Seal Island and German Bank.
Cape Sable Island	• During migration, the eastern and southern shores of Cape Sable Island host globally significant numbers of semipalmated sandpiper, short-billed dowitcher and Atlantic brant during migration. • Nationally significant numbers of willet and piping plover (Endangered – SARA) are also found here during the migratory and nesting seasons.
Bon Portage Island	• Migratory stopover site and refuge for several significant aggregations of waterfowl, shorebird, songbird and raptor species. • Supports significant numbers of Leach's storm-petrel, great black-backed gull, herring gull and great blue heron, as well as the only black-crowned night heron colony in the province. Additionally, a snowy egret pair has been recorded on the island during nesting season, which is a nationally rare occurrence.
Lobster Bay Area	• Highly productive area for American lobster.
Scatarie Island	• Noted for its diversity of fauna and habitats, including coastal wetland complexes and heath barrens and has been known to host nationally significant numbers of Bicknell's thrush and at-sea aggregations of several seabird functional guilds.
Lockeport Harbour	• High concentration of lobsters that are potentially reproducing.

Medway Harbour Area	• Important area for waterfowl, e.g., Critical Habitat for piping plover (Endangered – SARA) and purple sandpiper.
Tobacco Island	• Supports significant colonies of waterfowl such as common eider and great blue heron and aggregations of merganser spp., goldeneye spp., scoter spp. and common eider.
Country Harbour Islands	• Supports significant at-sea aggregations of several seabird functional guilds, e.g., roseate terns (Endangered – SARA), Leach's storm-petrel, scoter spp., goldeneye spp., common eider, merganser spp. and American black duck.
Sugar Harbour Islands	• Supports significant colonies of waterfowl, e.g., common eider, great black-backed gull, herring gull, merganser spp., goldeneye spp., scoter spp., common eider and purple sandpiper, as well as relatively moderate roseate tern (Endangered – SARA) numbers.
Point Michaud and Basque Islands	• Hosts globally significant numbers of nesting great cormorant, as well as relatively significant populations of great black-backed gull, purple sandpiper and overwintering common eider.
Guyon Island	• Supports significant colonies of great black-backed gull, tern spp. and significant aggregations of overwintering common eider.
Green Island	• Hosts a rare colony of black-legged kittiwake. • Supports significant colonies of great black-backed gull, tern spp. and significant aggregations of overwintering common eider.
Pearl Island	• Hosts colonies of Atlantic puffin, razorbill and black-legged kittiwake, as well as great black-backed gull, scoter spp. and common eider.
LaHave Islands and Surrounding Areas	• Supports significant aggregations of several waterfowl species, e.g., scaup spp., goldeneye spp., Common eider, American black duck, merganser spp. and scoter spp.
Eastern Shore Archipelago	• Supports significant populations of waterfowl during migration periods, e.g., globally significant population of the Atlantic subspecies of common eider.

Portnov Islands	• Supports globally significant numbers of nesting Great Cormorant, colonies of great black-backed gull, and several significant aggregations of overwintering common eider.
Outer Tusket Islands	• Supports significant at-sea aggregations of several seabird colonies, e.g., common eider, great black-backed gull and herring gull, and represents one of the few locations where the Atlantic puffin breed in NS. • Noddy Island and Flat Island accounted for two of five inshore grey seal breeding colonies.
Rocks off Cape Fourchu	• Supports globally significant numbers of nesting great cormorant, as well as several significant aggregations of overwintering common eider.
Sources: Allard *et al.*, 2014; BSC, 2013; Breeze *et al.*, 1997; Bundy *et al.* 2014; Buzeta, 2014; Clark, 2006; Davis and Browne, 1996b; DFO, 2002b, 2009, 2011c, 2011e, 2012; Doherty and Horsman, 2007; Environment Canada, 2012; Gibson and Bowlby, 2009; Green, 2011; Harris, 2006; Hastings *et al.*, 2014; Horsman *et al.*, 2011; Hudon, 1994; IBA Canada, 2014; King *et al.*, 2016; Koeller *et al.*, 2007; Lane and Associates, 1992; Lidgard, 2007; MacKinnon *et al.*, 1994; MacLean *et al.*, 2009; McCullough *et al.*, 2005; Mills and Laviolette, 2011; Nocera, 2000; Parks Canada, 2010; RSIS, 2012; Schaefer *et al.* 2004; Tremblay *et al.*, 2009; Waters and Clark, 2005; Zwanenburg *et al.*, 2002.	

