REGIONAL ASSESSMENT OF OFFSHORE WIND DEVELOPMENT IN NOVA SCOTIA

FINAL REPORT

JANUARY 2025

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Final Report for the Regional Assessment for Offshore Wind Development in Nova Scotia

Prepared by: The Regional Assessment Committee Established by the Federal Minister of Environment and Climate Change

January 23, 2025

Letter to Ministers

January 23, 2025

The Honourable Steven Guilbeault
Minister of Environment and Climate Change Canada

The Honourable Jonathan Wilkinson
Minister of Energy and Natural Resources

The Honourable Trevor Boudreau
Minister of Energy

Dear Ministers Guilbeault and Wilkinson and Boudreau,

The Committee for the Regional Assessment of Offshore Wind Development in Nova Scotia has completed our regional assessment report in accordance with our mandate issued on March 23, 2023. Herein, the Committee submits our final report for consideration by the Government of Canada and the Government of Nova Scotia. The Committee's report is based on extensive engagement completed during 2023 and 2024, research, and expert input provided throughout the regional assessment process up to the end of the public comment period for the draft report on December 20, 2024.

Sincerely
The Committee for the Regional Assessment of Offshore Wind Development in Nova Scotia
James Wooder (Co-Chair)
Ann Wilkie (Co-Chair)
Lorraine Whitman
Graham Daborn
Stephen Parsons

Acknowledgements

We would like to begin by acknowledging that our lives, our work and this Regional Assessment take place in Mi'kma'ki, the ancestral and unceded territory including land, water and air, of the Mi'kmaw people. As visitors, multi-generational settlers and Indigenous people on these territories, we acknowledge that we are all Treaty people and our relationship to this land and L'nu Mi'kmaw people is based on the historic Peace and Friendship Treaties that were created in the 18th century between the British Crown and the Mi'kmaq. Showing respect for, and honouring, our relationship with Mi'kmaw peoples is an essential part of our work and an important step that we are taking toward reconciliation.

The Committee for the Regional Assessment of Offshore Wind Development in Nova Scotia wishes to acknowledge, with thanks, all those who provided their advice, information and time.

Firstly, we wish to thank those who took part in the engagement sessions held across the Maritimes. Their willingness to travel, to share their experiences and insights was essential to our work.

We are grateful to the groups and individuals that met with us throughout the Regional Assessment process and provided written feedback during the Public Comment Period. We are also grateful to the Advisory Group members who volunteered their time and provided expertise on a variety of topics.

The Committee would like to acknowledge the Mi'kmaw communities and organizations who participated in the Regional Assessment engagement process.

The Committee would also like to recognize the formation of the Nova Scotia Fisheries Alliance for Energy Engagement as a productive coordinated step towards facilitating a shared future where both a growing sustainable wild caught seafood sector and the offshore energy sector can co-exist and bring cumulative prosperity to the maritime economy.

The Committee appreciates the Canada-NS Offshore Petroleum Board for allowing the Committee use of their boardroom facilities throughout the process of the Regional Assessment for meetings and workshops.

The Regional Assessment for offshore wind development in Nova Scotia is one step in a regulatory process to inform and improve future planning, licensing and impact assessment processes for future offshore wind activities. In the event the industry proceeds, it is our hope that the planning and development of this renewable energy resource will address the energy needs of all Nova Scotians, will support economic development throughout the province in a responsible manner and bring positive, meaningful and sustainable economic development opportunities to Indigenous communities in Mi'kma'ki for generations to come.

***

The Regional Assessment Committee for Offshore Wind in Nova Scotia also wishes to emphatically acknowledge the tremendous contribution to this endeavor made by the members of the Secretariat. Without their dedication, intelligence, toleration, youth and unfailing good humour, this project could not have succeeded:

Sydney Allen

Carys Burgess

Jeff Janes

Sara Lax

Janice Ray

Andy Walter

It has been a privilege and a pleasure to work with all of them. We wish them well in their future careers.

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Acronyms and Abbreviations

2SLGBTQI+	Two-Spirit, Lesbian, Gay, Bisexual, Transgender, Queer and Intersex. The plus sign is inclusive of people who identify as part of sexual and gender diverse communities, who use additional terminologies.
AC	Alternating Current
ACOA	Atlantic Canada Opportunities Agency
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
Aegir	Aegir Insights
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
CAD	Canadian Dollar
Canmet	Canmet Energy
CAPEX	Capital Expenditure
CCTH	Nova Scotia Provincial Department of Communities, Culture, Tourism and Heritage
CEA	Cumulative Effects Assessment
CEPA	*Canadian Environmental Protection Act*
CER	Canada Energy Regulator
CER Act	*Canadian Energy Regulator Act*
CFWG	Commercial Fisheries Working Group (Scotland)
CI	Construction and installation phase
CIS	Canadian Ice Service
CMM	Confederacy of Mainland Mi'kmaq
CNSOER	Canada-Nova Scotia Offshore Energy Regulator
CNSOPB	Canada-Nova Scotia Offshore Petroleum Board
CO2	Carbon dioxide
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
CWS	Canadian Wildlife Service

DFO	Department of Fisheries and Oceans Canada
DND	Department of National Defence
EBSA	Ecologically and Biologically Significant Area
ECC	Nova Scotia Provincial Department of Environment and Climate Change
ECCC	Environment and Climate Change Canada
ECEL	East Coast Environmental Law
ECOSF	Eastern Canadian Offshore Scallop Fleet
ECSAS	Eastern Canada Seabirds at Sea
eDNA	Environmental DNA
EEZ	Exclusive Economic Zone
EIB	European Investment Bank
EIS	Environmental Impact Statement
EMF	Electromagnetic Field
EMSP	Enhanced Maritime Situational Program (Transport Canada)
EPP	Environmental Protection Plan
ESRF	Environmental Studies Research Fund (Canada)
ESSIM	Eastern Scotian Shelf Integrated Management Initiative
EU	European Union
FAA	Federal Aviation Administration (US)
FLOWW	Fishing Liaison with Offshore Wind and Wet Renewables Group
FSC	Food, Social and Ceremonial (fisheries)
FTE	Full-time Equivalent
GCIFA	Guysborough County Inshore Fishermen's Association
GBA Plus	Gender Based Analysis Plus
GDP	Gross domestic product
GHG	Greenhouse gas
GIS	Geographic Information Systems
GPS	Global Positioning System
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

IEE	Institute for Energy and the Environment
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
km	Kilometers
km/hr	Kilometers per hour
KMKNO	Kwilmu'kw Maw-klusuaqn Negotiation Office
KW	Kilowatt
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
MARLOA	Maritime Local Operating Area
Max	Maximum
MBS	Migratory Bird Sanctuary
MEKS	Mi’kmaw Ecological Knowledge Study
MEOPAR	Marine Environmental Observation Prediction and Response Network
MMO	Marine Management Organization (England)
MNWA	Marine National Wildlife Areas
MOU	Memorandum of Understanding
MPA	Marine Protected Area
MRC	Marine Renewables Canada
m/s	Meters per second
MSP	Marine Spatial Planning
MW	Megawatt
NAFO	Northwest Atlantic Fisheries Organization
NAICS	North American Industry Classification System
NAO	North Atlantic Oscillation
NB	New Brunswick
NEMOEC	New England – Maritimes Offshore Energy Corridor
NEPA	Natural Environment Policy Act (US)
NL	Newfoundland and Labrador
NGO	Non-governmental organization
NMCA	National Marine Conservation Areas

NOAA	National Oceanic and Atmospheric Administration
NRC	National Research Council
NRCan	Natural Resources Canada
NREL	National Renewable Energy Laboratory (US Department of Energy)
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 *(from the Interim Report)*
RA	Regional Assessment
RCN	Royal Canadian Navy
RD	Repowering and decommissioning phase
RFP	Request for Proposals
ROSA	Responsible Offshore Science Alliance
ROV	Remotely operated vehicle
SA	Site Assessment
SAR	Species at risk
SARA	Species at Risk Act

ScotMER	Scottish government's Marine Renewable Energy Program
SEA	Strategic Environmental Assessment
SEER	US Offshore Wind Synthesis of Environmental Effects Research
SEIA	Socio-Economic Impact Analysis
SiBA	Significant Benthic Area
SOCG	Statement of Common Ground
SPANS	Seafood Producers Association of Nova Scotia
SREP	Smart Renewables and Electrification Pathways Program
SSCRI	Scotian Shelf Collaborative Research Initiative
STEM	Science, technology, engineering and mathematics
t	Tonnes
TAC	Total Allowable Catch
TC	Transport Canada
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 IEE	The Institute for Energy and Environment at the Vermont Law and Graduate School
The Initiative	The Nova Scotia Offshore Wind Collaborative Research Initiative
The Minister	The federal Minister of Environment and Climate Change
The RA	The Regional Assessment of Offshore Wind Development in Nova Scotia
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
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
USD	US dollars
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
WETO	US Department of Energy's Wind Energy Technologies Office
WHSRN	Western Hemispheric Shorebird Reserve Network
WWF Canada	World Wildlife Fund Canada

Executive Summary

The Regional Assessment of Offshore Wind Development in Nova Scotia evaluates the potential for sustainable energy generation while balancing environmental, social and economic considerations. Nova Scotia has set ambitious renewable energy targets, including generating 80% of electricity from renewable sources by 2030 and achieving net-zero emissions by 2050. Offshore wind energy, with its significant potential to reduce greenhouse gas emissions, is considered central to meeting these goals.

There are currently no offshore wind projects in Nova Scotia. This Regional Assessment was initiated as an early step with the overall goal of providing information, knowledge and analysis regarding future offshore wind development activities in the Study Area and their potential effects. Other objectives include informing and improving future planning, licensing and impact assessment processes for these activities in ways that help protect the environment and health, social and economic conditions while creating opportunities for sustainable economic development. Conducted by an independent five-member Committee over 22-months, and supported by a Secretariat of seven, this final Regional Assessment report provides a summary of existing conditions, a comprehensive analysis of potential positive and adverse impacts, the opportunities and challenges associated with offshore wind development and the identification of potential development areas. The Regional Assessment is aligned with recent legislative updates of the amended Accord Acts and the establishment of the Canada-Nova Scotia Offshore Energy Regulator. The final report concludes with a series of themed recommendations addressing the development and management of an offshore wind industry in Nova Scotia.

Approach, Activities and Outcomes

The Regional Assessment focused on a 300,000 km^2 Study Area encompassing federal and provincial jointly managed waters and inclusive of the continental shelf and slope off Nova Scotia. The Study Area does not include provincial internal waters.

The Committee implemented a collaborative and inclusive approach with engagement as a cornerstone of the process. The Regional Assessment included over 120 sessions involving Indigenous communities, government agencies, fisheries groups, non-governmental organizations, industry representatives and the public. These opportunities to engage in person provided critical insights into participant concerns and priorities. The Committee also drew on lessons from other jurisdictions with established offshore wind industries to identify effective mitigation strategies, inform regulatory planning and understand potential socio-economic impacts. Data collection and analyses of existing surveys and studies on the offshore environment were used to undertake constraint mapping. As part of the assessment, the Committee also considered *Netukulimk*, a Mi'kmaq approach that embraces the sustainable use of natural resources while maintaining balance with the physical, emotional, social and spiritual relationships a person has with the world around them.

Central to the Committee's effort was the inclusion of the Two-Eyed Seeing (*Etuaptmumk)* approach, combined with the precautionary principle and adaptive management practices. Uncertainties and risks were considered and informed the development of the Committee's final recommendations including the identification of eight potential development areas and a framework for balancing the development of a new renewable energy industry with environmental and socio-economic considerations.

Potential Impacts and Mitigation Measures

Offshore wind development requires consideration of several impact-producing factors throughout all phases of a project lifecycle. Environmental impacts such as seabed disturbance, noise and electromagnetic fields were identified as key concerns. Socio-economic impacts included potential interference with fishing, marine transportation and other ocean uses. Collaborative planning and further engagement with all interests will be essential to minimizing conflicts and addressing knowledge gaps.

Offshore wind development also presents opportunities for beneficial impacts including potential significant economic opportunities derived through necessary upgrades to existing infrastructure (ports and the electricity grid) and the construction, operation, maintenance and decommissioning of wind farms. These economic opportunities and associated employment opportunities are dependent on labour availability and supply chain readiness.

Potential Development Areas

The Regional Assessment identified eight potential development areas within the Study Area. Potential development areas were then classed as either Tier 1 or Tier 2 based on the overall understanding of conditions within each area and uncertainties for potential offshore wind development to take place.

The Committee believes that Tier 1 areas contain the least number of known constraints compared with other areas. These five areas – Sydney Bight, French Bank, Middle Bank, Sable Island Bank and Western Emerald Bank – have been subject to extensive engagement and technical feedback from government and non-government specialists since the issuance of the Interim Report.

The Tier 2 areas also present potential for offshore wind development based on known constraints. However, these areas have either not been through the same level of engagement or received the same level of technical feedback as Tier 1, or, as in the case of Canso Bank, engagement indicated uncertainties and potential issues related to offshore wind development that require further investigation and understanding. Three potential development areas are included in Tier 2 — Canso Bank, Misaine Bank and LaHave Basin.

To protect sensitive coastal ecosystems, potential underwater archaeological and culturally important sites and to reduce coastal visual impacts, the Committee recommends a 25 km buffer zone along the coastline and around Sable Island. While incursions into this zone may be justified under specific circumstances, the buffer is intended to balance development needs with other ocean users, environmental and cultural preservation.

Socio-economic Challenges and Opportunities

Offshore wind development has significant economic potential for Nova Scotia's economy. As a new industry, it could generate thousands of jobs, stimulate regional economic growth and establish the province as a leader in renewable energy. However, realizing these benefits will require investment in port infrastructure, supply chain development and workforce training. The scale of the opportunity suggests Nova Scotia must adopt a regional and potentially a national approach to successfully meet the demands imposed by such large, multi-billion-dollar investments. The envisioned development scale presents challenges for local communities, including potential strains on housing, healthcare and social services. It is essential to identify and address these impacts early while simultaneously ensuring that disadvantaged groups are not disproportionately affected.

Data and Knowledge Gaps

The Regional Assessment highlights significant gaps in baseline environmental data, socio-economic projections and technological understanding. These gaps include a limited understanding of the marine ecosystem, what cumulative effects may arise and how these effects may be addressed, and the readiness of local supply chains, labour markets and infrastructure to support offshore wind development. Addressing these uncertainties will require coordinated research involving fisheries groups, government agencies, industry, Indigenous organizations and academic institutions. The Committee recommends an immediate and systematic approach to addressing these gaps through new governance structures, targeted studies, monitoring programs and investments in research and innovation. It is hoped that adoption of the Committee's recommendations will ensure that future decision-making is informed, adaptive and responsive to the evolving needs of both the offshore wind industry and the province.

Recommendations

The Committee's recommendations focus on supporting the development of a sustainable offshore wind industry in Nova Scotia through eight key themes that include addressing data gaps and advancing research to understand environmental, socio-economic and technological impacts, ensuring socio-economic feasibility by fostering equitable opportunities and minimizing barriers for disadvantaged groups, and guiding project development with robust regulatory frameworks. The Committee also emphasizes coexistence with other marine users and the need for a compensation framework to address situations that cannot be adequately avoided or mitigated, and adopting adaptive management to address ongoing changes in technology and the marine environment including those generated by cumulative environmental effects. Strong governance structures and inclusive decision-making processes are encouraged, alongside investments in education, training and infrastructure to build local capacity and support a resilient supply chain. Overall, the recommendations aim to balance renewable energy ambitions with environmental preservation, stakeholder interests and sustainable economic growth.

Conclusion

By addressing environmental risks, leveraging economic opportunities and integrating diverse perspectives, the province can harness its offshore wind potential to achieve renewable energy goals while ensuring long-term ecological and socio-economic sustainability. The Committee's recommendations emphasize the importance of a regional approach that incorporates strategic planning, inclusive governance and proactive investment to lay the foundation for a thriving offshore industry. The findings and recommendations will guide regulatory frameworks, inform project-specific impact assessments and support Nova Scotia's and Canada's necessary transition to a renewable energy future.

Plain Language Summary

Offshore wind energy can help Canada meet its energy needs and reduce the effects from climate change. Conducting a regional assessment is a useful way to understand the potential impacts of offshore wind development beyond individual wind projects. It also helps to understand where we need to learn more to make wise decisions. The information collected can be used to help inform future individual wind project impact assessments and recommend areas where wind development could happen with fewer impacts.

On March 23, 2023, the Minister of Environment and Climate Change chose five people (the Committee) to do the Regional Assessment of Offshore Wind Development in Nova Scotia. The Study Area includes jointly managed federal-provincial waters in the Atlantic Ocean offshore of Nova Scotia. It includes the Scotian Shelf and part of the Gulf of St. Lawrence. Internal provincial waters are not included within the Study Area.

The Government of Canada wrote a Terms of Reference to provide the Committee direction on what it needed to do and when it needed to be completed. The Committee was asked to write two reports. The first report, the Interim Report, was completed on March 23, 2024. This report is the second and final report and includes:

- a description of the Regional Assessment;
- a summary of who and how the committee engaged with people;
- a description of offshore wind;
- a description of the environment and social conditions in the Study Area;
- the possible effects of offshore wind development;
- the possible future development areas for offshore wind;
- cumulative effects from all ocean activities;
- data and knowledge gaps;
- economic opportunities for Nova Scotia;
- Recommendations and
- Conclusions.

To gather information, the Committee held over 120 engagement sessions in Nova Scotia, New Brunswick and Prince Edward Island. These included meetings, information sessions for Indigenous communities, and open houses. During these events, the Committee provided information about the regional assessment, answered questions, heard concerns, and gathered information. The Committee also collected information from Advisory Groups, government agencies, experts, and other countries that already have offshore wind projects.

To guide their work, the Committee took the following approaches:

- When science found a possible risk, the priority was placed on protecting people from that harm (precautionary principle);

- Believed that managing this development should be monitored and adjusted to improve results (adaptive management); and
- Recognized the strength of Indigenous and Western Knowledge and treating them with equal respect (Two-Eyed Seeing - *Etuaptmumk*).

The Committee studied the possible positive and negative effects on the environment, and social, culture and economic conditions that are important to Nova Scotia. As part of the assessment, the Committee considered *Netukulimk*, a Mi'kmaq concept that embraces the sustainable use of natural resources while maintaining balance with the physical, emotional, social and spiritual relationships a person has with the world around them. The Committee also looked at the experience of other countries to understand guidelines, best practices, and ways to monitor and avoid negative effects.

Eight areas were identified as places where the Governments of Canada and Nova Scotia may want to consider offshore wind development.

Overall, the Committee developed 35 recommendations they feel are important to consider for the development of offshore wind in Nova Scotia. These recommendations included a buffer zone of 25 km from the coastline and 25 km around Sable Island where no projects would take place.

This report has been given to the federal Ministers of Environment and Climate Change and the Minister of Natural Resources and Energy. It has also been given to the Nova Scotia Minister of Natural Resources and Renewables.

It is important to know that the Ministers do not have to accept all or any of the recommendations. It is up to them to decide how this information will be used and where wind development may take place offshore Nova Scotia.

Koqoey Wesku'tasik

Siko'ku's 23, 2023, Nikanus wjit Wskitqamuey aqq Pem-pilua'sikl Telikiskɨkl mekenapni nanijik skwijinu'k (Alsusutiey Mawio'mi) Iloqaptmnew Tli-we'tua'luwettal Apaqtukewe'l Wju'sne'l Iko'tasik Tami Maqamikewey No'pa Sko'sia (Maqamikewey Iloqaptasik). Maqamikewey Iloqaptasik pipanuijemk wiaqtek Apaqt ula eymu'k. Wiaqtekl Wta'muk etl-maqatkwik aqq Paqtapa'q St. Lawrence etek mikawe'k No'pa Sko'sia aqq Epekwitk, aqq Northumberland Strait.

Alsusutiey Mawio'mi amujpa wije'wmi'titl Kisutasikl Wije'wmumkl ekinua'tekekl ta'n ketu'-tla'taqatimk aqq koqoey wjiatew. Kisutasikl Wije'wmumkl elt teplutasik Alsusutiey Mawio'mi lukwatmnew tapu'kl kinua'taqne'l. Amskwesewey kinua'taqney, Ewsilukwasik Kinua'taqney, piskwakitasikɨp Siko'ku's 23, 2024 aqq wiaqtekɨp wesku'tasik pipanuijkaqn, ta'n tel-lukutimkɨs, knu'kwaqnn ekinua'tekekl ta'n ketu' ika'tumkl lukwaqne'l mtmo'taqnn wjit Apaqtukewey wju'sn, ekinua'taqn ta'n teli-mekenasik ta'n ika'ten, aqq elt amskwesewe'l kisutasikl wjit lukwaqney ewe'wmumk Apaqtukewey wju'sn wjit Kaplno'l. Ula kisutasikl kisa'tu'titl Alsusutiey Mawio'mi Kespɨtek Kinua'taqney.

Wiaqtek:

- Wesku'tasik Maqamikewey Iloqaptasik;
- Ekinua'tekemk koqoey net Apaqtukewey wju'sn
- Ekinua'tekemk wskitqamuey aqq ta'n telkaqnik etl-pipanuijkemk;
- Tal-we'tua'luek Apaqtukewey wju'sn;
- Tami app kisi-iko'ten lukwaqne'l mtmo'taqn wjit Apaqtukewey wju'sney
- Mawa'tumk tel-we'tua'luek msɨt koqoey teliaq Apaqtuk.
- Koqoey me' nutatek kinua'taqney aqq kjijitaqn
- Tal-wlapesitaq No'pa Sko'sia; aqq
- Kwilutasikl

Apaqtukewey wju'sney wjit wasoqnmamkewey keknue'k kulaman tepteskɨtten tel-nuta'mk wasoqnmamkewey aqq kulaman mu tetuji-we'tua'luenuk pem-pilua'sikl telikiskɨkl. Kulaman tepteskɨtten ula metue'kl ika'mkl, Kaplno'l No'pa Sko'sia iknmuj mekenmn ta'n ika'ten "wju'sne'l wjit wasoqnmamkewey" wjit lukwaqne'l mtmo'taqn 2025al. Asite'lsuti tewiatew wjit ta'n ika'ten lukwaqne'l mtmo'taqn 2025al kisna 2026al, ne'wt mesnmi'tij asite'lsuti wjit lukwaqney, mtmo'taqne'l iloqaptɨtaq wskitqamuey aqq ta'n tl-wettua'luetew lukwaqn. Ne'wt mesnmumk asite'lsuti wjit lukwaqn, tapuipunqekl kisna nesipunqekl tli-pkije'tew ke'sk mu poqjitasinuk. Mawi-amskwesewe'k wju'sne'k etlite'tasik ika'laten natamiaw 2030al, katu jiptuk ma' ika'latji misoqo suel 2035al.

Kejituek wla'sisoq maqamikew iloqaptasiktn ke'sk mu sapa'tasinuk lukwaqnn.

Mɨta nuta'q pekaji-iloqaptasik ta'n tl-we'ttua'ten wskitqamu aqq koqoey weji-kina'masimk kis-we'wasitew wejatekemk ta'n tujiw wesku'tasik pilue'l iloqaptekemkl.

Ta’n ketu-tla’taqatijik maqamikew iloqaptasik na iknmuanew kinua’taqn, kjijitaqn aqq koqoey wejiaq iloqaptekemk pilue’l apaptukewe’l wju’sne’l lukwaqne’l ta’n elmi’knik ika’ten etli-iloqaptekemk maqamikew aqq aji-wla’sitew tel-kiskaja’tumk aqq tel-sapa’tumk lukwaqne’l kulaman menaqajewo’ten wskitqamuey aqq ta’n telo’ltimk.

Mawo’tu’tijek kinua’taqn, Alsusutiey Mawio’mi ika’tu’tipn piamiw 120 etlewistu’timkl nkutey mawaknutma’timkl, ekinua’taqne’l L’nue’katik, aqq mawita’mkl No’pa Sko’sia, New Brunswick aqq Epekwitk.

Etlewistu’timkl ewe’wasikɨpnn ekinuatuemk koqoey net apaqtukewey wju’sney lukwaqn, wesku’tasik koqoey kisi-pipanikesimk, jiksɨtmumk koqoey sespete’tasik aqq mawo’tumk kis-tlua’tiji wenik.

Ekinua’taqn elt weja’tup nuji-ilumua’tijik, kaplno’le’l mtmo’taqne’l, kejitekewinu’k aqq pilue’l eleke’wa’ki’l ta’n ki’s ala’tutit apaqtukewey wju’sney lukwaqn. Alsusutiey Mawio’mi wije’wmi’tipn kina’masuti’l wejiaql menaqewa’simk tel-maliaptekemk aqq Etuaptmumk (*Two-Eyed Seeing*). Alsusutiey Mawio’mi iloqaptmi’tip koqoey wela’luek aqq o’pla’luek wjit Wskitqamey aqq tel-mawo’ltimk, telo’ltimk aqq teli-pkwatekemk mɨta keknue’kl ula wjit No’pa Sko’sia.