Appendix 10.1 List of Committee Recommendations

Theme	Theme Number	Recommendation
Existing knowledge, gaps and necessary research	T1-1	Develop a Scotian Shelf Collaborative Research Initiative (SSCRI)
	T1-2	Fund *Mi'kmaw Ecological Knowledge Studies* (MEKS)
	T1-3	Create a shared repository of data and sources
	T1-4	Provide support for ongoing research in federal departments on modelling and marine spatial planning
	T1-5	Provide funding to Mi'kmaw organizations for research on adaptive management
	T1-6	Prioritize and expand the general collection of environmental data, especially in the vicinity of the PDAs, including the bathymetric and substrate characteristics, bird behaviour and habitat use, and marine mammal behaviour and habitat use within the RA Study Area
	T1-7	Open discussions with the State of Maine to contribute to and develop a mutually supportive research agenda associated with their proposed floating OSW test site
	T1-8	Establish Participant Funding to last at least five years
Socio-economic feasibility and consequences	T2-1	Establish a Port Advisory Group
	T2-2	Undertake Class D (conceptual design) cost estimate and model impacts
	T2-3	Adopt a regional/national planning approach for the provincial OSW Roadmap
	T2-4	Initiate socio-economic studies for key communities
	T2-5	Engage the Departments of Education and Early Childhood Development and Skills, Labour and Immigration in the evolution of the OSW Roadmap
	T2-6	Establish targeted immigration and recruitment programs to attract foreign specialists
	T2-7	Compile a database on GBA+ research specific to the OSW industry
Project development	T3-1	The establishment of a 25 km coastal buffer zone
	T3-2	The adoption of Tier 1 and Tier 2 Proposed Development Areas (PDAs)
	T3-3(a-f)	Development of Bid criteria and bidder pre-qualification
	T3-4	Development of guidelines regarding in-field personnel transfers
	T3-5	Requirement for adequate security related to abandonment and decommissioning activities

	T3-6	The potential reduction of existing abandoned pipeline corridor exclusion zone
Coexistence and compensation	T4-1	The establishment of a compensation regime to address economic loss caused by exclusion based on the principles set out in T4-1(a) to T4-1(d)
	T4-2	The development of a compensation guideline based on the principles set out in T4-2(a) to T4-2(g)
	T4-3	The establishment of an industry wide funding model based on equitable distribution of liability among OSW leaseholders
	T4-4	The establishment of participation funding to support fishers in implementing these recommendations
Cumulative effects	T5-1	Recognise that responsibility for cumulative effects is shared and tiered
	T5-2	Prepare guidelines and data sources for developers
Governance	T6-1	CNSOER to prepare best practice guidelines and guidance documents for the OSW industry
	T6-2	Recommend First Nation representation on CNSOER Board
	T6-3	Recommend that project-specific impact assessments for OSW projects are required
	T6-4	Consider requiring all vessels to have an approved vessel tracking system installed and operating while in the RA Study Area
	T6-5	DFO to review their management and regulatory processes
Education and training	T7-1	Nova Scotia Department of Education to work with elementary, middle and high schools, colleges and universities to develop curriculum, educational and training programs related to OSW and other renewables
	T7-2	Nova Scotia Department of Education to develop curriculum for new upskilling, retraining and micro-credential programs to enable the current marine workforce to transition into new roles in support of OSW development