Iloqaptaqati’tijek Alsusutiey Mawio’mi ankaptmi’tip *Netukulimk*; Mi’kmawey ankita’tusaqn wjit ta’n menaqaj teli-anko’tmumk aqq ewe’wmumk koqoey wejiaq wskitqamu’k aqq nespiw ta’n tel-wije’mumkl kina’matnewe’l wejiaql mtininewey, telita’simk, nsɨtuo’qn aqq teli-ktlamsɨtasimk teli-pkitawsimk wskitqamu’k. Alsusutiey Mawio’mi elt ekina’masultipnik ta’n tel-lukuti’tij pilue’l eleke’wa’ki’l kulaman kisi-kina’masultitaq wije’wmumkl aqq wela’sikl tel-lukutimkl aqq ta’n tel-jiko’tmumk aqq tepsiktmumk koqoey o’pla’luek.

Mekenasikɨpn ukmuljin te’sɨkl maqamikal wsku’tasiktn ta’n kisi-ika’ten wju’sne’l lukwaqne’l elmi’knik. Katu jiptuk se’k ika’ten elmiaq “kaplno’l” kiwanskita’sij ta’n tett ika’ten “wju’sne’l wjit wasoqnmamkewey”. Alsusutiey Mawio’mi elt kwilutmi’tij mu ika’tasiktn lukwaqne’l aji-wjuow aqq jel 25 km pemjajika’sikl aqq mu aji-wjuow jel 25 km tepow sable Island.

Mawa’tumk, Alsusutiey Mawio’mi kisa’tu’titl 34 kwilutaqn telte’tmi’titl keknue’kl ankaptasiktn wjit ta’n ketu’ iko’tumkl Apaqtukewe’l wju’sne’l No’pa Sko’sia. Koqoey wejiaq Maqamikewey Iloqaptasik wjiatew kekina’masuti aqq ta’n tli-naji-wla’ttew tel-kiskaja’tumk Apaqtukewe’l wju’sne’l No’pa Sko’sia elmi’knik. Keknue’k kjijitunew mu amujpa Nikanusk wije’wmi’tikl msɨt ula kwilutasikl.

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 environment. Each of the 10 warmest years in the historical record has occurred in the past decade (Lindsey and Dahlman, 2024). Rising temperatures alter habitats, causing some species to move to cooler areas; this can lead to increased competition and potential extinction for those unable to adapt or relocate. Ocean acidification, a result of increased carbon dioxide (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, impacts from climate change are undermining the resilience of natural ecosystems and threatening biodiversity and the services provided to human society. Effects are transferred to human 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 can be particularly evident on shallow water fisheries, such as shellfish harvesting, from increasing ocean temperatures and acidification. Further, warmer waters can lead to habitat loss and increased vulnerability to disease, while acidification weakens shells and reduces survival rates. These changes can disrupt the food chain and threaten the livelihoods of communities and economies dependent on those 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, but preferably 1.5°C above preindustrial levels (Government of Canada, 2016). Regrettably, the average

global temperature exceeded 1.5°C in 2024 (NOAA, 2024).[1] 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 (NS), 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 NS, 2021).

These commitments necessitate bold actions. 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).

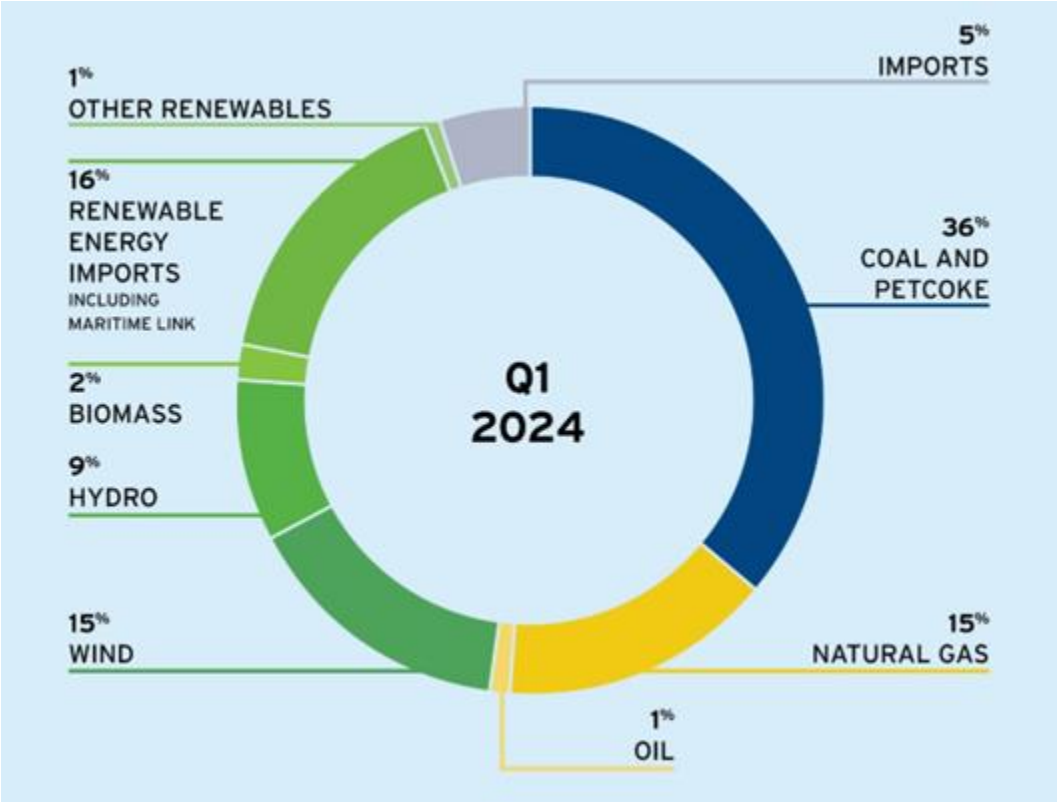


Figure 1.1. Energy Production Sources for Nova Scotia (Nova Scotia Power, 2024b)

[1] 2024 was the world's warmest year on record. https://www.noaa.gov/news/2024-was-worlds-warmest-year-on-record

Four power plants in the province still 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, energy production will demand innovation and substantial investment. Both the federal and provincial governments are looking to OSW as a new and valuable source of renewable 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 for those who currently use those waters and for the communities onshore that support both the new industry and existing marine activities.

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 OSW industry is new to Canada and the regulatory framework is evolving. The intended framework for Atlantic Canada would resemble 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[2] 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, amending the oil and gas legislation and enabling the CNSOPB to 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*, gained Royal Assent on September 20, 2024.

The CNSOER will administer the requirements of the amended Accord Acts and the associated Offshore Renewable Energy Regulations. The intent of the amended legislation and new regulations is to develop modern safety and environmental protection regulations that will apply to site assessment, construction, operation, and decommissioning and abandonment activities related to offshore

[2] 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").

renewable energy projects in Canada's federal offshore area (NRCan, 2024). The Canada Offshore Renewable Energy Regulations came into force on December 16, 2024. The proposed Regulations under the Accord Acts are expected to be pre-published in the Canada Gazette, Part I in spring 2025, for public comment (NRCan, 2024). Natural Resources Canada (NRCan) is working to ensure that the development of these regulations is coordinated with coastal provinces and territories.

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 federal impact assessment.[3] 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 Canada (the Minister) has the discretion to require a project that is not a designated physical activity to undergo an impact assessment where in his or her opinion, the carrying out of that physical activity may cause adverse effects within federal jurisdiction. The Minister may also choose to exempt an otherwise designated project from an impact assessment.

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

- an authorization pursuant to the *Fisheries Act* (1985) for the death of fish and/or the harmful alteration, disruption, or destruction of fish habitat;[4]
- a permit or authorization pursuant to the *Canada National Marine Conservation Areas Act* (2002) for activities that are consistent with the management plan in the marine conservation area;[5]
- a permit for handling stranded birds pursuant to the *Migratory Birds Convention Act, 1994;*[6]
- a permit pursuant to the *Species at Risk Act* (2002) to conduct an activity that may affect a listed species;[7] and
- a permit pursuant to the *Canadian Navigable Waters Act* (1985) for interference or obstruction of the public's right to navigation.[8]

Relevant provincial legislation includes the:

- *Special Places Protection Act* (1989) which provides for the preservation, protection, regulation, exploration, excavation, acquisition and study of archaeological and historical remains and paleontological sites;[9]

[3] Refer to Section 2 (44) of the Physical Activities Regulations: SOR/2019-285
[4] Refer to Section 34 (1) of the *Fisheries Act*
[5] Refer to Section 15 of the *Canada National Marine Conservation Areas Act*
[6] Refer to Section 70 of the Migratory Birds Regulations, 2022 - SOR/2022-105
[7] Refer to Section 73 of the *Species at Risk Act*
[8] Refer to Section 5 of the *Canadian Navigable Waters Act*
[9] NS Special Places Protection Act: https://nslegislature.ca/sites/default/files/legc/statutes/specplac.htm

- *Endangered Species Act* (1998) which provides for the protection, designation, recovery and other relevant aspects of conservation of provincial species at risk;[10]
- *Environment Act* (1994-95) which provides for the protection and prudent use of the environment and includes the goal of maintaining the principles of sustainable development;[11]
- *Environmental Goals and Climate Change Reduction Act* (2021) which sets goals to address climate change;[12] and
- *Beaches Act* (1989) which provides for the protection of beaches and associated dune systems as significant and sensitive environmental and recreational resources.[13]

1.4 Timelines

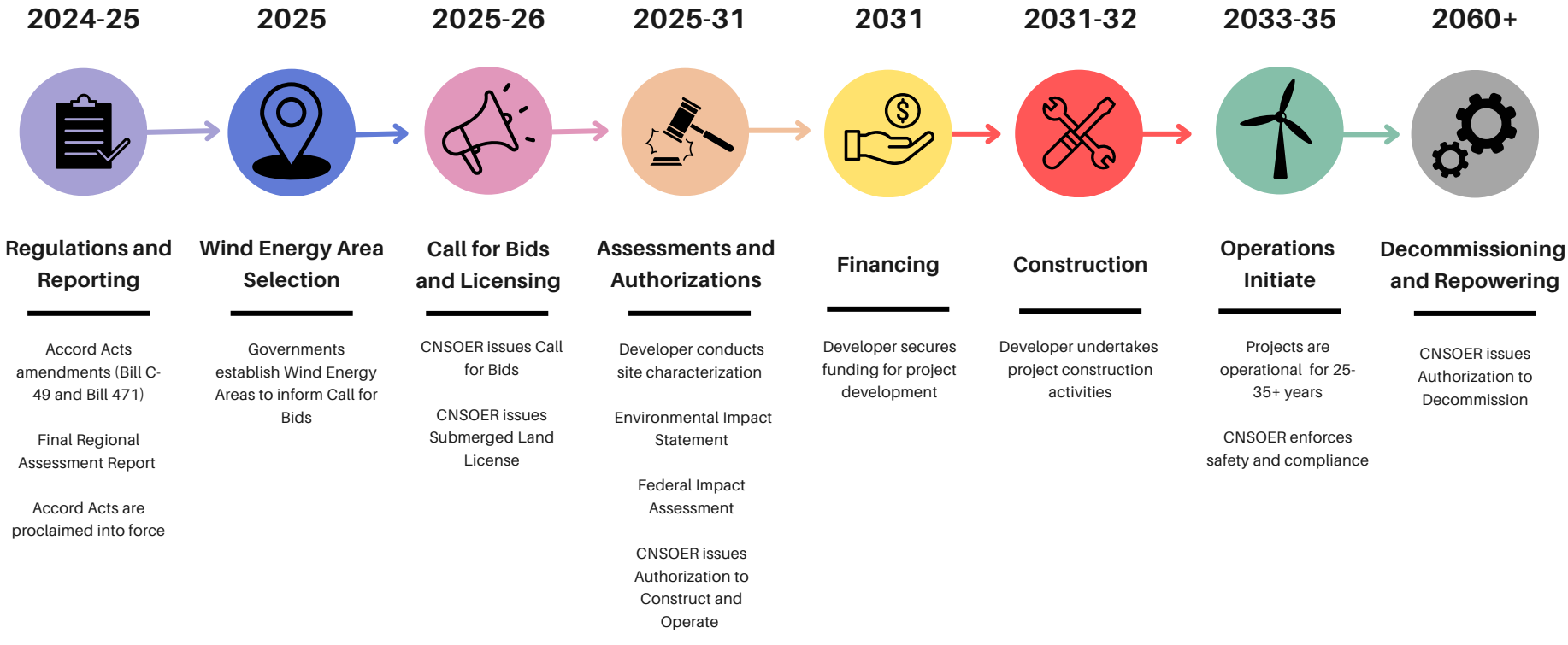
The RA is one of several initiatives that are either underway or planned as the OSW regulatory framework evolves. There are many things that need to fall into place to allow the industry to move ahead in Canada and NS, and a delay in one component may impact the timing of others. Certain activities occur consecutively while others occur concurrently. Therefore, Figure 1.2 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.

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 (assuming a project of 10 turbines or more) 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 decides 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), 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

[10] NS Endangered Species Act: https://nslegislature.ca/legc/bills/57th_1st/3rd_read/b065.htm
[11] NS Environment Act: https://nslegislature.ca/sites/default/files/legc/statutes/environment.pdf
[12] NS Sustainable Development Goals Act: https://nslegislature.ca/sites/default/files/legc/PDFs/annual%20statutes/2019%20Fall/c026.pdf
[13] NS Beaches Act: https://nslegislature.ca/sites/default/files/legc/statutes/beaches.htm

Committee's understanding that there will be multiple opportunities for engagement at various stages of the process outlined in Figure 1.2.



Disclaimer: Dates are approximations based on the Committee's interpretation of best available information as of January 2025 and are subject to change.

Figure 1.2 Approximate Timeline for Offshore Wind Development in Nova Scotia

Figure 1.2 does not include any reference to the timelines or processes associated with potential OSW development in provincial internal waters. NRR has indicated that it will not proceed with further consideration of OSW development in provincial internal waters until after the completion of this RA.

1.5 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.[14] 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:

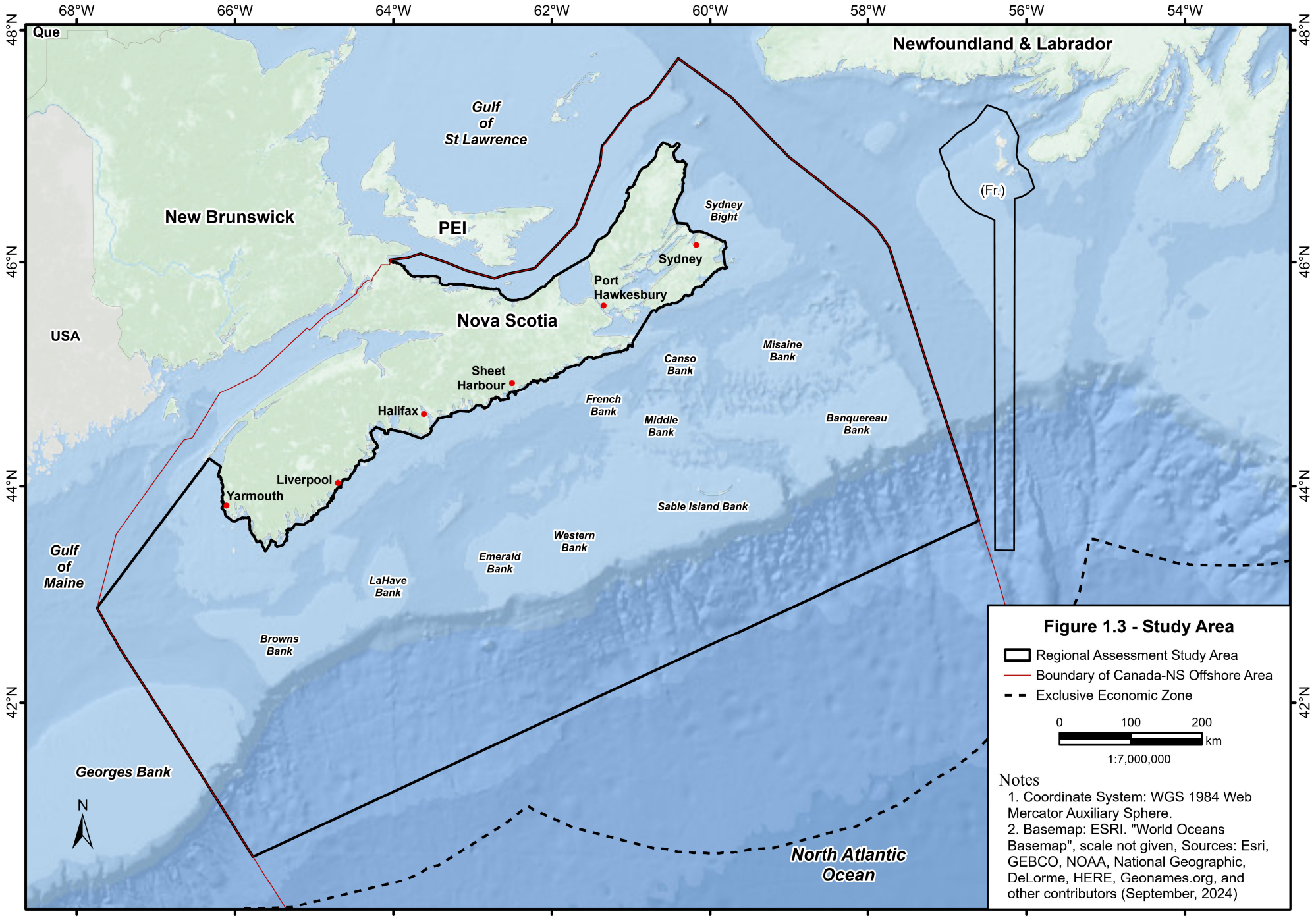
- determining whether the assessment will be undertaken by the Impact Assessment Agency of Canada (IAAC) or by an independent committee;
- establishing a Terms of Reference (TOR) which describes the scope of the proposed goals and objectives;
- advising how scientific information and Indigenous knowledge 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 IAAC to commence a planning exercise. In March 2023, the Minister, in partnership with the federal Minister of Energy and Natural Resources Canada 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. These documents 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.

The approximately 300,000 km^2 area under consideration (the RA Study Area) is depicted in Figure 1.3 and includes the continental shelf and slope off NS. The scope of the RA includes the requirement to identify Potential Development Areas (PDAs)within the RA Study Area; to identify and analyse the potential environmental, health, social and economic effects and benefits of OSW development

[14] Section 92 of the Impact Assessment Act (justice.gc.ca)

activities; and to make recommendations for mitigation and monitoring. While the RA is key to the early planning of OSW development in NS, it is not a legislated decision-making process and does not replace other project specific permitting processes.


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
(Fr.)
N
North Atlantic Ocean
Figure 1.3 - 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 this difference and has attempted to address it as the context requires. Similar confusion was expressed about the provincial "internal" waters[15] 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. Finally, with respect to the potential for OSW activities to impact Indigenous rights, the Committee was required to receive advice and perspectives from Indigenous peoples but was not involved in formal Consultation in the context of the Crown's duty to consult, nor did the Committee have a mandate to make any determination as to the existence or alleged infringement of such rights.[16]

1.5.1 Underlying Premises of the RA

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, OSW development has the potential to result in physical, ecological and socio-economic consequences for the RA Study Area and for the province. The mandate of the RA as detailed in the TOR is broad, and the challenge for the Committee was 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 the capability to sustainably generate electricity and contribute to the greater environmental challenges 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[17] 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 renewable energy,

[15] 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)
[16] TOR A1.1, 1.2
[17] A document adopted in 1992 at the United Nations Conference on Environment and Development, also know as the Earth Summit, that provides guidance for countries on sustainable development.

but 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 Etuaptmumk 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 approach 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 *Netukulimk* (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) 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 approach, 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 sections 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 requires regulators and all involved parties (Indigenous leaders, industry, fishers and other stakeholders), to come together to detail what additional matters should be addressed. Adaptive management 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.

1.5.2 Committee Processes and Procedures

The Committee has not undertaken any primary research in support of this report. The RA process has relied on the diverse expertise, knowledge and experience of the Committee 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 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 available on the Registry.

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 would hold diverse perspectives and interpretations. Had these differences been considered significant and a level of consensus not attained, the dissenting Committee member had the option of voicing a separate dissenting view in writing. This proved unnecessary.

2.0 Approach, Activities and Outcomes

As stated in section 1.5.2 the Committee has not undertaken any primary research in support of this report. The Committee conducted extensive engagement and has relied on the research, constraint mapping and input of experts, 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 (US). In addition, the Committee has enlisted the support of several independent contractors with expertise to address specific issues (see 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;
- 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 Indigenous and community knowledge and information from participants to 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 to identify various opportunities for participation.

Engagement activities included responses to general communications; official notices and updates posted to the Registry; open house/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 and were posted to the Registry.

2.1.1 Engagement Approach

2.1.1.1 General Communications

Information sharing throughout the RA process was achieved via the Registry and the use of the RA 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 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 requests).

General communications and updates were sent to participants via the RA email and posted to the Registry for public access and review. These types of communications included:

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

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, and 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 topics 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. The Committee met for a final time with Advisory Groups in December 2024 to gather feedback on the Draft Report.

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/information sessions, Indigenous community sessions and in-person meetings and briefings. The Committee also 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 throughout the RA process.

A formal Public Comment Period was held for 50-days following the release of the Draft Report to allow all Indigenous peoples, the public, organizations and any other person or group to review and provide comments.

2.1.2.1 Indigenous Engagement

During the RA planning process, IAAC reached out to Indigenous contacts throughout the Maritime provinces, including Newfoundland and Labrador (NL), and Quebec (Appendix 2.1) to establish a participant list. This list was then used by the Committee for their initial outreach and introductions. The Committee accepted as many opportunities as possible to meet with various Indigenous band councils, communities and organizations.

Early meetings focused on sharing information about OSW and 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 the following communities:

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

During the Public Comment Period, the Committee met with the following communities to hear their feedback and answer questions on the Draft Report:

- Elsipogtog First Nation
- Millbrook First Nation
- Sipekne'katik 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);
- Nova Scotia Native Women's Association; 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 the Department of Fisheries and Oceans Canada (DFO). Dialogue was encouraged and 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 early recommendations from the Interim Report. At each session the Committee made an illustrated presentation and answered questions. Subsequent discussions were very informative. Feedback forms and input boards were again set up to gather feedback on the RA process and the Interim Report.

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

2.1.2.3 Government Departments and Agencies

The Committee met with federal representatives including DFO, Environment and Climate Change Canada (ECCC), Indigenous Services Canada (ISC), IAAC, NRCan, Parks Canada and Transport Canada (TC). The Committee also met with 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 CNSOPB, and from NS municipalities. 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 (DND), Atlantic Canada Opportunities Agency (ACOA) 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 wished 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 the selection of PDAs (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 Engagement (NSFAEE) includes representation from many groups in the seafood harvesting and processing sector in NS and was developed from a shared belief that responsible development of offshore energy resources can coexist with a sustainable and prosperous fishing industry (NSFAEE, 2024). NSFAEE members have a shared vision for coexistence 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 other 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. DFO has landings data for fisheries with a small number of license holders such as the sea cucumber fishery. However, to comply with the Government of Canada's privacy policy (known as the "Rule of Five"), these data cannot be shared publicly. These landings were incorporated into the DFO Technical Report "Application of Marxan with Zones as a marine spatial planning decision-support tool: a case study for offshore wind planning in Nova Scotia." Similarly, scallop fishery catch data are incorporated into the publicly available database[18], excepting cases where there are privacy concerns.

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 OSW farm.

The Committee also 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 OSW development.

Fishers also expressed concerns that access to many fishable areas is already being limited due to various levels of "protected" status. which could be further compounded by large scale wind farm deployment, while noting that certain 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 OSW and the fishing industry.

[18] DFO "database" refers either to the DFO Marine Spatial Planning Atlas or the Eastern Canada Commercial Fishing (ECCF) dataset.

2.1.2.5 Offshore Wind Developers

The Committee met 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. 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 (IR). 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.

After the release of the Draft Report, the Committee offered again to meet with any interested developers. Meetings were held with DP Energy and SBM Offshore, Atlantic Canada Offshore Developments and MRC in November/December 2024.

2.1.2.6 Other

The Committee received briefings from several subject matter experts in academia, 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.

In addition to holding meetings with participants, Committee members also attended two OSW themed conferences held in Halifax in November 2024. Committee members presented at the Net Zero Atlantic Nova Scotia Offshore Wind Research and Development Forum (presentation can be found here) and the Marine Renewables Canada Annual 2024 Conference (presentation can be found here). A booth with information about the Regional Assessment, content from the Draft Report and a copy of the Draft Report was set up at both events to answer questions and encourage feedback on the Draft Report.

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 the fall and spring engagement programs 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;
- the economic and social importance of the inshore fisheries;
- 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;
- 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 protected areas, refuges, critical habitats for species at risk, and aquaculture, and the potential additional displacement that could be 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
- a lack of knowledge of how the industry could or will benefit Nova Scotians 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 representatives 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 considered by the Committee. Each study had specific objectives and analytical approaches that influenced the outputs and conclusions. There are also limitations associated with the data and methodologies applied that need to be considered when interpreting the results. It is specifically noted that social criteria were largely excluded from these studies, but a vital component that the Committee has considered in depth.

These studies represent an important body of work and have been considered in detail by the Committee.

2.2.1 Canada Marine Planning Atlas

As part of its Marine Spatial Planning Process, DFO has released and continues to update the Canada Marine 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 that was retained by NRR in 2023 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 the 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 the geographic information system (GIS) 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 (MSP) 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 used in both the Canmet and Aegir Insights studies and a range of ecological and socio-economic components to find suitable areas for OSW while avoiding overlap with certain features that include, but were 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;[19]
- vessel density and traffic routes;
- existing oil and gas activity; and
- aquaculture leases.

The modeling employs an analysis using Marxan with Zones[20] 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 fishing activity, the analysis will develop multiple solutions for each scenario to find areas that meet those specified avoidance criteria.[21]

Different single-sector (a scenario focusing 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 French Bank.

[19] 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.
[20] 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/.
[21] 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.

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 should be considered in future work. Data gaps and limitations have been noted including those related to marine bird migration pathways and marine mammal movements.[22]

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.

2.2.6 Industry Survey on Offshore Wind Areas

As indicated in section 2.1.2.5, the Committee issued an IR to NRCan and NRR to solicit information regarding the location and types of OSW development projects that prospective 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.

[22] For example, ECCC has stated in their feedback that the DFO Marxan model used 50km hexagonal grid cells to accommodate marine bird distribution. They noted that Sable Island, highlighted as potentially low conflict for OSW, has a gap in spatial coverage in that area due to the physical characteristics of the area and difficulties with vessel navigation. ECCC feels this resulted in the data gap in ECSAS coverage being presented as an optimal solution for the Marxan Model (see ECCC feedback on Registry).

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 and ongoing data collection program. The Committee was able to supplement their analyses of potential development areas by referencing GSC data on 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.

In some cases, data limitations will impact micro-siting of projects within PDAs and should be taken into account in the design of future field programs. While the identification of PDAs was directly informed by several studies (see section 2.2), only one study incorporated aerofauna (birds, bats and flying insects) data (Nagel *et al.*, 2024); this study highlighted several limitations including:

- species present within the RA Study Area and migratory movements or connectivity, e.g., flight paths and migration corridors, and predictive density models (which assist with understanding bird distribution);
- specific species at risk, e.g., Leach's storm petrel;
- important locations, e.g., Country Island, and shorebird sites; and
- collision and displacement vulnerability data for seabird species (see ECCC feedback on the Registry).

As the planning of OSW in NS continues, these data will be important to assemble and consider and will facilitate a better understanding of how aerofauna avoid or interact with OSW structures.

It also 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 to ensure a comprehensive and accurate understanding of the region to inform future planning and

assessments. Addressing these gaps early allows for the 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 without such input 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 potential development areas;
- a recommendation to establish a 25 km coastal buffer leading to no proposed OSW development in the Northumberland Strait and Gulf of St. Lawrence at this time; 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 inform 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 coexistence 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 had 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, and to engage with the provincial Department of Finance in modelling the economic impacts of estimated capital and operating expenditures associated with several OSW development scenarios

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 into 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, coexistence opportunities, necessary monitoring and research programs and the positive effects resulting from large scale OSW investment. The Committee took note of this body of knowledge and met with various OSW operators to discuss approaches that could be applied to NS.

There are lessons to be learnt on many fronts while recognizing that each jurisdiction is unique. The United Kingdom (UK), Denmark, the Netherlands, Germany and the United States, are each engaged in OSW development. 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 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 socio-economics (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 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 OSW 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 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 and appropriate and tested mitigation 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, 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 Coexistence

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 coexistence between marine users within its footprint (ScottishPower 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 agreement and disagreement between the parties (ScottishPower 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 (ScottishPower Renewables, 2021). The SOCG is referenced in the Commercial Fisheries chapter of East Anglia ONE's environmental statement (ScottishPower 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 (ScottishPower 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 identified 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.

The Roadmap (discussed further in section 3.3.1.1 of this report) also references the necessity for port infrastructure. Section 4.5.2.4 provides data on the port infrastructure that exists in the province and 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 of Scotland 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 the development of Hornsea 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 Grimsby, 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 its 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, and rental costs have risen. 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 plan carefully for the industry's arrival; to finance the cost of the necessary port infrastructure; to train and attract the required labour force across a wide range of disciplines and to ensure 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 of where compensation entitlement is determined by the loss caused by debris and spills (CNSOPB, 2017). Bill C-49, which amended the Accord Acts, does not explicitly establish requirements to address the issue of economic loss associated with 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 including conditions of an authorization that address impacts associated from debris or attributable damage. The Accord Acts, however, provide a legislative

requirement under section 98.7 (c) to acknowledge the importance of fishing activities during the licensing process.

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 Fishing Liaison with Offshore Wind and Wet Renewables Group (FLOWW) 'Best Practice Guidance' in the UK (FLOWW, 2015) which seeks to establish coexistence 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, 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 for 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 (initiated in 2023) is further evidence that coexistence and compensation issues are still being worked through some thirty years after the first OSW 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 in the US 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). Reference has also 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 in 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 European Union (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.[23] 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, 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) isa case in point. It is noted that there are huge differences between the well-developed German

[23] The Province of NS 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.

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 in Germany 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 ultimately be 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; one study concluded that the high percentage specification for local content has made Taiwan's OSW 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 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 the BOEM practice of including fisheries mitigation efforts and compensation proposals in OSW bid processes (section 2.6.5). 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 OSW 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. Further, 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 study 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)[24] was passed, requiring that OSW procurement must be

[24] 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

"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 OSW 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 coexistence 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 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 consisting 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, 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).

The desire to improve OSW project economics and accelerate decarbonization efforts has resulted in an increase in both individual turbine rated capacity, and the number of turbines installed in a single project. The average rated capacity of OSW 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), China has recently installed an 18 MW turbine in Guangdong province (Lewis, 2024), and turbine manufacturer Mingyang is 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). Overall project size has increased from an average of 400 MW in the 2012-2017 timeframe[25] to individual projects now regularly exceeding 1 GW of installed capacity (Equinor, 2023).

In terms of the potential scale of the industry for NS, the Committee has noted that the provincial government plans to have 5 GW of offshore leases issued by 2030, which establishes a mid-term baseline that will 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 therefore, 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, and which are discussed in section 5 and section 8.

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

[25] See 1991-2001 The First Offshore Wind Farms (Chapter 2/6) | Ørsted

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 onshore infrastructure (NYSERDA, 2024). Developments that are close to shore may not require an offshore substation and will transmit electricity directly to shore (NYSERDA, 2024).

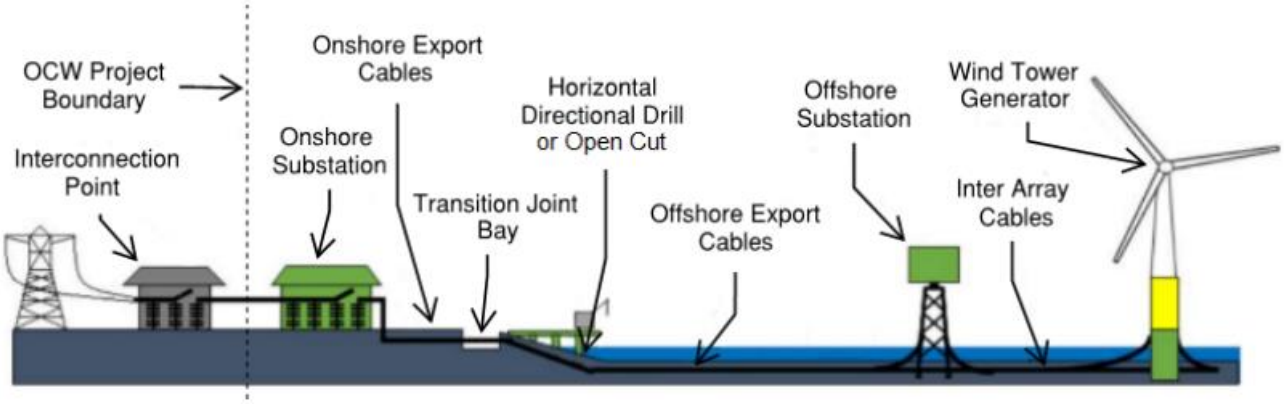


Figure 3.1. An Offshore Wind Farm Showing Fixed (Monopile) Foundations (Ocean Wind LLC, 2022)

3.1.3 Turbine Components

The main components of an OSW turbine are depicted in Figure 3.2 and include the blades, the nacelle (containing the generator), the tower and the foundation (in Figure 3.2 shown as a fixed monopile) (NYSERDA, 2024). The type of foundations, i.e., the means by which the turbines are supported and kept in place, are important from an overall capital cost perspective, the type of potential environmental impacts generated and the type and scale of economic benefits likely to accrue to the province. 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 3.1.4

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).

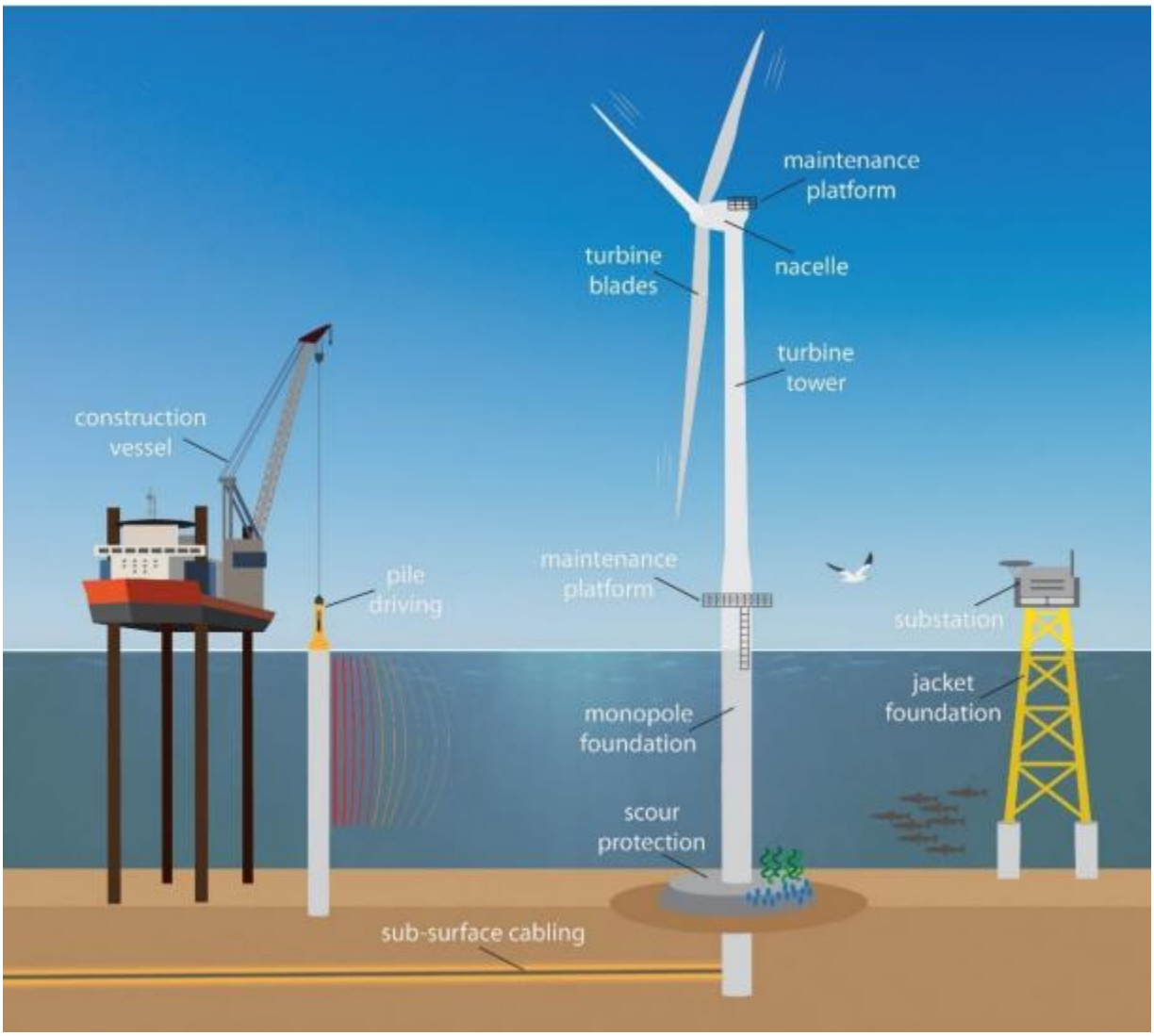


Figure 3.2. Main Components of an Offshore Wind Turbine (Biodiversity Research Institute, 2024)

As discussed in the opening section of this chapter, turbines used in OSW farms are increasing in size. Due to the increased speed and consistency of the wind resource, 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 therefore increasing as a function of higher rated capacity. Figure 3.3 shows this increasing evolution of turbine height and power output from early windmills to present day design.

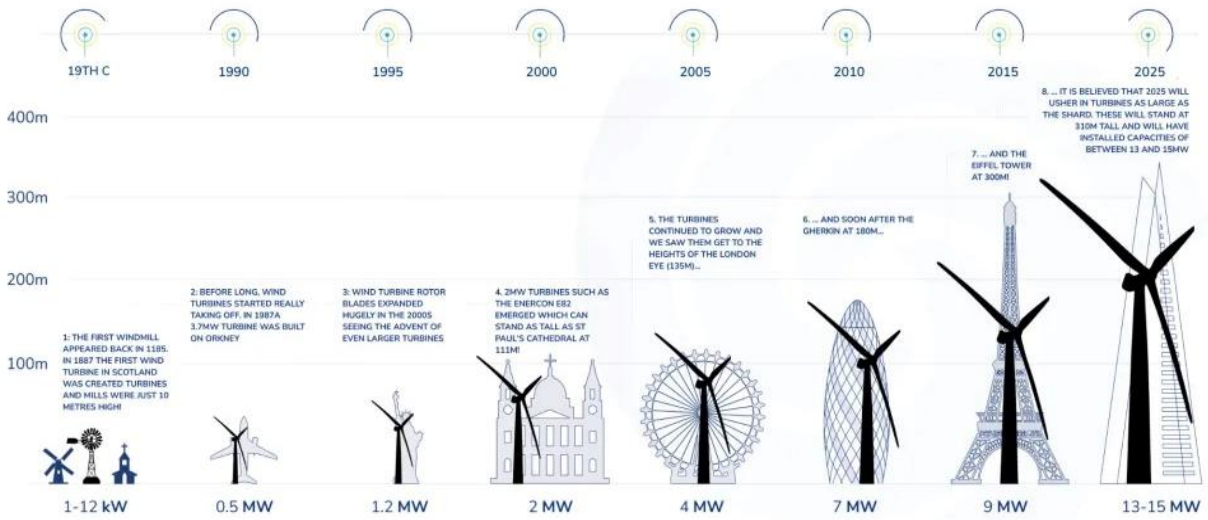
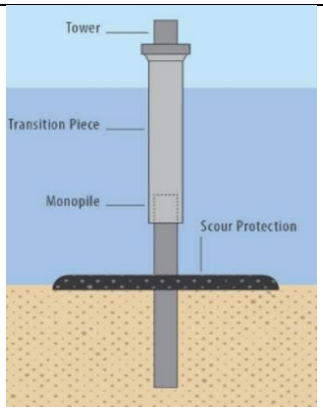
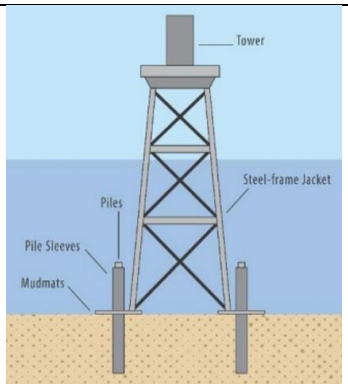
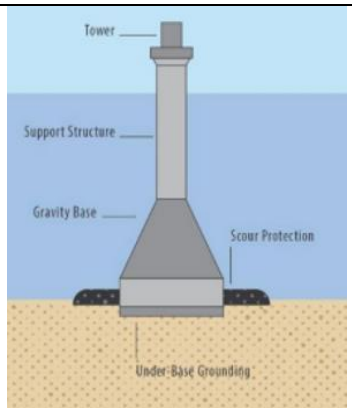


Figure 3.3. Evolution in Height and Power of Wind Turbines (Lumify Energy, 2023)

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. Fixed bottom foundations are attached directly to the seafloor, theoretically possible 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 has its origins in equipment deployed for the oil and gas industry and is typically considered in water depths ranging from 100 m to 1,000 m. These designs require an anchor mechanism that provides buoyancy to the wind turbine to restrict the pitch, roll and heave motions of the turbine in turbulent waters (Tang and Kilpatrick, 2021). Floating options are important to consider because approximately 80% of the global OSW resource potential is in water with depths exceeding 60 m (BVG Associates, 2023) and for some countries, with a narrow continental shelf, floating turbine foundations offer the only opportunity for large-scale OSW deployment (MRC, 2024a). It is however important to note that floating turbine foundations are still a relatively expensive technology because the design is new and has not yet been deployed at a commercial scale (Orsted, n.d.)

Table 3.1. Fixed Foundations

Type	Description	Image
Monopile	Monopiles are made of tubular steel and are a proven technology with mature supply chains. Monopile foundations can be mass produced, and vessels for transportation and installation already exist. Where suitable substrate (sand and gravel) and water depths (less than 60 m) occur, monopile foundations are the preferred and most cost-effective foundation type. 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 seabed conditions. The structures are stiffer and, for deeper water locations, generally require less steel than monopiles. Installation typically uses 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	This design is 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 these foundations very expensive for deep-water sites. Depths: Between 15 m to 40 m water depth.	

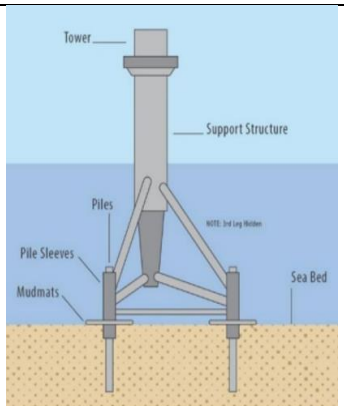
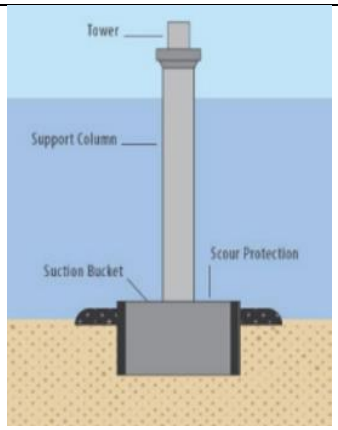
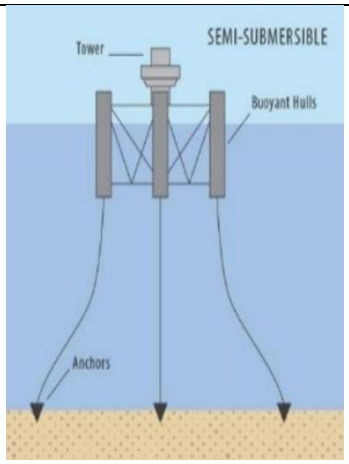
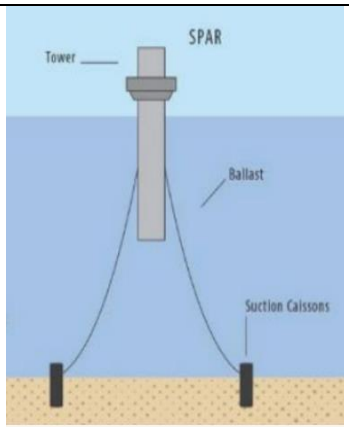
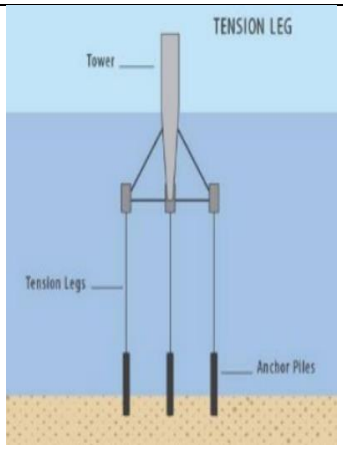
Type	Description	Image
Tripods and tripiles	Tripod foundations combine monopile and jacket structures producing a central column frame with triangular supports that insert into the seabed. The legs of the tripod foundation are spaced from 20 m to 40 m apart. The use of these foundations is rare, as they 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 a fixed platform anchor similar to a monopile, but using a large diameter open bottomed tube embedded in the sediment and sealed at the top. Pile-driving is not required thereby offering 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. Specific soil types are required and because of the shallow embedment this design is 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 Foundations

Type	Description	Image
Semisubmersible	Semi-submersible foundations 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 the suitability over a wide range of water depths. The design and cost challenges continue to drive innovation as the OSW industry considers deeper waters. 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 the tall structure. Depths: Greater than 100 m water depth.	
Tension Leg Platform	This foundation type consists of columns and pontoons with a unique mooring system consisting of vertical tendons to restrain turbine movement. A Tension Leg Platform has good stability and can be used in a range of water depths, but construction and anchoring system costs are higher than other floating 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 various environmental, geophysical, economic and infrastructure factors (Empire Engineering, 2021). Several key considerations are discussed briefly in Table 3.3.

Table 3.3. Foundation Selection Considerations

Environmental/Geophysical Considerations	Economic/Infrastructure Considerations
Water depth. To date, the deepest fixed bottom installation occurred in 58.6 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, developers may be influenced by 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, cables exit the foundation and are typically buried in the seabed (static cables). With floating foundations, cables 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 (dynamic cables) (BVG Associates, 2024). Figure 3.4 depicts two types of potential dynamic cable configurations.

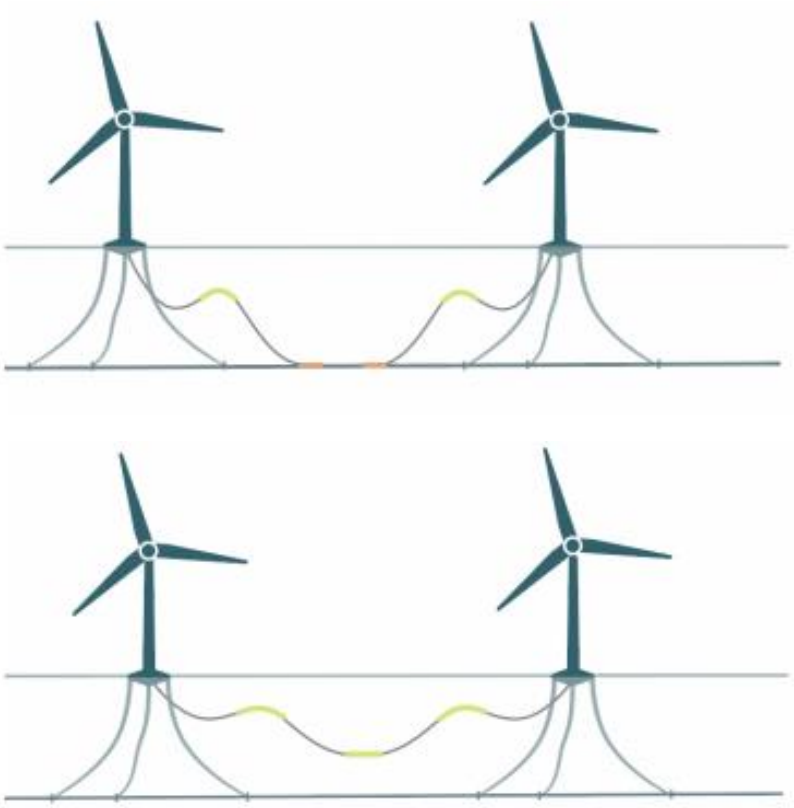


Figure 3.4. Two Types of Cable Configurations for Floating Offshore Wind Turbines.
Lazy wave (top): attached buoyancy modules provide lift at the midwater cable section.
W-shape (bottom): buoyancy modules suspend entirety of cable above the seabed.
Although not pictured here, a dynamic cable can be used without buoyancy 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, they are buried in the seabed or covered for protection where possible (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 power is converted from AC to HVDC before transmission), are facilities placed on foundations like those used for turbines and are subject to the same selection constraints (NREL, 2024). To date, substation foundations have typically been fixed monopiles or jackets and 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).

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 1.4 and depicted in Figure 1.2. 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 RA being one of these early steps. The planning and development phase involves government, regulators and developers, each of whom undertakes preliminary studies, desktop evaluations of data and in some cases physical data collection[26] 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).

Prior to the issuance of a call for expressions of interest or bids for a specific development area, governments typically assess the following (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 construction and operating and maintenance phases;
- location of suitable sites for grid interconnection and the cost of required upgrades;

[26] In NS, 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.

- anticipated impacts on nearby coastal communities;
- abundance and frequency of the various marine wildlife species using the area;
- anticipated environmental impacts;
- 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 license to conduct further site assessment and undertake a process that may eventually result in an authorization to construct an OSW project. As discussed in section 2.6.6, the criteria for assessing bids have yet to be established for the NS licensing process. Bid criteria constitute an important topic linked to the socio-economic aspects of the Committee's TOR and discussed 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 (EIS). Site assessment work typically 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 are 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 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 (discussed 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 (section 1.3) 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. This phase requires the use of multiple port facilities, a wide variety of vessels (see 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 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 to 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):

- 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 is 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[27] 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 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).

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

3.2.4 Repowering and Decommissioning

When OSW farms reach the end of operation, 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[28] 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 that may have been 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 require significant and costly decommissioning processes.

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

Three oil and gas projects have been successfully abandoned in NS: 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 include financial requirements for the offshore renewable energy

[28] 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).

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 in mature OSW jurisdictions estimated in the range of $3 to $4 billion USD.[29] These numbers would price the ten-year global target of an additional 380 GW (GWEC, 2023) at well over a trillion USD. The Global Wind Energy Council (GWEC) (2023) suggests that the cost of production for a 1 GW OSW project may be decreasing with increasing scale. The industry is becoming an economic force 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); 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 a 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 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 scope, resources and timeline to undertake anything like the NREL analysis, and note has been taken of the pending MRC Request for Proposals that is looking to characterize the Atlantic Canadian supply chain for the emerging OSW industry (MRC, 2024b). However, the RA 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

[29] The recent Hornsea Two windfarm, currently the world's largest at 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).

may be affected by future offshore wind development activities within the RA 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 the NS "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 challenges and opportunities analysis (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 component 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 30 GW 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 of a successful launch of an OSW industry in NS.

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. The vessel has a self-elevating unit with moveable legs capable of lifting the hull above the sea (for fixed installations) and is equipped with a large crane for installing components.
Heavy Lift Vessels	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	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 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	X		Commonly purpose-built vessels for laying and burying subsea cables, i.e., array and export cables, into the seafloor.
Crew Transfer Vessels and Helicopters	X	X	Transport crew and marine mammal/bird observers to and from the project site.
Remote Operated Vehicles (ROVs)	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.

Vessel/Equipment	Project Phase		Purpose
	PC/CI/RD	O&M	
Pile-driving Hammer Engines	X		Drive 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 cables.
Service Operation Vessels	X	X	Transport crew to the site and provides offshore living accommodation and workspace.
Survey Vessels	X	X	Perform geotechnical or geophysical surveys.
Tugboats	X	X	Transport equipment and barges to project site.
Sources: Corio, 2022; NYSERDA, 2017; US EPA, n.d. 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 life span. 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 section 4.5.2.4 and section 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 (the Shelf), 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 does not include the Bay of Fundy, the Canadian portion of Georges Bank or the Gulf of Maine. 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 eastern 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, in combination with an examination of commercial fisheries data and implementation of the 25 km buffer (see section 6), it was decided that OSW 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). Fisheries data to support this decision are discussed in section 4.5. The remainder of this section deals only with the existing conditions in the RA Study Area that apply to the Shelf and Sydney Bight areas.

4.1 Ecosystem Overview

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 based on a “reasonably well-defined food production system” (Pepin *et al.*, 2014; Kenchington *et al.*, 2016) and supports important fisheries, 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).

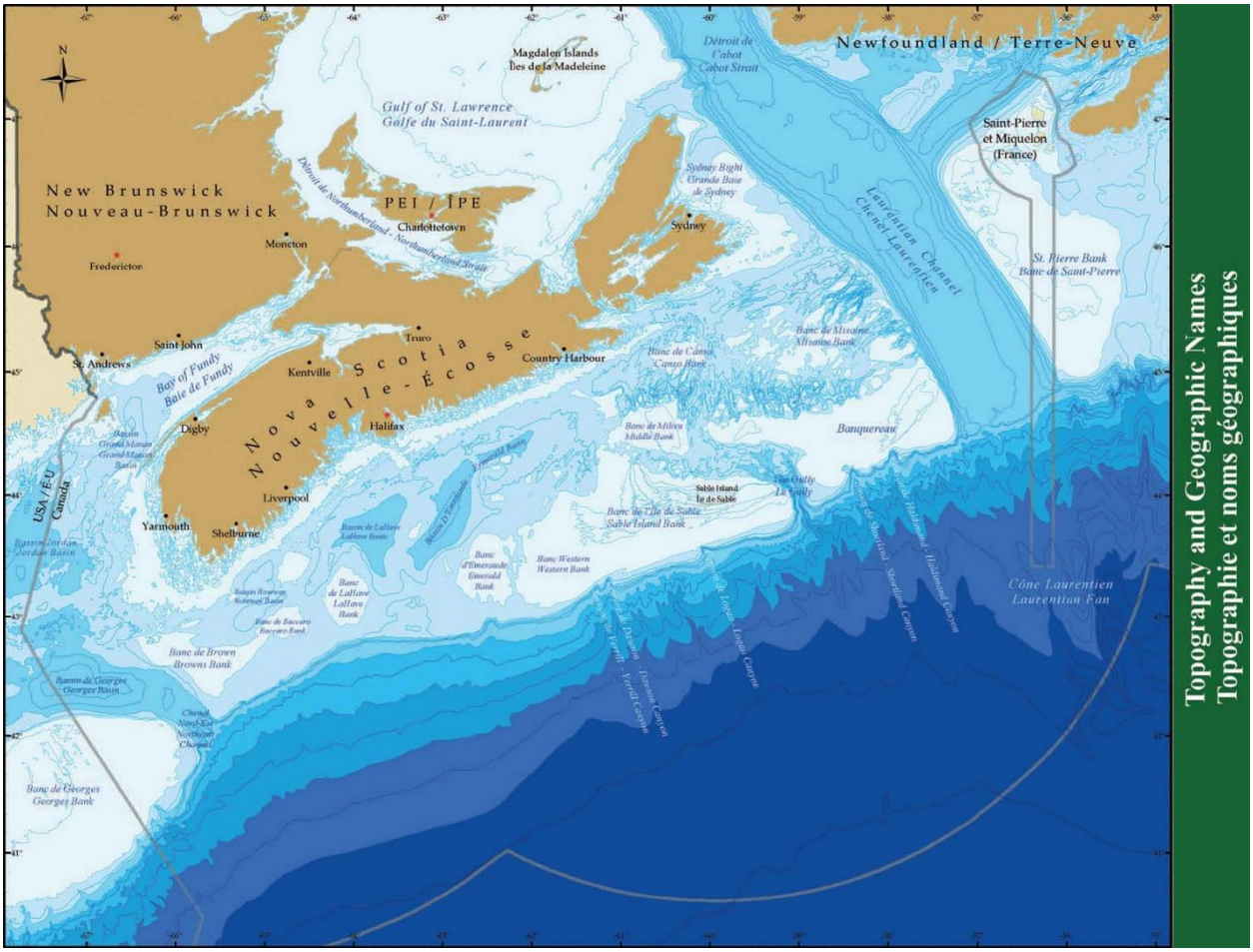


Figure 4.1. Geographic Extent of the Scotian Shelf (Breeze *et al*., 2005)

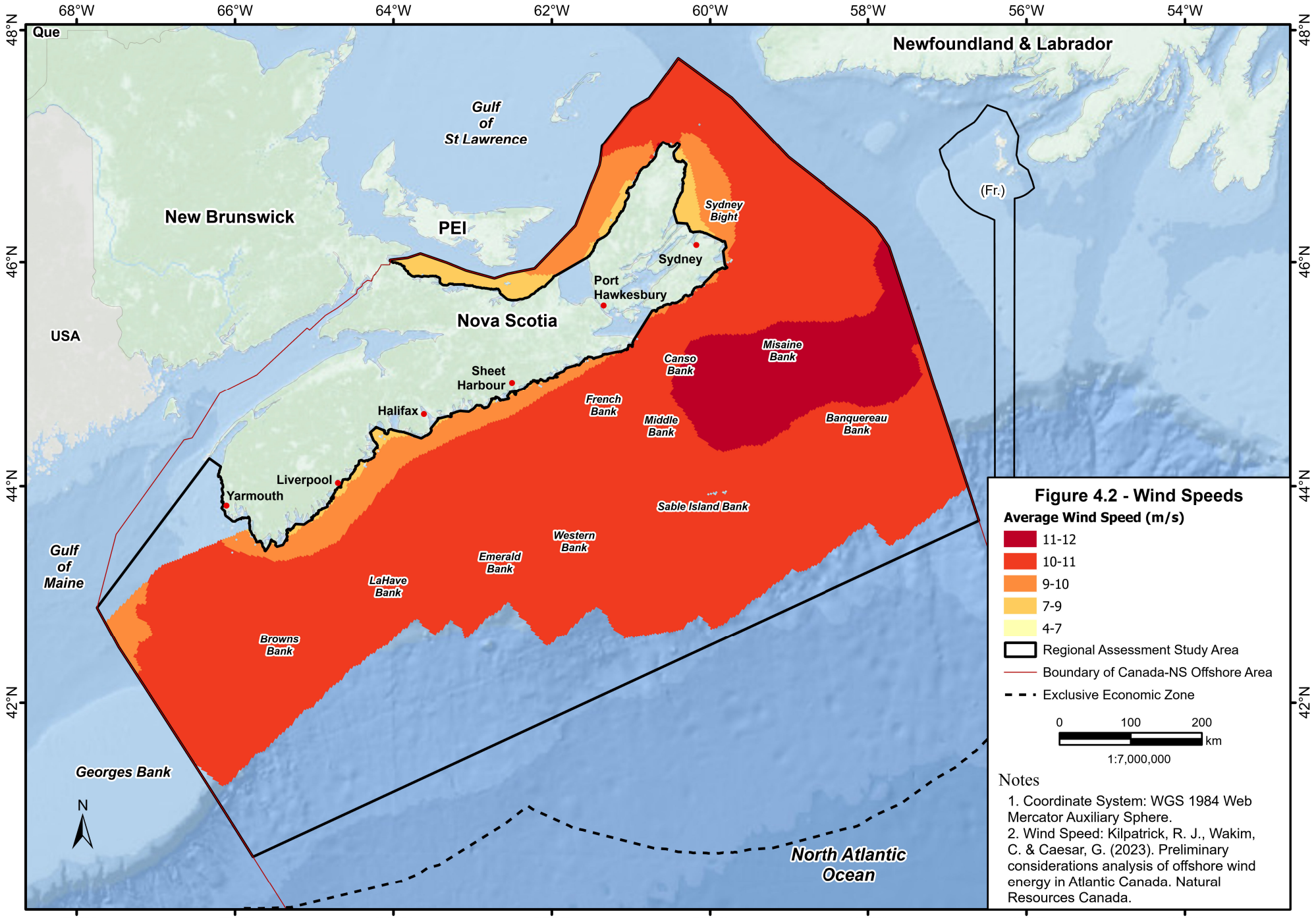
The ecological system is fairly typical of coastal waters at this latitude, with food webs that reflect the prevailing conditions of water depths, mixing patterns, salinity, substrate characteristics and nutrient and light availability. Like other coastal areas with significant human influences, e.g., 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 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 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). Global wind systems are fueled by energy from the sun which drives large-scale surface ocean currents that transfer heat from the tropics to the polar regions (NOAA, 2011). Ocean winds influence the Earth's climate system and contribute to the oceans' ability to store carbon dioxide from the atmosphere (AAAS, 2019). Increased storm surge levels, coastal flooding and erosion during storms are largely due to changes in ocean wind speeds and wave heights (AAAS, 2019). These winds are stronger, more consistent and usually less turbulent than winds onshore and have attracted attention from prospective OSW 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).

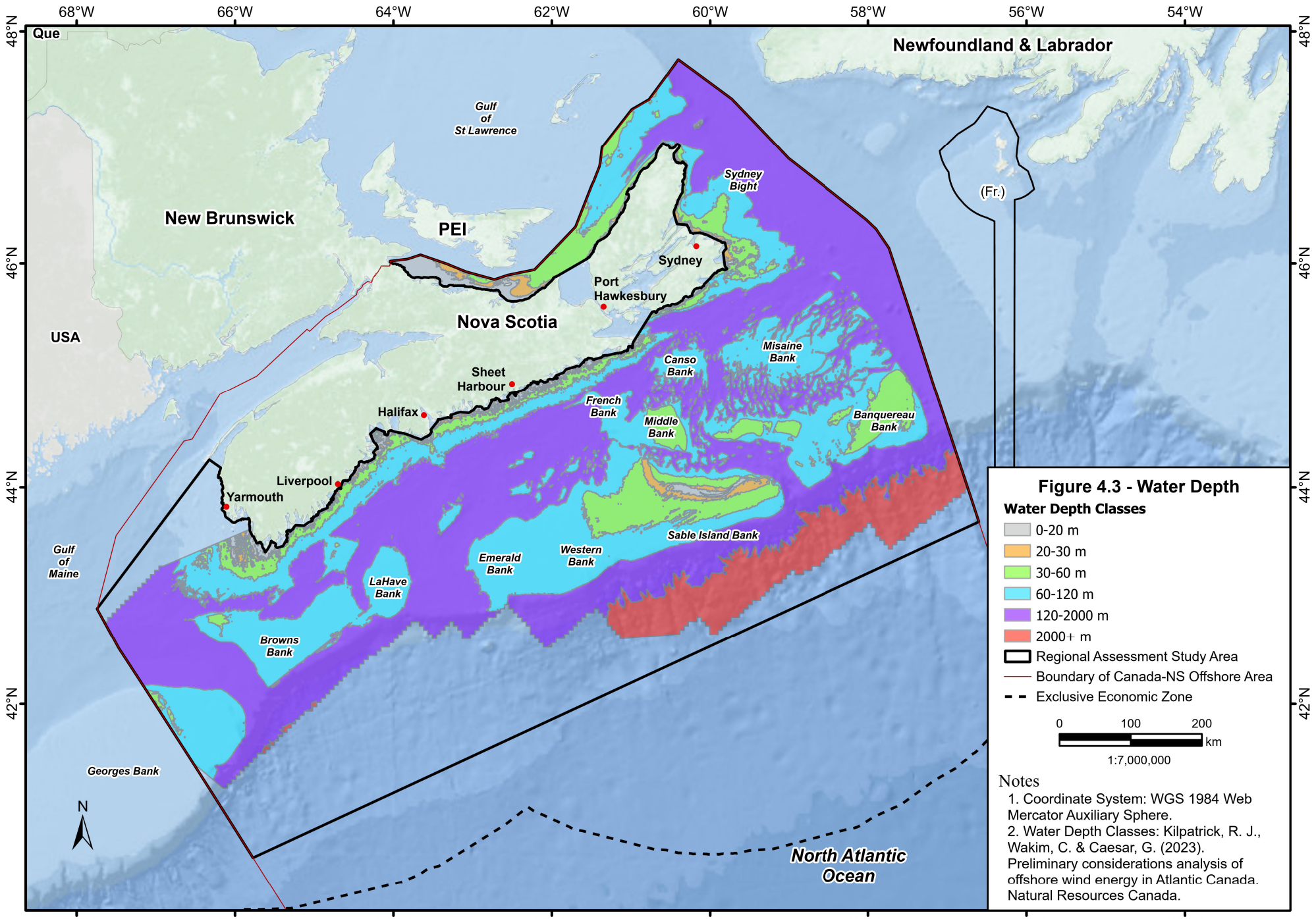

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Canso Bank
Sheet Harbour
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Banquereau Bank
Liverpool
Yarmouth
Sable Island Bank
Western Bank
Emerald Bank
Gulf of Maine
LaHave Bank
Browns Bank
Georges Bank
North Atlantic Ocean
(Fr.)
N
Figure 4.2 - 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 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 Shelf included in the RA study area 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.


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Canso Bank
Sheet Harbour
Halifax
French Bank
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
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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 its 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 the fisheries conducted.

4.2.3 Marine Geology

The RA Study Area encompasses most of the Shelf and Slope. The Shelf is relatively shallow with many areas < 100 m in depth; 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 glaciation during the Quaternary period when the advance and retreat of ice resulted in widespread erosion, deposition of till and creation of many 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 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 Shelf can be divided into the inner, middle and outer shelf regions. The inner region extends from the coast out to approximately 25 km offshore and is mostly 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 region 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. The outer region is a series of relatively flat shallow banks, including Sable Island which is the only emergent portion of Sable Island Bank. However, during past glacial retreats (Shaw *et al.*, 2002) the entire bank was exposed. Sands form large sand ridges that 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 generating storm-driven currents, waves, and

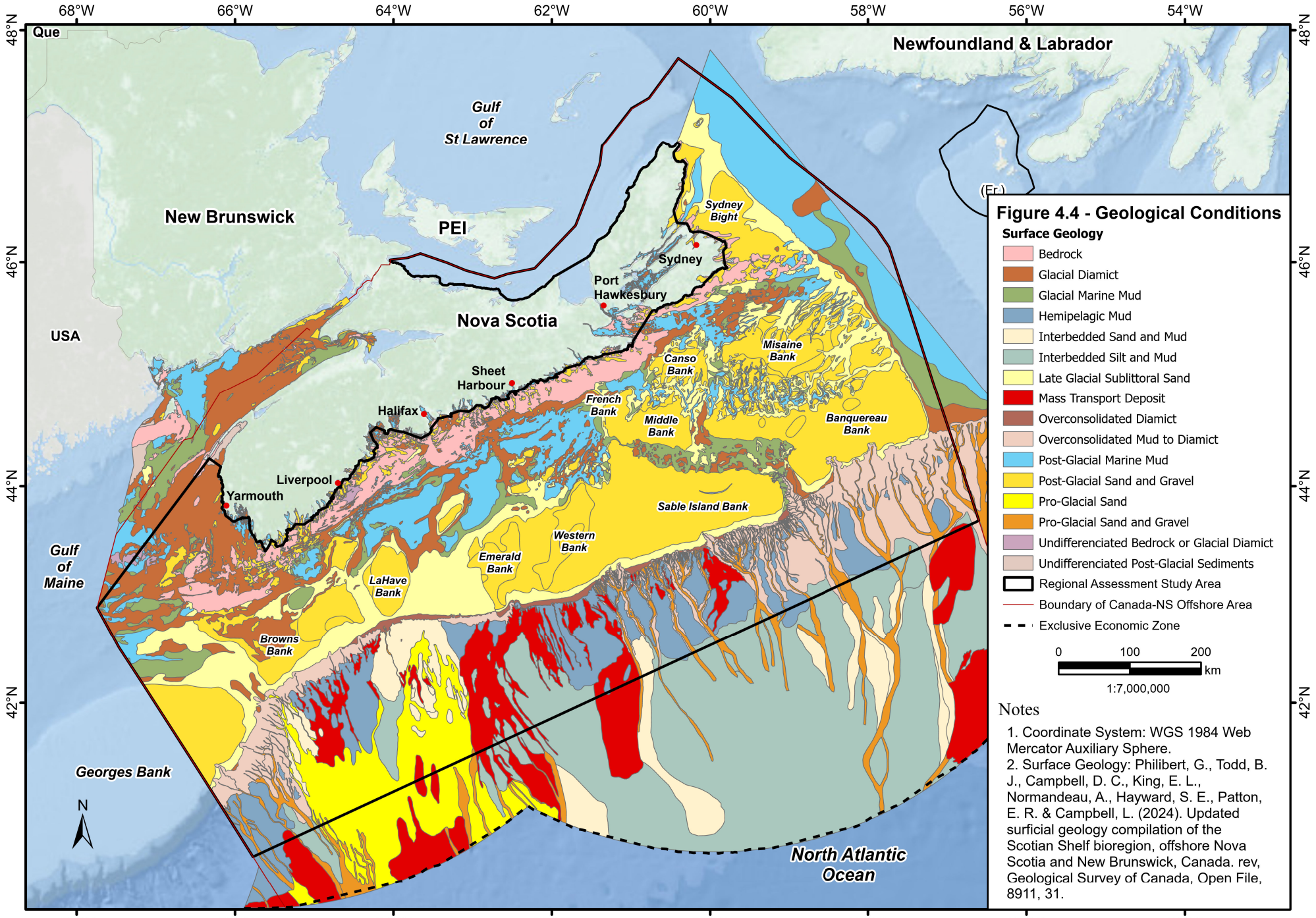
other processes. The sand ridges of Sable Island Bank are oriented NE-SW and migrate eastward (Li and King, 2007). Ridge size decreases from west to east due to changes in water depth, grain size and decreased dynamic conditions (Li and King, 2007). Sable Island is morphologically similar to a barrier 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) with 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). Slumped deposits resulting from periodic mass sediment failures along the shelf slope (Mosher *et al.*, 2004) and occasional extensive shell beds are found in the middle portion of the shelf. The continental slope consists of muds that show evidence of benthic life, e.g., bioturbation and 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 that there are no large quantities of glauconite. Glauconite sand is crushable and becomes clay-like and relatively impenetrable under stress, creating issues during installation especially for monopiles (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. 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. Research is ongoing within NRCan[30] and the province of NS. Additional studies and research are required to fill many of these data gaps.

It is noted that the description of geology is limited to the 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 the 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.

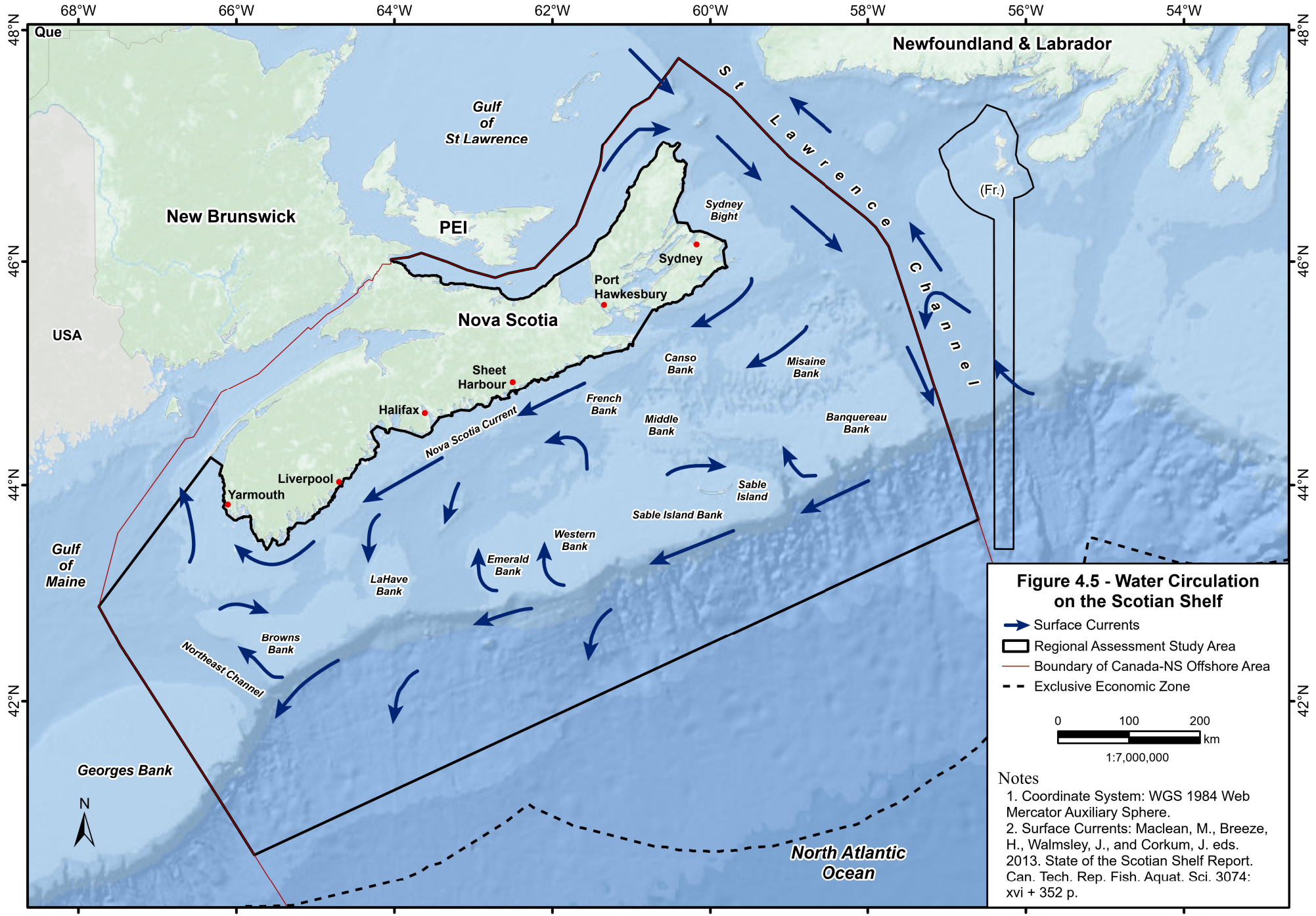
[30] NRCan feedback on Draft RA Report


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LaHave Bank
Gulf of Maine
Browns Bank
Georges Bank
North Atlantic Ocean
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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
0
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1:7,000,000
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 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 organisms from the south (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 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 Shelf itself, the circulation follows the major channels (Figure 4.5).


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Nova Scotia
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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
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North Atlantic Ocean
Figure 4.5 - Water Circulation on the Scotian Shelf
Surface Currents
Regional Assessment Study Area
Boundary of Canada-NS Offshore Area
Exclusive Economic Zone
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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.

OSW farms can impact hydrodynamics in the surrounding ocean in three principal ways: 1) through an atmospheric wake effect that reduces wind speeds behind wind turbines that can reach the ocean surface, reducing surface wind stress and wind-induced currents; 2) through changes to surface mixing resulting from the increased turbulence in wind movements downwind of a turbine; and 3) through subsurface mixing induced by the presence of the turbine substructure within the water column (ACPA, 2023; van Berkel et al., 2020). Specifically, hydrodynamics and wind wake effects around OSW turbines are driven by physical ocean processes including tides, stratification, water depth and wind-driven currents; and atmospheric processes such as turbulence and stability, all of which have significant natural variation (ACPA, 2023; van Berkel et al., 2020).

Increased turbulent mixing caused by wind turbines may enhance nutrient mixing and stimulate primary production, in turn enhancing zooplankton abundance, including copepods (ACPA, 2023). Primary production may decrease however due to reduced light penetration, if turbulence levels are significant and cause sediment resuspension (ACPA, 2023). It is also noted that that hydrodynamic impacts are highly dependent on OSW farm layout and wind turbine parameters, including turbine size (hub height and power capacity), type of foundation, turbine spacing within the OSW farm and the spacing between adjacent OSW farms and therefore, extensive build-out of OSW farms is likely necessary for these structures to have a significant hydrodynamic impact (ACPA, 2023). OSW turbines in the US, which are larger and more widely spaced, are likely to have less hydrodynamic influence than the smaller, more closely spaced turbines currently in operation in Europe and other parts of the world (ACPA, 2023).

There is little reason to suppose that this circulation pattern will be greatly influenced by the development of OSW on the 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 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 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 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 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, but 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).

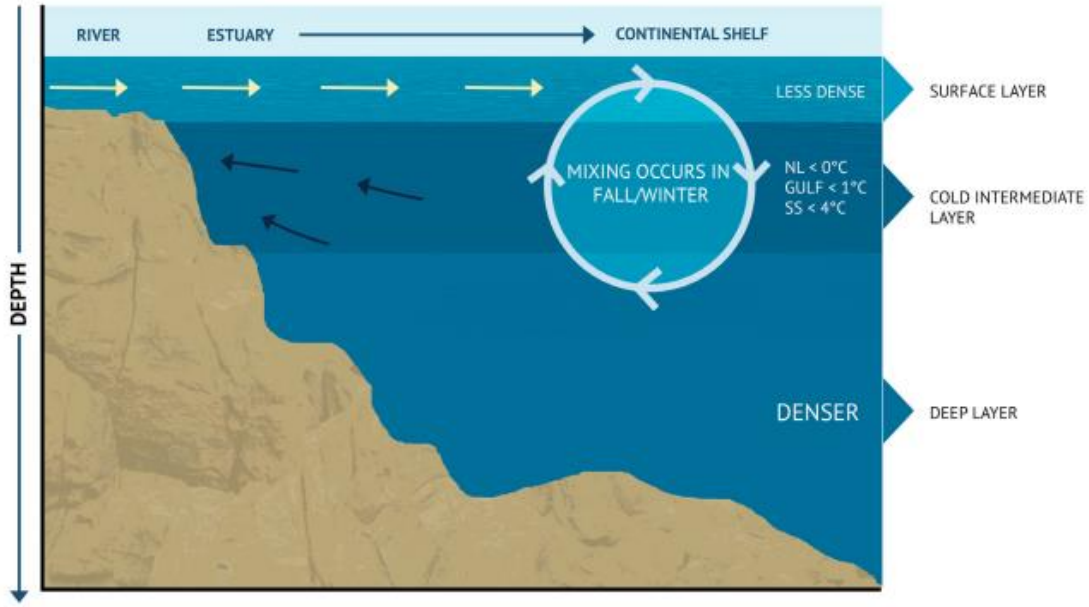


Figure 4.6. Stratification and the Cold Intermediate Layer (Bernier *et al*., 2018)

4.2.6 Sea Ice and Icebergs

Sea ice is monitored on a weekly basis by the Canadian Ice Service (CIS) over 4 regions that incorporate the RA Study Area (Figure 4.7). and are based on the median ice concentration when the ice cover reaches a maximum extent at the end of February.

- Region 1: North Coast NS
  - fully ice covered every winter
- Region 2: Cabot Strait and South
  - variability in the extent and concentration are linked to temperature and winds
- Region 3: South Coast of NS
  - variability in the extent and concentration are linked to temperature and winds
- Region 4: West Coast of NS
  - sea ice is not present every year

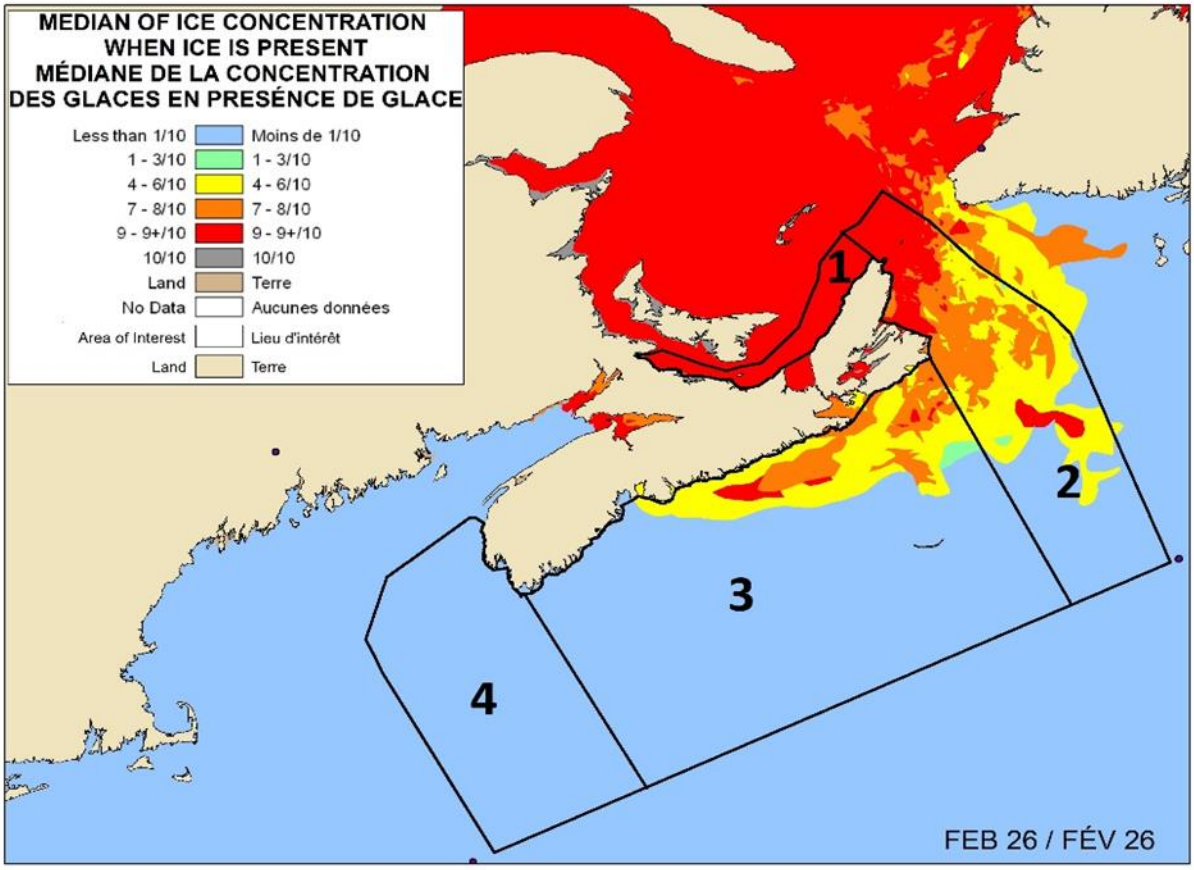


Figure 4.7. Median ice concentration when ice is present at the winter maximum in the four regions of the RA Study Area (CIS, 2023)

The sea ice cover in the RA Study Area reaches a maximum extent near the end of February and a maximum thickness near the end of April (Figure 4.8). There is no record of the presence of multi-year/old ice in the RA Study Area in the East Coast Regional chart archive (CIS, 2023). Trends for the total cumulative ice area Regions 1, 2 and 3 (trends were not calculated for Region 4), over the 51-year period from 1969/70 to 2019/20 showed a decrease in coverage for each region.

- Region 1: North Coast NS, -3.2% / decade (95% confidence)
- Region 2: Cabot Strait and South, -5.4% / decade (99% confidence)
- Region 3: South Coast of NS, -8.0% / decade (99% confidence)

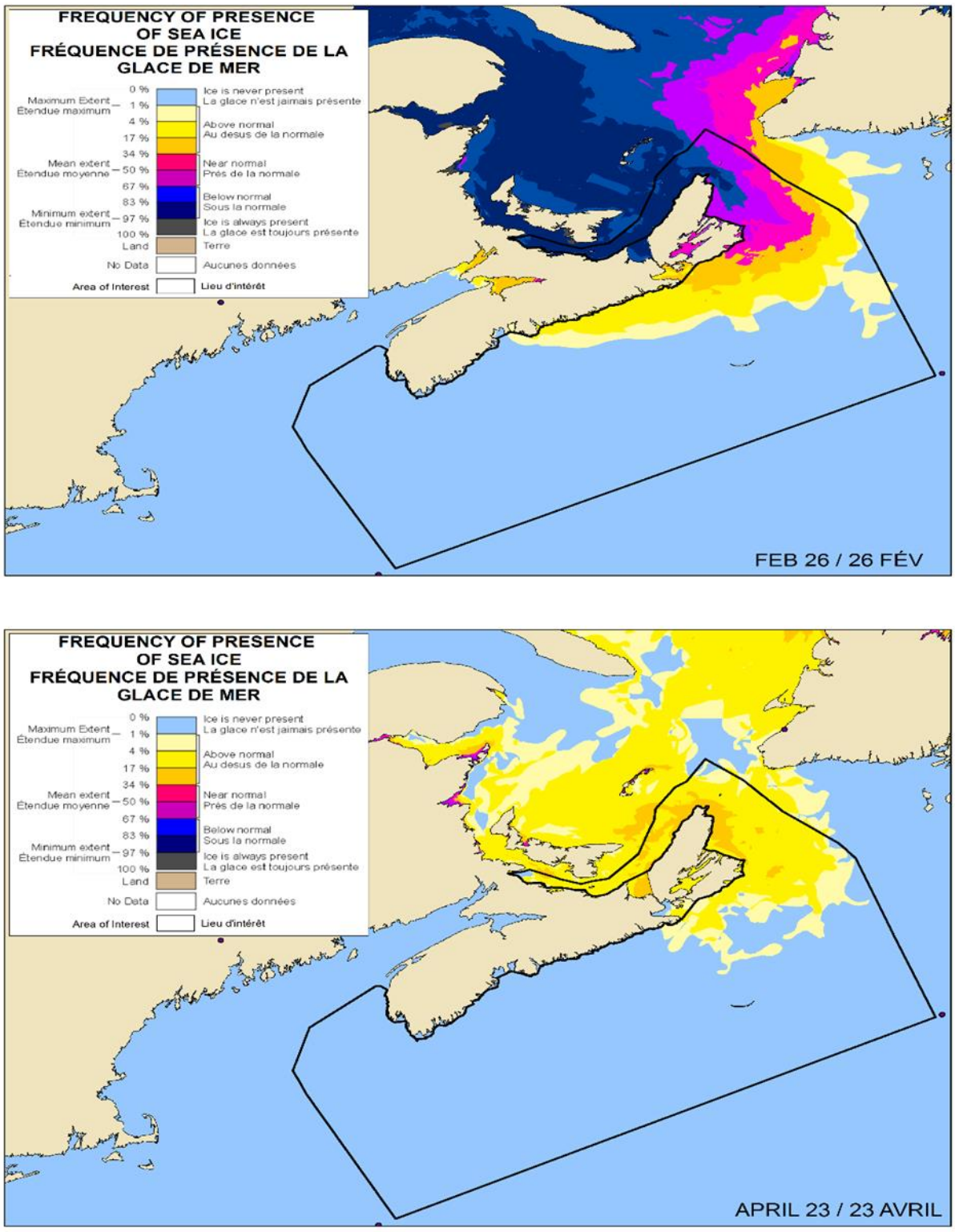


Figure 4.8. Frequency of presence of sea ice for February 26 (maximum extent) and April 23 (maximum thickness). *Top*: Frequency of presence of sea ice 1990/91 to 2019/20 for February 26; *Bottom*: Frequency of presence of sea ice 1990/91 to 2019/20 for April 23 (CIS, 2023)

The NRC-PERD Iceberg Sighting Database is the most comprehensive dataset of iceberg observations. It is important to note that the sightings are opportunistic and the absence of iceberg sighting in a specific location, at a specific time, does not necessarily mean there were no icebergs. It would be rare, however, for icebergs to be present along the southwestern shoreline without being recorded.

Sightings of icebergs in the RA Study Area are becoming increasingly rare, with the majority of sightings occurring in the Cabot Strait and south (Figure 4.9):

- 252 icebergs sighted between 1836-2020
- 79 icebergs sighted in the 1960s
- 34 icebergs sighted in the last 50 years (1971-2020), 20 of these were in 1995
- icebergs sighted in 6 of the last 30 years (1991-2020)

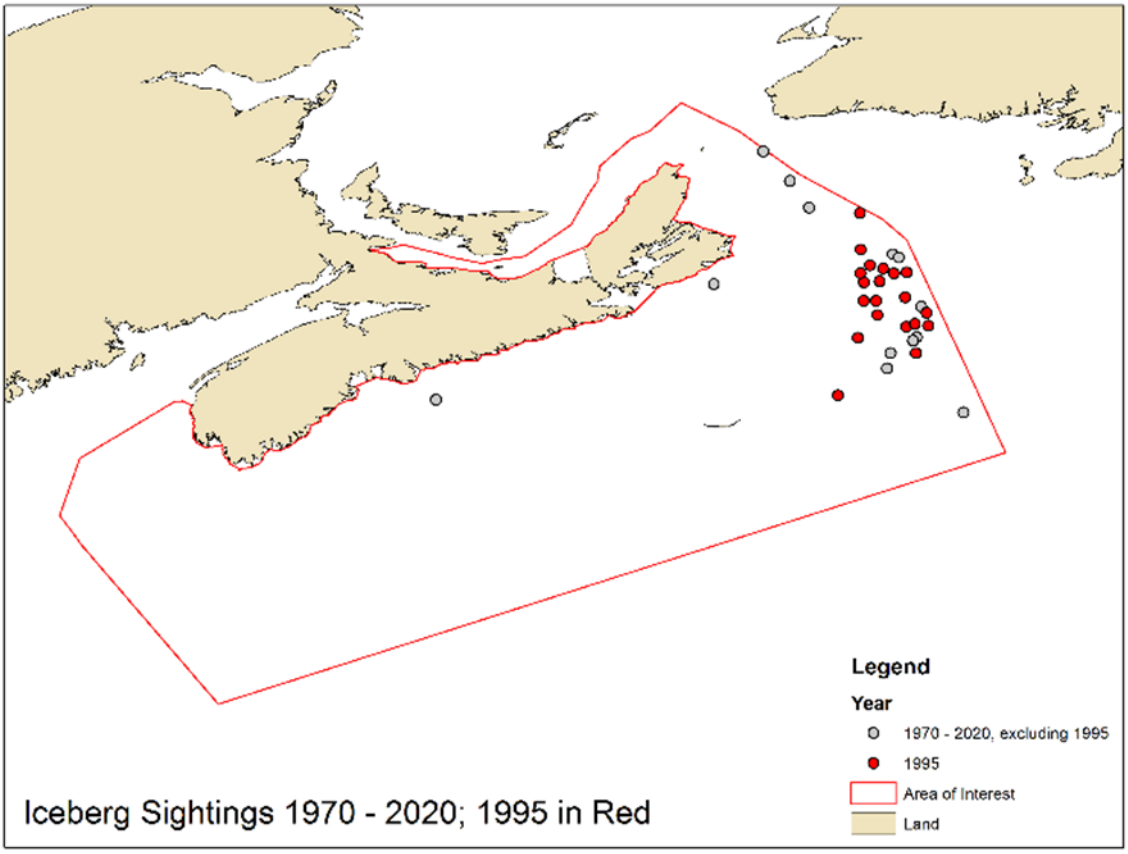


Figure 4.9. Location of sighted icebergs in the PERD Iceberg Sighting Database for the period of record 1970 to 2020 with icebergs from 1995 shown in red (NRC, 2023)

4.2.7 Wave Conditions

The 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 over much of the Shelf,

but this has recently been 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 and the strength and stability of stratification in the water column; it is therefore an important influence on both the productivity of the water column and the scour protection necessary to support fixed wind turbine foundations and associated cabling.

4.2.8 Changes

Like most shallow coastal waters, the 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 (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 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, warming of the Shelf waters and changes in Gulf Stream dynamics have influenced plankton abundance, biomass and community composition on the Shelf through the 2010s and early 2020s (Casault *et al.*, 2023). Additional analysis is required to characterize the mechanisms driving the changes, the relationship to higher trophic levels and therefore the future state of the Shelf plankton (Robicheau *et al.*, 2022).

4.3 Ecological Characteristics and Structure

As noted already, the 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 warming ocean conditions, and its intensity has varied according to the depth of mixing of the surface water and nutrient levels (Pepin *et al.,* 2013; Craig *et al.,* 2015; Bernier *et al.,* 2023). 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 from deeper waters 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 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 and released controls on small, fatty fish species, which primarily feed on zooplankton (see section 4.3.1 below).

An evaluation of numerous indices of species, processes and conditions on the eastern portion of the 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 result 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 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). Some of these changes are reflected in the recent rise of new fisheries such as those for sea cucumber and whelks.

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 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*) 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 – microbes such as *bacteria* and *fungi.* An important component of the plankton on the Shelf, especially in summer, consists of 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 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 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 provides the intrinsic link between primary producers and secondary consumers, i.e., fish, birds, turtles and mammals and supports the fisheries (Figure 4.10).

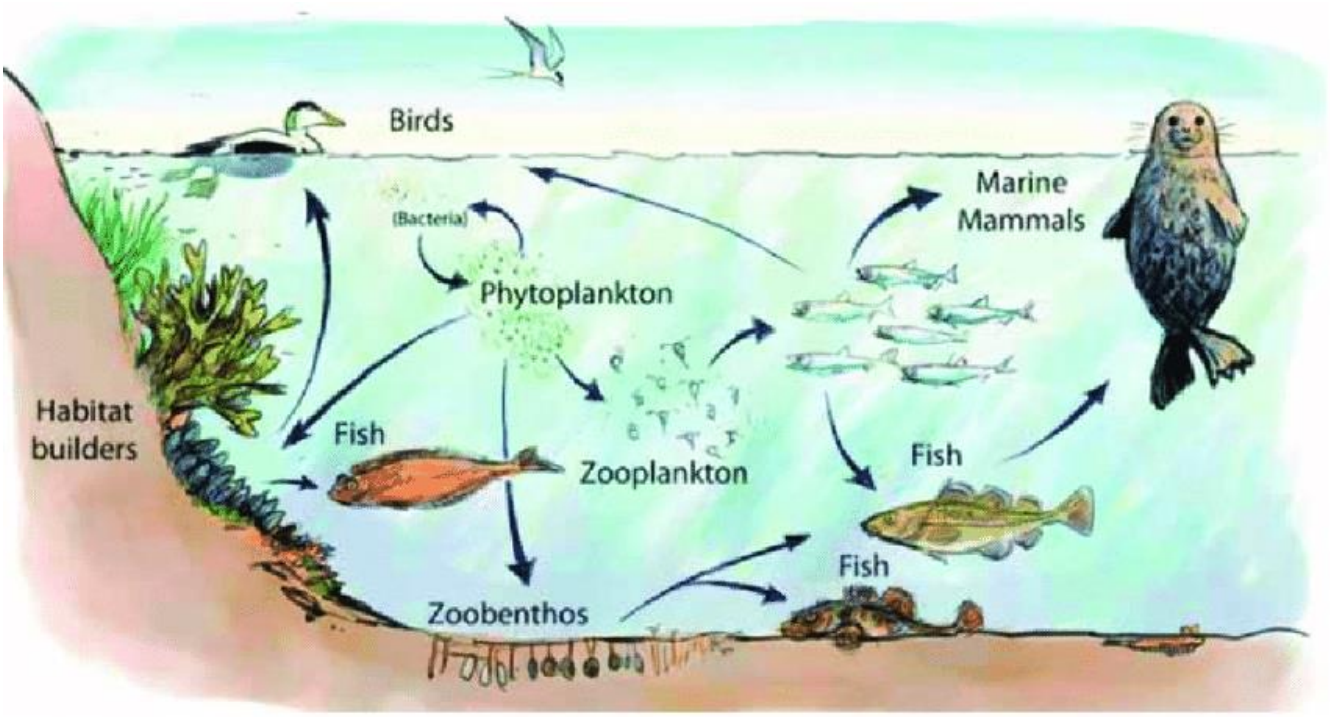


Figure 4.10. Food Web Diagram (Belgrano *et al.*, 2018)

The composition of the zooplankton on the 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, some birds 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 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 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 Shelf, which affect fish abundance and movements, are related to major shifts in the masses of water derived from the Gulf Stream, NS Current and Labrador Current (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 OSW development because it is expected that turbulence from operating turbines will affect the degree of mixing taking place in surface waters of the shelf downwind of turbines, therefore affecting biological productivity (see section 5.5.9). The availability of remote sensors mounted on buoys or on 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 species 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). There are some deeper areas on the mid- and inner-Scotian Shelf that are known to host sponges, sea pens and, in some instances, large gorgonian corals (DFO, 2017c). Corals and sponges are not harvested in this region, but they do 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 of the coral and sponge species in this region may not be formally recognized as Species at Risk (SAR) but are considered species of conservation concern within SiBAs and as such, additional planning and/or mitigation should be applied to avoid potential impacts from placement of infrastructure (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 fecal 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.

Some of the primarily benthic species are the basis of important fisheries and are listed in Table 4.1.

4.3.3 Organisms of the Water column

This term is used to include all larger aquatic organisms that are capable of independent swimming. This obviously includes fish, turtles and marine mammals and some larger crustaceans, e.g., shrimp and lobster, that spend at least part of their lives in the water column. Many of the fish, turtles and mammals 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 Shelf and of 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 American 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, including the waters within 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.

Table 4.1. Summary Table of Important Invertebrate Species of Special Status 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
Lesser bobtail squid
Shortfin squid
Spoonarm octopus

Note: Committee recognizes this list is likely incomplete and will need to be updated for project-level impact assessments.

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 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 resulted in some 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 assessed by the Committee on the Status of Endangered Wildlife in Canada (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 designated as Endangered under SARA, together with two (northern wolffish and spotted wolffish) designated as Threatened, and one (the Atlantic stock of the striped wolffish) 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 (especially elasmobranchs), 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 (see section 5.4.2).

Appendix 4.1 provides a detailed list of fish species of special status, including life history characteristics, that may be present in the RA Study Area. A summary of the list is provided in Table 4.2. 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 of Fish Species of Special Status 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	-
	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: Southwest NS/Bay of Fundy: critical zone, Offshore Scotian Shelf: uncertain, and Coastal NS: uncertain
	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, Atlantic pop.	COSEWIC status: Special Concern
	Butterfish	-
	Capelin	-
	Great white shark	SARA Status: Endangered
	Pollock	-
	Porbeagle shark	COSEWIC status: Endangered
	Shortfin mako shark	COSEWIC status: Threatened

Sub-categories	Species Common Name	Species Status according to SARA, COSEWIC and DFO
	Spiny dogfish shark, Atlantic pop.	COSEWIC status: Special Concern
	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 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 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; Scheibling *et al*., 1999). 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 the 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 (eDNA) techniques 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 NS. 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, including several species at risk, 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 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. 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 assessed by COSEWIC as species in danger of disappearing from Canada. The RA Study Area also includes critical habitat for North Atlantic right whale and northern bottlenose whale. Critical habitat has not yet been identified for blue whale (DFO, 2024). 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 NS.

Marine mammals of all sizes, including several species at risk ranging from the blue whale to the relatively small Sowerby's beaked whale, may be affected by threats from human activities in the marine environment such as 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, e.g., in the southern North Sea or the Baltic, there is not much that can be learned from OSW experience in those areas. This reinforces the need for an effective pre-commitment phase of research and monitoring (see section 10.1).

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 assessed as Endangered by COSEWIC (2023) (see Table 4.3 for a full list of SAR bat species). According to COSEWIC (2023), wind energy development is the most immediate and concerning threat for bat species. The planned increase in wind power capacity will increase this threat, but mitigation is possible (COSEWIC, 2023). Bat carcasses 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). There is obviously still much to be learned about the effects of wind turbines on bats.

Bats are essentially terrestrial 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). More commonly, recent studies have reported bats within 50 km of the coast (Hatch *et al.*, 2013; Solick and Newman, 2021). Migratory tree bats (hoary, silver-haired, and eastern red bats) are known to migrate over long distances and have been documented traversing marine environments during seasonal movements (pre- and post-breeding). The eastern red bat has been observed flying up to 160 km from mainland NS (Czenze *et al.*, 2011). Evidence also exists that smaller bats, e.g. *Myotis* bats, also move offshore (Doucette *et al.,* 2024). *Myotis* bats have been documented during the breeding season on St. Paul Island, off the coast of Cape Breton, suggesting smaller scale movements offshore to and from hibernation sites (ECCC Feedback, 2024).

There are a number of records of bats present at considerable distances from the NS shoreline (Table 4.3) – 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; Doucette *et al.,* 2024). Lucas and Hebda (2011) reported the silver-haired bat, hoary bat and eastern red bat that were observed on Sable Island between May and December. These are medium- to large-bodied bats compared with other species in NS and have very wide distribution in North America (COSEWIC, 2023). Doucette *et al.* (2024) detected silver haired bat, *Myotis* species, eastern red bat and hoary bat on Sable Island between late September to early December. 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.

Table 4.3. Bat Species Observed in Offshore Nova Scotia

Species Common Name	Species Status according to SARA, COSEWIC and DFO
Silver-haired bat	COSEWIC Status: Endangered
Eastern red bat	COSEWIC Status: Endangered
Hoary bat	COSEWIC Status: Endangered
Big brown bat	Not at risk
Little brown bat	SARA Listing: Endangered
Tri-coloured bat	SARA Listing: Endangered
Northern myotis	SARA Listing: Endangered
Source: ECCC, 2024	

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 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 Bermuda and storm-petrels, cormorants, gannets, gulls, terns, auks, phalaropes, sea ducks and geese (waterfowl), loons and herons, are ubiquitous over the inshore areas of the 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 and Labrador, 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 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, a distance of 12 km – 13,000 km.

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 4.4 and 4.5 list some of the principal species in this region. See Appendix 4.6 for detailed list of SAR bird species.

Table 4.4. 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
Mallard	-
Gadwall	-
American Wigeon	-
Sea ducks	
Common Eider	Nest along Atlantic Coast
Red-breasted merganser	Common along coast in fall to spring, few nest on coastal islands
Shorebirds	
Semi-palmated 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
Geese (Waterfowl)	
Canada goose	Coastal areas in southwest NS during spring and fall migrations; large numbers overwinter at Port Joli and Cole Harbour
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	Islands off Cape Breton
Roseate tern	Coastal islands
Common tern	Eastern and south shores
Arctic tern	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	

Note: The Committee recognizes this list is likely incomplete and will need to be updated for project-level impact assessments.

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

Table 4.5. 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 (Waterfowl)	
Brant	Coastal areas in southwest NS during spring and fall migrations
Diving 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
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

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
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; from Breeze *et al.,* 2002.

Data provided to the Committee by ECCC in 2024 are based on densities estimated from periodic at-sea surveys in the Eastern Canada Seabirds at Sea (ECSAS) Database (ECCC, 2022a). While the data are limited by the intermittent nature of the surveys (via ships of opportunity), 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. Winter data are also lacking for several species due to lack of surveying effort during this time period. While the Committee notes that these gaps exist (temporally and spatially), the ECSAS database is still a key data set in understanding pelagic bird densities.

The Eastern Shore Islands situated along the southeast coast of central NS support breeding congregations of greater than 4,000 common eider duck. Harlequin ducks 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 coastal buffer is designed in part to minimize the impact on these species, it is probable that many birds will exceed that distance from shore. Ducks, scoters, shearwaters and others are well known to travel substantial distances to reach highly productive areas of the 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 4.11) 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 4.12). 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 further researched before permits to build are issued.

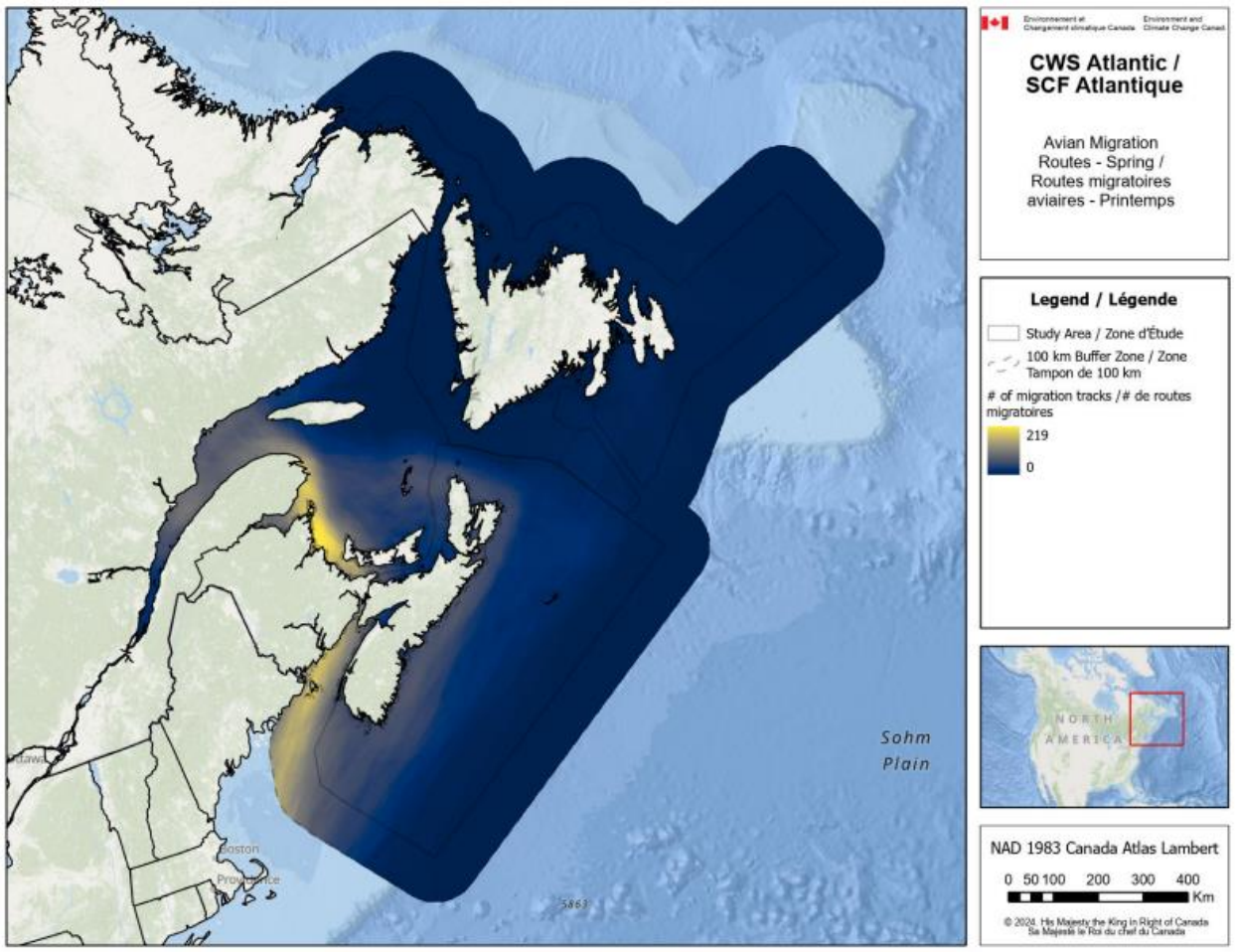


Figure 4.11. Avian Migration Routes – Spring

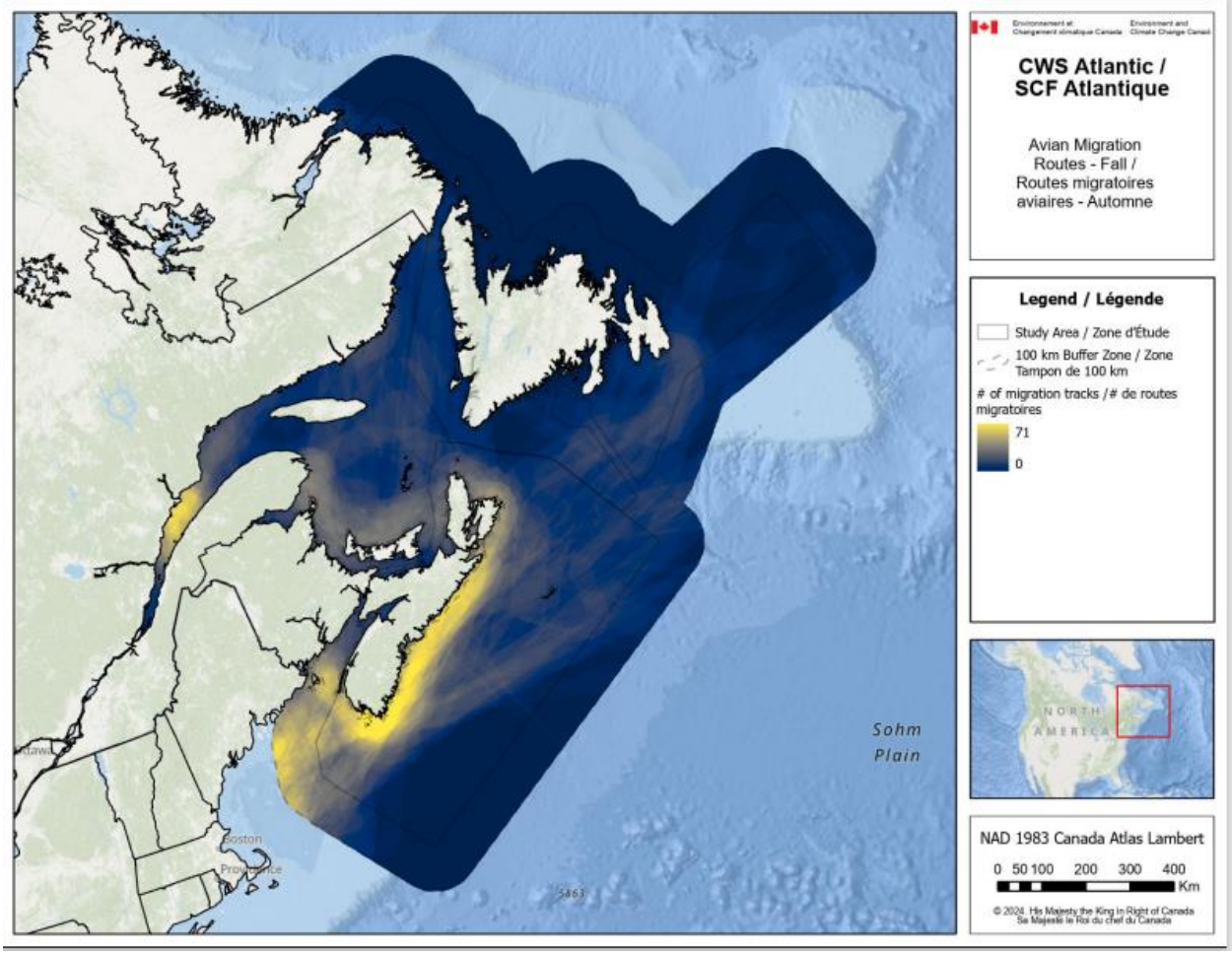


Figure 4.12. Avian Migration Routes – Fall

Movement and migration routes are critical due to the potential exposure of migrating wildlife to OSW development. To identify movement corridors, ECCC conducted an extensive review of tracking efforts in the Atlantic Canada offshore for species that migrate into and out of the region or move through the region on route to breeding areas beyond Atlantic Canada. Tracking data were collected using devices deployed on animals that record locations over time, providing information on where and when aerofauna are using offshore areas.

Movement models were created to identify patterns of space use for species across each season with available data. Migration routes of tracked birds were mapped with an applied buffer. All buffered tracks for a given migration period and species were then summed into a single map for spring (Figure 4.11) and fall (Figure 4.12).

Motus data[31] can provide important insight into the migration movement of smaller aerofauna species, including shorebirds, landbirds and bats (Leung and Geldart, 2024). 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 RA Study Area. This mapping and associated context report and data contributors are also in the ECCC submission.

It is important to note that there are various other avian species that are considered “extralimital”, using the RA Study Area for foraging during the year, e.g., Bermuda petrel (endangered). Information on these species is provided in the ECCC submissions.

All OSW developments have the potential to adversely affect aerofauna through collision mortality, habitat-mediated changes, and behavioural responses including avoidance, displacement and attraction (Williams *et al.,* 2024). Behavioural effects are direct responses to OSW energy structures or activities. Attraction behaviour may be maladaptive such that it increases the risk of collisions. Lighted offshore oil and gas platforms are known to attract nocturnally migrating birds and bats, which can increase energy expenditures and potentially lead to starvation or collision-related mortality (Hope Jones, 1980; Russell, 2005; Hüppop *et al*., 2006). Species that may be vulnerable to lighting-related effects include nocturnally active seabirds (Montevecchi, 2006) and nocturnal aerofauna migrants (Hüppop *et al*., 2006; Van Doren *et al.*, 2017). Other factors such as cloud cover, moon phase, as well as lighting characteristics can influence vulnerability to lighting-related effects (Kerlinger *et al.*, 2010; Ronconi *et al*., 2015; Gehring *et al.*, 2009; Cook *et al.*, 2011). 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. Limited evidence does not, however, indicate no impact. Mortality evidence is difficult to collect in the offshore environment as it is challenging to adequately detect and survey for mortalities from collisions offshore. Collision is more likely if seabirds fail to avoid OSW 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 occurs when seabirds actively avoid wind farms, leading perhaps to a loss of ideal foraging or other important habitat. Monitoring and

[31] For more information on Motus data, see the Motus as a Tool for Offshore Wind Assessment and Monitoring: a Knowledge Review report, available here: 159393E.pdf

follow-up studies at operating OSW 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 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, 2012a; 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 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 indication 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 has been identified throughout the RA Study Area as indicated on Figure 4.13 (section 4.4.5).

Immature loggerhead sea turtles occur fairly regularly at the edge of the 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 assessed 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). In 2017, the loggerhead sea turtle was designated as Endangered under SARA. The species migrates north to the edge of the Shelf during the summer months and returns south for the winter.

Kemp's Ridley turtle has occasionally been reported in waters off NS; however, it is generally found further south, and the Shelf has not been considered part of its regular foraging habitat (Marquez, 1995; TEWG, 2000; Bonjiorno, 2024). 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 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.

In the RA Study Area, the primary threat to sea turtles is fishing (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 being considered further.

4.3.8 Ecosystem Changes

The ecosystem of the RA Study Area has undergone significant changes over the last 100 + years, primarily associated with human interventions. These include historic overharvesting of fish, birds and mammals, and especially the widespread and extended overharvesting of groundfish (cod, haddock, pollock etc.) and pelagic fish (mackerel, herring and large pelagics) over more recent decades. Fishing has greatly reduced the abundance, distribution and genetic diversity of many species and has altered food webs on the Shelf, perhaps on a permanent basis (Charles *et al*., 2009; DFO, 2012b). 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. Nonetheless, while human-induced climate change has only been widely recognized in recent decades, it is an ongoing, possibly inexorable, modifier of the Shelf ecosystem upon which so many people and other species depend (DFO, 2022m).

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 Shelf. Several instances in which abundance of fish species (as indicated by landings data) vary over an 18-to 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 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 (refer to section 10).

4.4 Protected and Special Areas

Several marine, coastal areas in NS are legally protected under federal, provincial, or other legislation or agreements due to their ecological, historical or socio-cultural characteristics and importance. Other areas have been formally identified as being special or sensitive through other relevant processes and initiatives, such as Conservation Agreements.[32] The variety of areas is substantial, ranging from Marine Protected Areas (MPAs), which receive maximal protection under federal law, e.g., *Oceans Act*, to areas identified for specific species conservation, such as fish, birds and mammals, or specific habitats, with varying levels of protection.

This section identifies and describes those protected and special areas that are within or around the RA Study Area.

4.4.1 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 4.6.

Table 4.6. Federal Legislation and Associated Special Areas

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

[32] **Species at Risk Act, s. 11** (1) A competent minister may, after consultation with every other competent minister, and with the Canadian Endangered Species Conservation Council or any of its members if he or she considers it appropriate to do so, enter into a conservation agreement with any government in Canada, organization or person to benefit a species at risk or enhance its survival in the wild.

Migratory Birds Convention Act, 1994, c. 22	MBS	ECCC	To conserve and protect habitat for migratory bird species.
Canada Wildlife Act, R.S., 1985, c.W-9	NWA	ECCC	To conserve and protect habitat for a variety of wildlife, including migratory birds and species at risk.
Canada National Marine Conservation Areas Act, 2002, c. 18	NMCAs	Parks Canada	To conserve and protect representative examples of Canada's natural and cultural marine heritage and provide opportunities for public education and enjoyment.
Canada National Parks Act, 2000, c.32	National Park / National Park Reserve	Parks Canada	To protect representative examples of Canada's natural heritage for the benefit, education and enjoyment of Canadians.
Species at Risk Act, 2022, c.29	Critical Habitat	DFO, ECCC, Parks Canada	Habitat identified under SAR recovery strategy or action plan as necessary for the survival or recovery of listed extirpated, endangered, or threatened species.

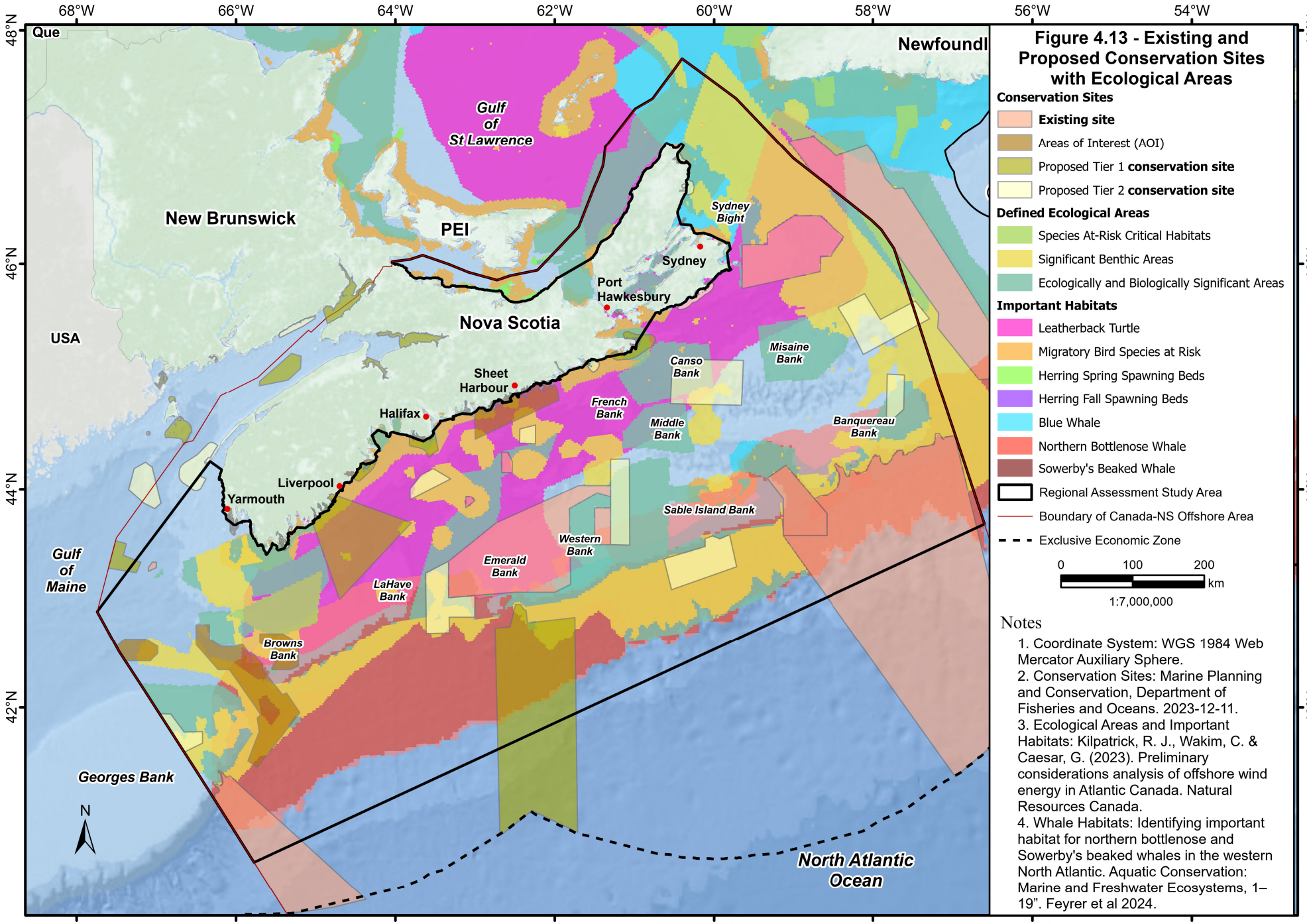
Source: Government of Canada, 2024a.

In addition to the above list, DFO, continues to develop a draft Conservation Network Plan in collaboration with Parks Canada and the Canadian Wildlife Service (CWS) for the Scotian Shelf-Bay of Fundy Bioregion (DFO, 2023c). The plan consists of existing federally designated conservation areas and a suite of proposed network sites for future protection. It is being developed using best practices in systematic conservation planning, incorporating ecological and human use data, scientific information on climate change, spatial analyses and feedback collected through engagement. Proposed network sites are classified as 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). The boundaries for these sites, however, are preliminary and subject to change through site-specific establishment processes, which include additional engagement with other levels of government, rightsholders and stakeholders. The network sites that are within or around the RA Study Area are presented on Figure 4.13.

Apart for one species (northern bottlenose whale), the defined ecological areas and important habitat layers included on Figure 4.13 are sourced from the CanMET Preliminary Considerations Analysis of Offshore Wind Energy in Atlantic Canada (Kilpatrick *et al.,* 2023). In response to a DFO recommendation to the Committee, more accurate data based on most recent science for the northern bottlenose whale important habitat have been used in the figure instead of the CanMET data for this species. These data were obtained from Feyrer *et al.*, 2024.

DFO also noted in feedback to the Committee that the best depiction of leatherback sea turtle important habitat is presented in Figure 2 of the Canadian Science Advisory Secretariat Science (CSAS) Response 2020/041 document entitled "Using satellite tracking data to define important habitat for leatherback sea turtles in Atlantic Canada: 2019 update." These data are not included in Figure 4.13 but are accessible in the CSAS document.[33]

[33] Using Satellite Tracking Data to Define Important Habitat for Leatherback Turtles in Atlantic Canada: 2019 Update


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
Newfoundl
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
N
Figure 4.13 - 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
Sowerby's Beaked 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.
4. Whale Habitats: Identifying important habitat for northern bottlenose and Sowerby's beaked whales in the western North Atlantic. Aquatic Conservation: Marine and Freshwater Ecosystems, 1–19". Feyrer et al 2024.

4.4.1.1 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 undertaken for biological/ecological, socio-economic and cultural factors. 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 NS, 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. Anns Bank MPA, located within the RA Study Area (Table 4.7). 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. Anns Bank MPA is located east of Cape Breton and includes most of St. Anns Bank, Scatarie Bank and a portion of the Laurentian Slope and Channel (Ford and Serdynska, 2013). St. Anns 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 AOIs located within the RA Study Area: Eastern Shore Islands AOI and Fundian Channel Browns-Bank AOI (Table 4.7). 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) and therefore falls largely within the 25 km buffer proposed in this report (refer to sections 6 and 10). 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 4.7. 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; it includes critical habitat for the endangered Scotian Shelf population of Northern bottlenose whale and 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, and approximately 30 species of cold-water corals.
St. Anns Bank MPA	4,364	• St. Anns Bank has the highest annual sea surface temperature range on the 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. Anns 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 the 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 the 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 and 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, called the Northeast Channel Coral Conservation Area.

Sources: DFO, 2019a, 2020b, 2023b, 2023c, 2023d, 2023g.

Regulations restricting activities are similar among MPAs, while 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).

4.4.1.2 Marine Refuges

Marine Refuges are area-based *Fisheries Act* closures that have been recognized as Other Effective Area-Based Conservation Measures (OECM) (DFO, 2022o). Marine Refuges are complementary to MPAs to help protect coastal and marine areas and protect marine biodiversity through the provision of long-term biodiversity benefits (DFO, 2022o). The main difference between the two is the primary purpose of the area. The primary objective of a protected area is conservation, however, an OECM is managed for another purpose while also achieving conservation and biodiversity outcomes. General examples of OECMs include military training areas, native prairie grasslands managed for beef production, or watershed protection areas around major metropolitan areas (Government of Canada, 2022b). The Government of Canada is working closely with provinces and territories, Indigenous peoples, the private sector, non-governmental organizations and local governments to find more ways to protect nature and biodiversity, build stronger communities and help combat climate change (Government of Canada, 2022b). These partnerships are crucial for identifying and recognizing OECMs, which are a key tool to help Canada reach the ambitious goals of conserving 25% of land and in-land waters by 2025 (Government of Canada, 2022b).

Fisheries closures under the Fisheries Act can be established for a variety of reasons and only those found to fulfill the OECM criteria are afforded the title of marine refuge and count towards Canada's marine conservation target. All existing and foreseeable activities in an OECM are assessed on a case-by-case basis to ensure that the risks they pose to the biodiversity conservation benefits are effectively avoided or mitigated.

To date, DFO has designated five Marine Refuges (Table 4.8) 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) which are located to the southwest of the RA Study Area. The Marine Refuges are listed in Table 4.8. 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 4.8. Marine Refuges and Fisheries Closure Areas in Nova Scotia

Name	Conservation Objective	Priority Actions
Emerald Basin and Sambro Bank Marine Refuge	Protect globally unique concentration of *Vazella pourtalesii*, a structure-forming species of glass sponge. Protect benthic habitats and associated communities.	Manage human activities to: Avoid or mitigate damage to or loss of *Vazella pourtalesii.* Avoid or mitigate disturbance of benthic habitats and communities
Corsair and Georges Canyons Marine Refuge	Protect cold-water corals including significant concentrations of large gorgonian corals, e.g., *Paragorgia arborea* and *Primnoa resedaeformis*. Protect deep-water habitats (continental slope, continental rise and abyssal plain) and associated benthic communities.	Manage human activities to: Avoid or mitigate damage to or loss of cold-water corals. Avoid or mitigate disturbance of benthic and deep-water habitats and communities.
Jordan Basin Marine Refuge	Protect cold-water corals, e.g., *Primnoa resedaeformis, Paramuricea* sp. and *Desmophyllum pertusum*, including the diverse bedrock pinnacle known as the Rock Garden.	Manage human activities to: Avoid or mitigate damage to or loss of cold-water corals. Avoid or mitigate disturbance of benthic habitats and communities.
Western and Emerald Banks Marine Refuge	Protect continental shelf habitats and associated benthic and demersal communities. Support productivity objectives for groundfish species of Aboriginal, commercial and/or recreational importance, particularly North Atlantic Fisheries Organization Division 4VW haddock. Protect benthic habitats that support juvenile and adult haddock and other groundfish species.	Manage human activities to: Avoid or mitigate damage to or loss of groundfish habitat and species, particularly 4VW haddock, avoid or mitigate disturbance of continental shelf habitats and communities. Increase understanding of: The role of the marine refuge as a reference area of low fishing activity for the Bioregion, what contributions the

		marine refuge provides to regional productivity and stock assessment. Evaluate, review and minimize harmful interactions associated with future fish harvest activities.
Eastern Canyons Marine Refuge	Protect cold-water corals including significant concentrations of large gorgonian corals, e.g., *Paragorgia arborea* and *Primnoa resedaeformis,* and *Desmophyllum pertusum* (formally known as *Lophelia pertusa*). Protect deep-water habitats (continental slope, continental rise and abyssal plain) and associated benthic communities.	Manage human activities to: Avoid or mitigate damage to or loss of cold-water corals. Avoid or mitigate disturbance of benthic and deep-water habitats and communities.
Scallop Buffer Zones (SFA 21, 22, 24)	These closures offer protection to other important species such as juvenile lobster, crab and others, and their habitats within the Estuary and Gulf of St. Lawrence Bioregion but not part of the Scotian Shelf Bioregion.	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.

4.4.1.3 National Wildlife Areas and Marine National Wildlife Areas

According to the *Canada Wildlife Act*, National Wildlife Areas (NWA) and Marine National Wildlife Areas (MNWA) are created and managed for the purposes of wildlife conservation, research, and interpretation (Government of Canada, 2023). The criteria for candidate areas include:

- The area supports at least 1% of the Canadian population of a species or subspecies of migratory bird, or species at risk, for any portion of the year where total populations are known;

- The area supports an appreciable assemblage of species or subspecies of migratory birds or species at risk, or an appreciable number of individuals of any one or more of these species or subspecies where total populations are not known, or the assemblage represents a regionally significant area;
- The area has been identified as critical habitat for a listed migratory bird or other species at risk population, subspecies or species;
- The area is a rare or unusual wildlife habitat of a specific type in a biogeographic region, or has special value for maintaining the genetic and ecological diversity of a region because of the wide range, quality and uniqueness of its flora and fauna; and
- The area possesses a high potential for restoration or enhancement, now or in the future, such that wildlife populations could be increased or managed to meet national objectives.

As the list of accepted NWAs is often updated, it is recommended that those with interests in an area, e.g., developers, researchers etc., check for newly established or proposed NWAs and MNWAs. There are, for example, two newly proposed NWAs with implications for OSW development in NS (Table 4.9). Proposals for the establishment of Country Island (21 hectares) and St. Paul Island (478 hectares) as NWAs have recently undergone public consultation and are anticipated to be accepted in early 2025.

Table 4.9. 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	• 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).

Source: ECCC, 2022b

4.4.1.4 National Marine Conservation Areas

National Marine Conservation Areas (NMCA) are established and managed to protect and conserve representative marine areas for the benefit, education and enjoyment of the people of Canada and the world. NMCAs include submerged lands, the water above them, and any

species found there. They may also include wetlands, estuaries, islands and other coastal lands. The proposed Pemsik 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 adjacent to Kejimkujik National Park Seaside and extends 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).

4.4.1.5 Migratory Bird Sanctuaries

Migratory Bird Sanctuaries (MBS) 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 that are in place. MBS are designated to protect marine and migratory bird species using areas for significant life cycle processes including, but not limited to, nesting, feeding and migration. MBS occur on private, provincial, federal or territorial lands. MBS designation follows a standard process that involves selecting a candidate area and comparing the candidate area against the following criteria to determine if the area can be classified as an MBS:

- Whether the area supports populations that are concentrated, for any part of the year, in order to meet one or several essential needs;
- The area is vulnerable to area-specific threats, including, but not limited to, hunting, exploration, development etc., that have the ability to affect significant portions of the population;
- The area supports populations that occupy habitats of restricted geographical area and that are vulnerable to human disturbance, including species listed under Schedule 1 of SARA or assessed by COSEWIC; and
- The area regularly supports at least one percent of a population of one species or subspecies.

Once established, regulations are created outlining what activities are allowed or prohibited with the MBS boundaries. While some activities may be permitted within an MBS, these are typically limited to low-impact activities that may be considered compatible with the conservation objectives of the area. Permits are required to undertake activities otherwise restricted within an MBS. Current MBS in NS are listed in Table 4.10.

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 4.10. 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 locally 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).
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.

4.4.1.6 Critical Habitat

Critical habitat is defined in subsection 2(1) 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". For aquatic species, SARA defines habitat as "spawning grounds and nursery, rearing, food supply, migration and any other areas on which aquatic species depend directly or indirectly in order to carry out their life processes, or areas where aquatic species formerly occurred and have the potential to be reintroduced". Subsection 58(1) of SARA includes a prohibition against the destruction of any part of critical habitat; the provisions to protect such habitat are described in SARA section 58(5).

4.4.2 Other Areas of Significance

4.4.2.1 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* (1996). 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, if disturbed, the ecological consequences (in space, time, or outward through the food web) would likely be greater than the effect of an equal disturbance in most other areas. 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 an 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).

4.4.2.2 Important Bird Areas and Key Biodiversity Areas

Important Bird Areas (IBA) are specific geographic regions recognized for their significance in supporting avian populations. The designation depends on factors including peak species counts and the percentage of the biogeographic population relying on the site annually. Currently, Birds Canada is in the process of transitioning many of the existing IBA to Key Biodiversity Areas (KBA). The KBA Program is a global initiative to identify all sites critical to wildlife populations. In Canada, three NGOs (Wildlife Conservation Society Canada, Birds Canada and NatureServe Canada) coordinate the national KBA program, which involves a network of hundreds of NGOs, governments, communities, experts and knowledge-holders. A number of locations within the RA Study Area have been identified as IBA or KBA.

KBAs are important for wildlife and nature to survive and thrive and are found across terrestrial, 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 KBA, 10 of which occur in marine ecosystems (KBA Canada, 2024a) (Figure 4.14). Of these 10, eight are located adjacent to the RA Study Area (KBA Canada, 2024b). Except for the Sable Island site, all marine KBA fall within the 25 km coastal buffer proposed in the Interim Report.

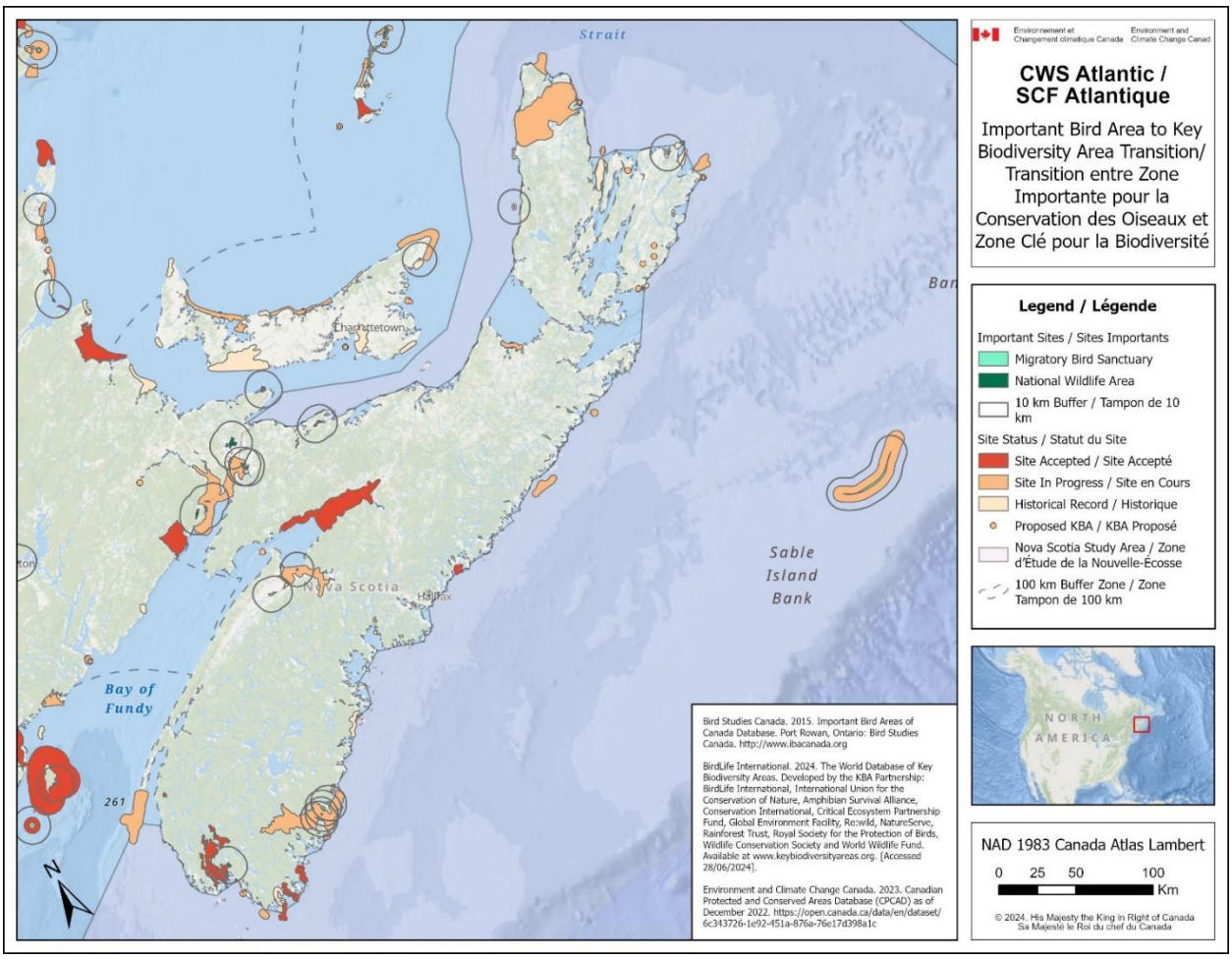


Figure 4.14. Key Biodiversity Areas (including MBAs, IBAs and NWAs)

Although many of these areas appear at first sight to be remote from the region currently under consideration for OSW development, many of the birds occurring in these areas 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 loons, several gulls, roseate tern, northern gannet, great cormorant, Leach's storm-petrel and razorbill. Their vulnerability to an OSW 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, (except for red-necked phalarope and red phalarope). 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 weather conditions as well as flight height, 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 4.11. 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 4.11. 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 North Atlantic 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 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.
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 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.

4.4.2.3 Marine Bird Colonies

Colonial waterbirds frequent coastal areas, with some found exclusively in the marine environment and others found in both marine and freshwater environments (ECCC 2019). These species typically gather, particularly for nesting, roosting, and foraging (ECCC 2019). The breeding season for colonial species in Canada extends from March through September, with timing varying across species and regions, depending on local conditions. Information on specific nesting times per region can be obtained from the Nesting Calendar Query Tool from Birds Canada. Once the breeding season is complete, most colony species disperse from breeding grounds to other areas within or outside of Canada. During the non-breeding season, species that do not breed locally may continue to be present. Bird colonies support high densities of species and individuals that use the surrounding areas for foraging. (ECCC can provide colony- and species-specific information for consideration).

The Banque informatisée des oiseaux de mer au Quebec and the Atlantic Colonial Waterbird Database contain records of individual colony counts, by species for known colonies in Eastern Canada. Publicly available colony records can be found on Open Government.

Work done by Ronconi *et al.* (2022) demonstrates seabird foraging distributions around colonies during the breeding season. These models use tracked individuals to estimate the probability of an individual using a location around a colony based on environmental variables related to bathymetry, ocean ruggedness, track distance from colonies and distance from the coast. Models are combined with information on colony size to generate prediction surfaces to estimate colony-centered density and distribution for each species. For species with insufficient tracking data, ECCC provides maps demonstrating theoretical foraging radii for individual species and foraging guilds, following the methods from Critchley *et al.*, 2018. (For more information, please see the ECCC Submission "Colonial Bird Theoretical Foraging Radii").

4.4.2.4 Regionally Important Waterfowl Sites

Sea duck key habitat sites are important areas for sea ducks in North America, particularly during migration and breeding seasons (ECCC, 2024i). Designation of Sea Duck Key Habitat Sites are intended to increase awareness of these important habitats and help to prioritize areas for conservation and protection efforts. A Sea Duck Key Habitat Sites Atlas is available from the Sea Duck Joint Venture. There are three Sea Duck Key Habitat sites that occur along the coast of NS: the Eastern Shore key habitat site includes offshore islands and ledges along the eastern shore; the Prospect key habitat site includes several kilometers of coastal and island shorelines along the south shore; and the South Shore key habitat site encompasses coastal areas, islands along the south shore as well as many estuaries, harbors, and bays. Additional information provided by ECCC is available on the Registry.

4.4.2.5 Regionally Important Shorebird Sites

Regionally important shorebird sites are related to the Western Hemispheric Shorebird Reserve Network (WHSRN). Shorebirds are located relatively close to the shore, but there are examples

of shorebirds occurring further from shore during migration. For more information see feedback provided by ECCC available on the Registry.

4.5 Human-use Overview

4.5.1 Fisheries

4.5.1.1 Indigenous Fisheries

Mi'kmaq in NS were signatories to Peace and Friendship Treaties with the British Crown in the eighteenth century. Other signatories include the Wolastoqey and Peskotomuhkati communities (Government of Canada, 2010). These treaties, including the Treaty of 1752, recognize Indigenous rights to hunt, fish and gather in traditional territories for "necessaries" and benefits that include economic activities (Harris and Millerd, 2010). Like other treaties, the Peace and Friendship Treaties are constitutionally protected by Section 35 of the Constitution Act, 1982 (Government of Canada, 2010).

Moderate Livelihood Fisheries

R. v. Marshall (1999) is a very important treaty fishing rights case, the findings of which confirmed that Marshall had a right to fish under the Peace and Friendship Treaties noting that Mi'kmaq and Maliseet Peoples have the right to "gather and earn a moderate livelihood through their treaty rights to hunt and fish" (DFO, 2021b; Government of Canada, 2010).[34] The parameters of the Moderate Livelihood Fishery are still evolving.

Indigenous fishing companies are economic drivers and significant employers in certain Indigenous communities. Indigenous fisheries continue to experience growth and are diversifying to include species outside of those traditionally harvested.

Food, Social and Ceremonial Fisheries

The 1990 frequently cited Sparrow decision of the Supreme Court of Canada (DFO, 2023n; Harris and Millerd, 2010) recognizes that Indigenous Peoples have the right to fish for food and social and ceremonial purposes (FSC) and that FSC activities take precedence over other activities, "excluding when conservation is of concern" (Warrior *et al.*, 2022). FSC fisheries are often regulated and managed separately from non-Mi'kmaw commercial and recreational fisheries and take place throughout the offshore area of NS.

4.5.1.2 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 Shelf, more than 25

[34] 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 (DFO, 2022p).

species are or were the focus of important commercial fisheries, representing some 50 distinct stocks. In addition, there are many invertebrate species harvested commercially on the Scotian Shelf including lobster, scallop, snow crab, shrimp, sea cucumber and whelk, surf clams, quahogs and other crabs, e.g., rock, Jonah, spider etc. (MacLean *et al.*, 2013). The primary fish species that have been or continue to be exploited from the Shelf include the groundfish (cod, halibut, haddock, pollock, monkfish, skates and flounders) and several pelagic species (notably herring, Atlantic mackerel, dogfish, tunas and swordfish). 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).

There is no directed commercial fishery for sharks. The pelagic longline fleet can retain porbeagle shark and blue shark as bycatch species; however, the fleet does not land sharks for commercial sale, and there is no commercial shark fishery in the RA Study Area.

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. Fishing for groundfish species can be done using various gear types, e.g., baited longline, gillnets, bottom trawls, dredge, handlines, harpoon and spear. In general, gear types are classified as 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 4.12

The RA Study Area falls within five Northwest Atlantic Fisheries Organization (NAFO) fisheries management areas: 4X, 4W, 4Vs, 4Vn and 5Ze. 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 and longlining, whereas other mobile techniques, e.g., 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, e.g., trawling, over many areas from the near shore to the edge of the 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. Management is done on annual cycles based on scientific surveys and population analyses;
5. the methodology for identifying areas of low and high conflict do not consider the influence caused by high numbers of fishermen and/or large landings, e.g., from a large fleet; and
6. entire ecosystem changes in abundance, location and interactions of target species resulting from fisheries changes and climate change.[35]

Fishing activities vary across the RA Study Area, reflecting the patterns of distribution of different highly valued species. Most, but not all, 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. In the last decade or so, inshore lobster boats, primarily in SW NS, have been fishing farther from the coast and in deeper waters. 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, halibut etc., tends to be most productive along the edges of the Shelf.

Figures 4.12-4.14 present the Commercial Fisheries Landings for all species, landings by mobile gear and landings by fixed gear respectively between 2012-2021. The data which are produced by NAFO was created by overlaying a 2-minute hexagonal grid (approx. 10km^2 cell) on species/gear type commercial fisheries point data and summing the total landings by weight reported for each cell over the ten-year period. Therefore, the value of each grid cell is equal to the total species/gear type landings in kg from 2012 to 2021 for the area and may represent many fishing events from several vessels over the ten-year period. DFO note the following potential limitations (see DFO webpage) and caution when interpreting these data:

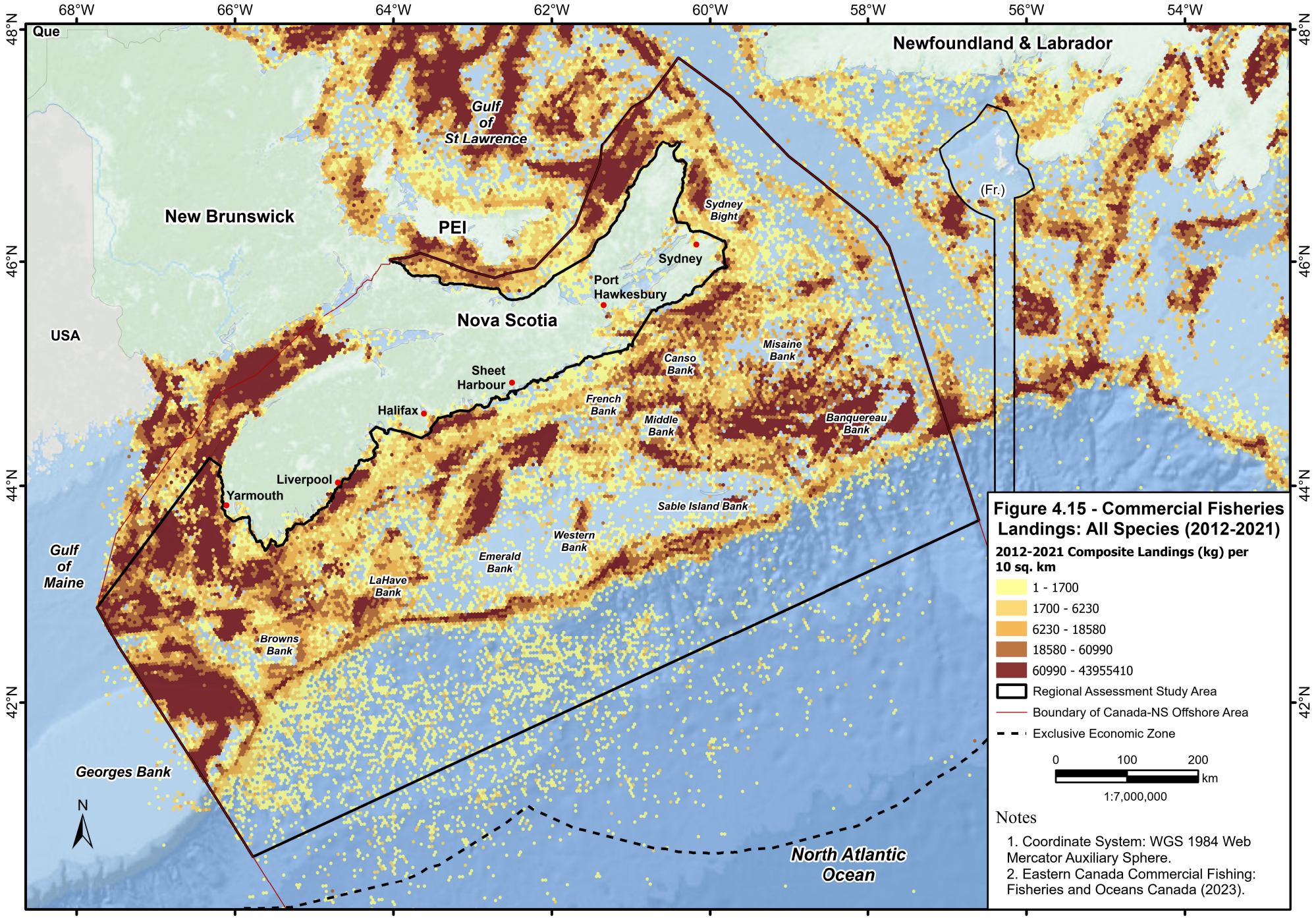
- Landings are only recorded from Canadian vessels greater than 35-ft and do not include information pertaining to international fishing vessels, i.e., around St. Pierre and Miquelon.
- Data have not been altered and are mapped from the original logbook entry for each record prior to amalgamation.
- Data may contain errors such as inaccurate or nonviable coordinates, landed weights and/or species identification. This includes, for example, cases of fishing events reported in a NAFO Division with corresponding coordinates falling outside that particular NAFO Division or fishing events which appear to be located on a land mass due to rounding errors in the original entries. Such cases were excluded from the dataset.
- Only one location is given for each fishing event; therefore, a fishing activity that would normally cover a large area, e.g., trawling, is only shown in a single location.
- Some species may not include all records or locations where activity is taking place due to regional differences in permissions for mapping, or because the fishery is only partially georeferenced, e.g., lobster.
- The locations/areas shown should only be used as an estimation of fishing intensity and a general guide of where particular species/gear type fishing occurs.

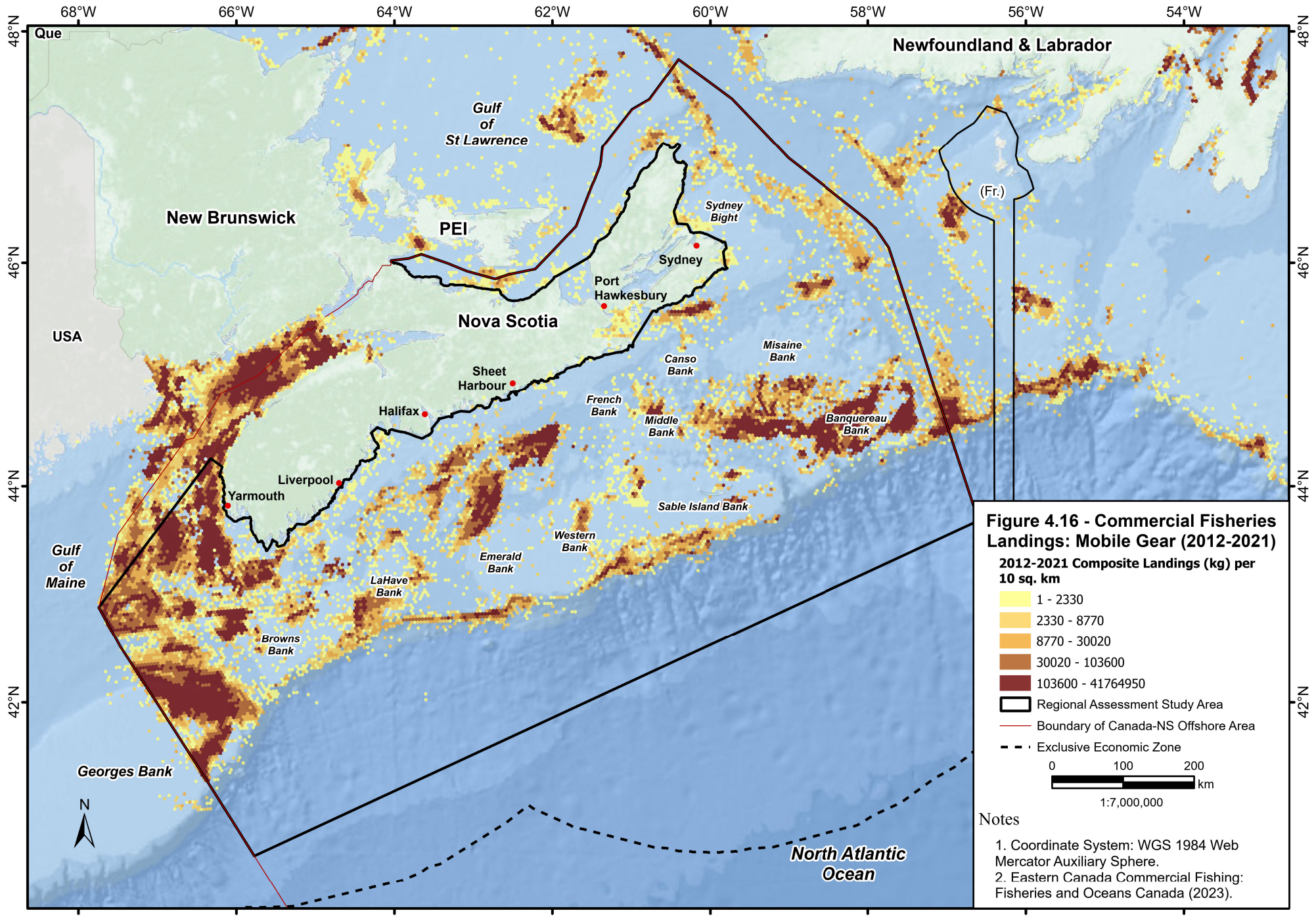
[35] For more information, see Bundy *et al.,* (2005). Balancing exploitation and conservation of the eastern Scotian Shelf ecosystem: application of a 4D ecosystem exploitation index.

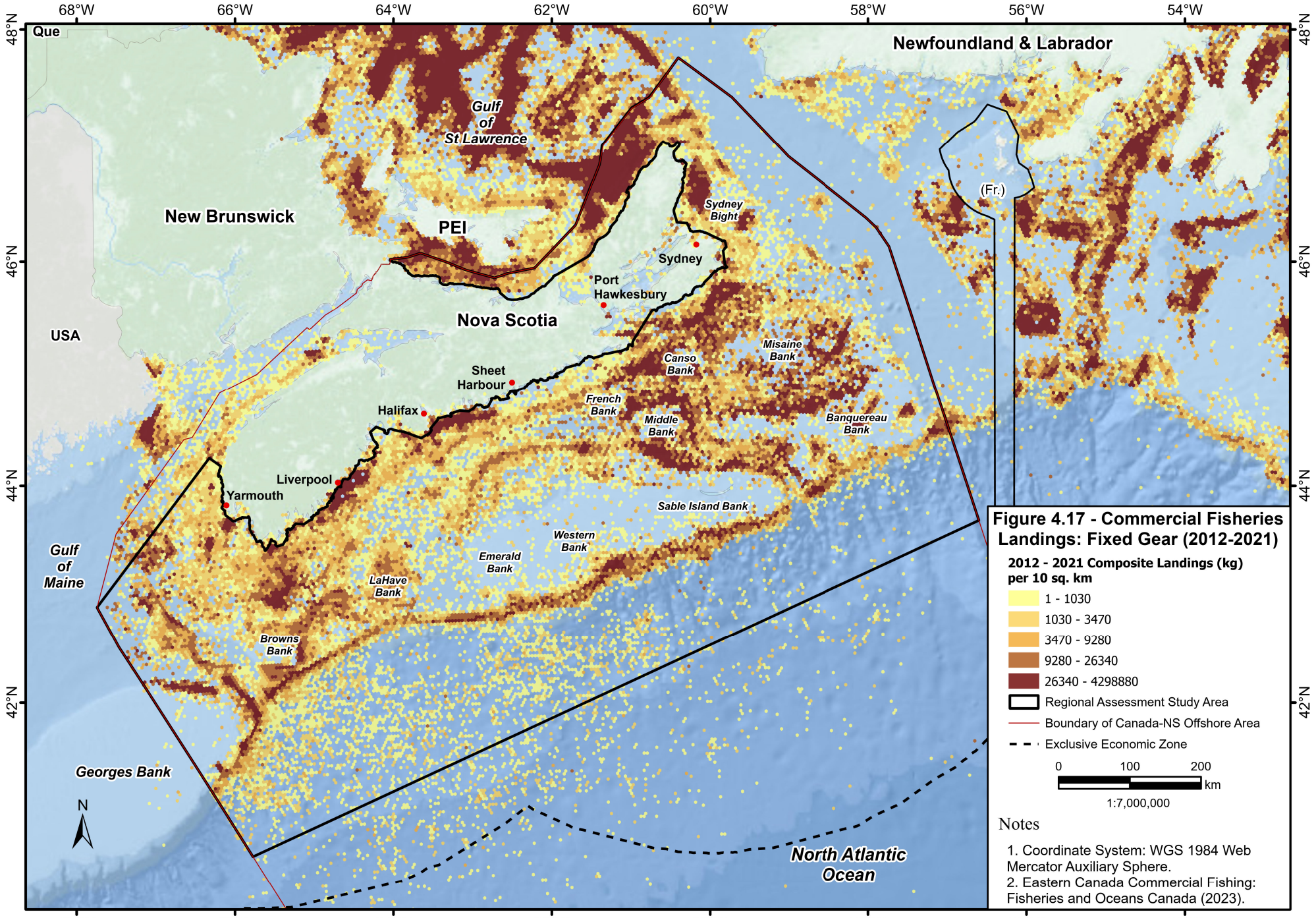
- This dataset has been privacy screened to comply with the Government of Canada's privacy policy. Privacy assessments were conducted to identify NAFO unit areas containing data with less than five vessel IDs, license IDs and fisher IDs. If this threshold was not met, catch weight locations have been withheld from these statistical areas to protect the identity or activity of individual vessels or companies.
- In some instances, permissions were obtained to map species or gears with a limited number of vessels, licenses, or fisher ids. The withheld areas are indicated by the unit area that has been removed and given a weight of -9999.
- Limited available fisheries data in relation to past and future trends.
- Knowledge and data gaps related to life history stages for certain species, particularly for those with planktonic stages such as lobster, scallop, snow crab, finfish etc., that depend on the energy and mixing brought about by wind energy.

Engagement with various commercial fishing organizations and individual fishermen reinforced the limitations of the DFO landings data listed above. Additionally, throughout the engagement period, the Committee was made aware that the landings data are solely based on landed weight and do not represent landed value of a specific fishery.

As explained in section 6, information shared during the engagement in combination with available fishing data resulted in the Committee's decision that OSW development should not at this time be considered in the Northumberland Strait or in the southern portion of the Gulf of St. Lawrence. In Figure 4.18, DFO Gulf Region provided the Committee with recent fishing catch data that supersedes what is presented in Figures 4.15-4.17. Details regarding the methods undertaken to produce the maps is provided on the Registry.


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 4.15 - Commercial Fisheries Landings: All Species (2012-2021)
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
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
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 4.16 - Commercial Fisheries Landings: Mobile Gear (2012-2021)
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).


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 4.17 - Commercial Fisheries Landings: Fixed Gear (2012-2021)
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).

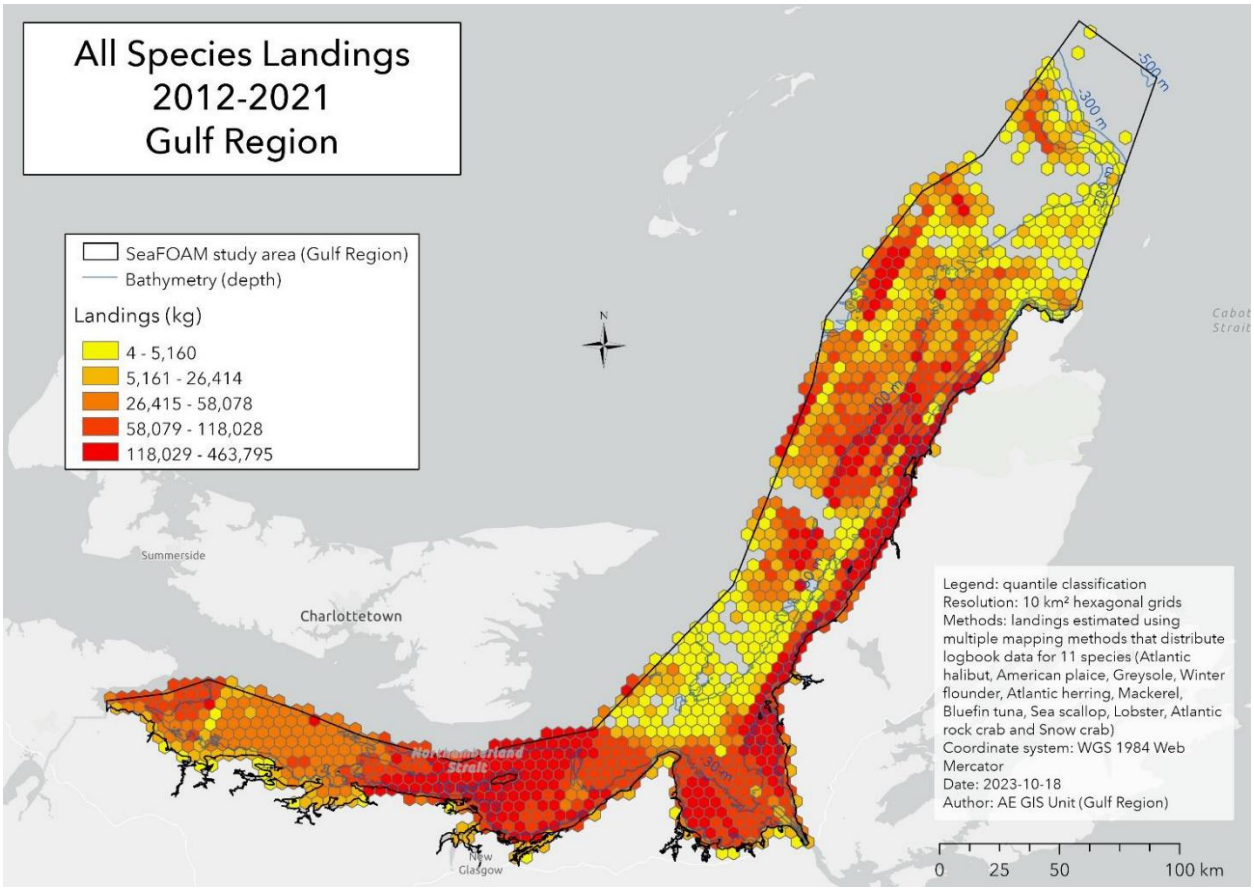


Figure 4.18. Commercial Fisheries Landings All Species Gulf Region (2012-2021)

Table 4.12. Summary of Nova Scotia Fisheries (Maritimes and Gulf Regions)

Main species	Technique(s)	# Licenses (Maritimes and Gulf Regions), 2023	Total Allowable Catch (tonnes)
Atlantic bluefin tuna	Longline surface (pelagic), rod and reel, electric harpoon, tended line and green stick.	283	2,350 t (2018-2020)
Clam (Arctic surf clam, quahog)	Dredge	821 (Offshore and inshore)	Quahog 12,387 t (2020); Arctic surf clams 20,943 t (2022)
Crab (snow, Jonah, rock, red and green)	Pot/trap	574	8,449 t (N-ENS, S-ENS and 4X; 2022)
Groundfish (Cod, halibut, haddock, pollock, flounder, hake flatfish, wolffish, Argentine, redfish, spiny dogfish, skates)	Bottom gillnets, midwater trawls, bottom trawl, longline bottom (groundfish)	2,373	For 2022 – 2023, TACs across these species ranged from 660 mt for Atlantic cod (4X5Y) to 16,500 t for winter flounder (4X). Roughly 50,000 mt total including bycatch for other gear types and regions.
Herring	Bottom gillnets, drift nets, Purse seine	1,851 (Offshore Scotian Shelf)	4,000 t (2024) (offshore Scotian Shelf), 1000 t (2024) (Georges Bank), 4,682 t (2024) (Eastern Shore), 6,400 t (2024) (Little Hope), 16,000 t (2024) (Southwest NS/Bay of Fundy)
Lobster	Pots/Traps	3,184 (2023)	720 t (2023, Offshore)
Mackerel	Small seiners (purse, tuck and bar)	N/A	470 t (2024)
Scallops	Dredge	411	5,005 t (2022)
Shortfin squid	Jiggers, handlines (SFA 17 –21), bottom and midwater trawls (4WX)	803	Directed fishery in the past, now mainly by-catch

Main species	Technique(s)	# Licenses (Maritimes and Gulf Regions), 2023	Total Allowable Catch (tonnes)
Shrimp	Pot/trap, bottom trawl	46 (SFAs 13-15)	2,300 t (SFA 13-15; 2022)
Swordfish	Longline surface (pelagic), e.g., harpoon and spear	1,032	1,348t (2020)
Whelk	Conical traps	1	700 t (4VS)
Other (Oysters, mussels, sea urchins, slime eel/hagfish, sea cucumber, 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)	1,999	Various, e.g., 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.

Note*: The data reported above omits the fishing undertaken by Clearwater vessels in more recent years (2022+) which has been steadily increasing.*

Total number of species licenses issued in Maritimes and Gulf Regions for NS in 2023 was 13,377.

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 4.13; 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 4.13. 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 OSW operations and their infrastructural components. Fisheries, using mobile gear such as a trawl, could become entangled with the anchor lines of a floating OSW turbine. The Committee is aware that longline fishing is considered a "fixed" gear fishery, however, main longlines drift long distances from where they were initially set during fishing operations (ICCAT, 2014). The Committee was advised that pelagic 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 kms 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, together with climate change, one of the most important causes of changes in fish stocks on the 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.

4.5.2 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 substantially concerned with the ecological consequences of potential OSW development, the TOR requires that the Committee reference Indigenous Interests and Rights as well as consider a range of socio-economic factors including 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.

4.5.2.1 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, the population in NS 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 4.14. 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 NS. There are 13 Mi'kmaq communities in the province with populations ranging from approximately 300 in Annapolis Valley First Nation to over 4,700 in Eskasoni First Nation. Table 4.15indicates that in 2024, there were 19,302 Mi'kmaq, of whom 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 4.15. 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 NS, 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 NS.

African Nova Scotians

The population in NS who self-identify as Black today includes both the African Nova Scotian population who have had a presence in the province 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 NS.

Underrepresented and Underserved 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 the RA 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 socio-economic 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 on this topic and prepare a report (Fusco *et al.,* 2024) on their findings including challenges and recommendations associated with attaining enhanced equity in the OSW 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 4.16 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 4.16. 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
2SLGBTQI+		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, e.g., 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 school 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, focused education about the potential of the OSW industry is to be encouraged.

4.5.2.2 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 NS, 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 younger 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[36] which outlines the actions that the federal government will take to support innovation and economic growth in Canada's oceans. This strategy also includes support for marine renewable energy as an integral part of effectively managing the marine resource.

[36] Blue Economy: Targeted Regulatory Review – Regulatory Roadmap. https://www.dfo-mpo.gc.ca/about-notre-sujet/blue-economy-economie-bleue/roadmap-feuille-route-eng.html

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 had 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 is nearly 600 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, including FSC 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. All Mi'kmaw communities in NS have invested in onshore wind developments and collectively produce 30 MW of power for the NS grid. Many individuals have trained as technicians to service the onshore wind industry.

The Mi'kmaq were the first to harvest the waters off NS. Today, because of the 1999 Supreme Court's Marshall rulings, 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 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 FSC and moderate livelihood fisheries.

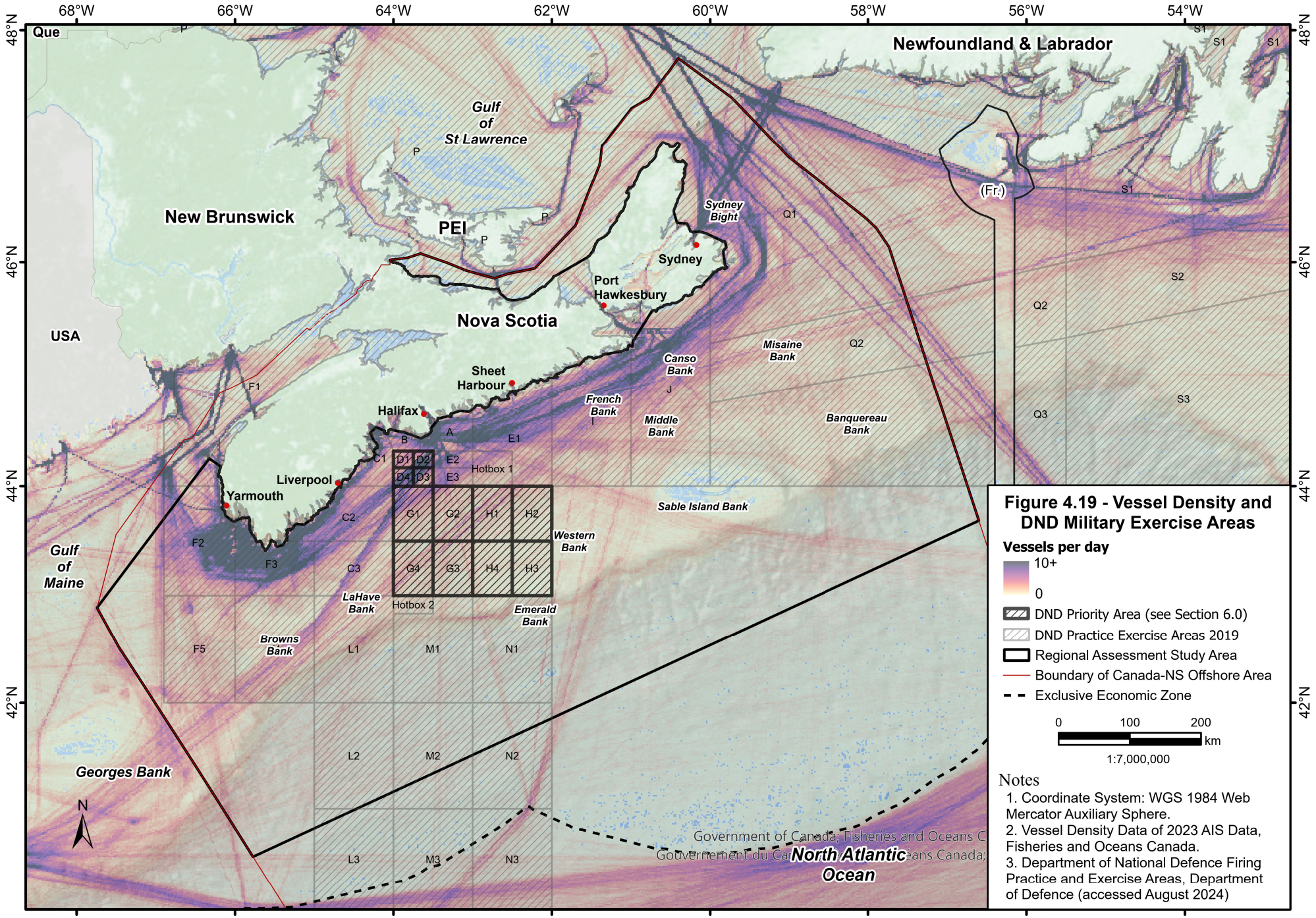
4.5.2.3 Other Users of Marine Waters

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 uses more defined corridors, as depicted in Figure 4.19 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 4.19 - 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 or for military purposes becomes year-round, or cargo vessels seek to benefit from the shorter transit time between Asia and Europe through the Northwest Passage, could significantly affect 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 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 4.19 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.

4.5.2.4 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 4.17 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 4.17. 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 OSW 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	T-shaped Wharf: 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. Close proximity to Hwy #103.	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.
	Industrial Park: immediately south of Shelburne Ship Repair Facility with marine rail and a marine industrial complex. Close proximity to Hwy #103.	The site would require new mooring facilities, however there is historical precedent of the site's suitability (used by the Canadian Navy for refueling).
	Sandy Point: bottom of Sandy Point at the Old Naval Base, a second base used in the cold war years for undersea acoustic surveillance. Close proximity to Hwy #103.	Although the site was never historically a port, Invest Nova Scotia identified the water depth immediately offshore and a large curving land feature that encompasses a deep-water mooring area as a prime candidate area for large seagoing vessels to access an onshore industrial area.
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.

Location and Wharf Facility	Infrastructure Available	Readiness/Necessary Upgrades
	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 bridge is used to access the highway. Marshalling space is limited.	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 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. The management of the facility has been adept, and the wharf modified, to ensure the safe handling of monopiles, transition pieces and blades. Monopiles have been offloaded over the caisson portion of the dock using structured steel bridging to

Location and Wharf Facility	Infrastructure Available	Readiness/Necessary Upgrades
		spread the load or have been offloaded by large crane. The dock has accommodated supply chain vessels which have been docked stem to dock, Mediterranean method, and product offloaded via ramp. A jack-up rig has also been used to deliver components dockside.
	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 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 transshipment of OSW components but is unlikely to be repurposed.

Source: DMDE Engineering, 2024; Shelburne Municipality Feedback, 2024; DMDE Engineering, personal communication, January 9, 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 OSW 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 NS, 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 is to serve the fishery; this will 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 has modified its operating practices to bear the weight of the necessary cranes.

Existing Electrical Transmission 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, i.e., 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 and MacIsaac, 2024) The province is considering the following as steps towards meeting their 2030 commitments:

- recent request for proposals (RFP) for 600 MW of land-based wind power;
- an additional 150 MW of battery storage; and
- commitment to the development of a second 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 OSW, 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 1 GW 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 or a subsea HVDC cable connecting NS directly to New England.

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 that connect the communities and the wharves (with the exception of Sheet Harbour), 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 NS, 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.

4.5.2.5 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. In 2016, NS experienced 270 premature deaths attributable to air pollution (Health Canada, 2021). 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.

4.5.2.6 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 NS: the Cape Breton Highlands National Park and the Kejimkujik National Park and Seaside Adjunct (Parks Canada, 2024). Cape Breton Highlands National Park 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 ranging from 10,000 to 5,000 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 and collaboration with CCTH through planning and preconstruction studies and into construction and operations.

Mi'kmaq archaeological heritage, e.g., sites, artifacts etc., are also present throughout the province and have been identified in submerged areas. During site characterization, there are protocols that must be

adhered to including engagement with Assembly of Nova Scotia Mi'kmaq Chiefs, KMKNO and the Mi'kmaw Nation in Nova Scotia.

4.5.2.7 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 study, 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 and aquaculture, 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 NS. 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 ability of federal and provincial governments 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 could assist in the attainment of the legislative targets and government policy objectives related to climate change. The extent of the contribution will be largely determined by infrastructure and labour constraints, timely decisions around approaches to, and investment in, capacity building and continued public support.

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 mitigation 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 IPFs, 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)[37] and provincial (Bill 471)[38] 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.[39] 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.

[37] 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

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

[39] 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)[40] 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 in the first half of 2025.

While the *CER Act* establishes the CER as the lifecycle 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.[41] The regulatory framework is robust. It is designed to promote the identification, avoidance and mitigation of risk and to 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 or 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 the Committee's view 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 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 decommissioned and the platforms removed. A great deal of that experience is directly transferable to OSW.

[40] 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.
[41] 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.[42] Every developer must designate a Facility Manager who is responsible for the safety and operations of the project;[43] it is the role of the regulator working with the Facility Manager to confirm that activities will comply with the applicable legislation before permitting any offshore work, during project operations and, when the time comes, during decommissioning and dismantling. 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;
- various documents associated with an Impact 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 entered into Memoranda of Understanding (MOU) with various government departments and agencies, e.g., DFO, ECCC and TC, to ensure effective

[42] See Bill C-49, s.170.2
[43] See Bill C-49, s.188

coordination among those that have some regulatory role relevant to the marine environment. This enabled the regulator to leverage the vast expertise that exists within the public sector before making regulatory decisions. It is anticipated that CNSOER will enter into comparable MOUs to facilitate their work with the OSW sector.

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 engagement needs to be captured on an ongoing basis both to fill in gaps or to enhance the utility of regulations as part of the adaptive management process. It is expected that the CNSOER will establish a series of detailed OSW "best practice" guidance materials.[44] Many other jurisdictions have established guidance materials for the OSW industry reflecting their current understanding of best practices,[45] 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 impacts 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 above, requires the integration of Indigenous knowledge, experience and ways of knowing. Netukulimk is essential 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 world around

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

[45] 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)

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 an approach 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 *et al.*, 2012). A presentation to the Committee on Two-Eyed Seeing (Etuaptmumk) included a discussion around the Seven Sacred Teachings and the importance of considering 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 guiding principles 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 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 4 and 8 and reinforce 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 VC. 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.

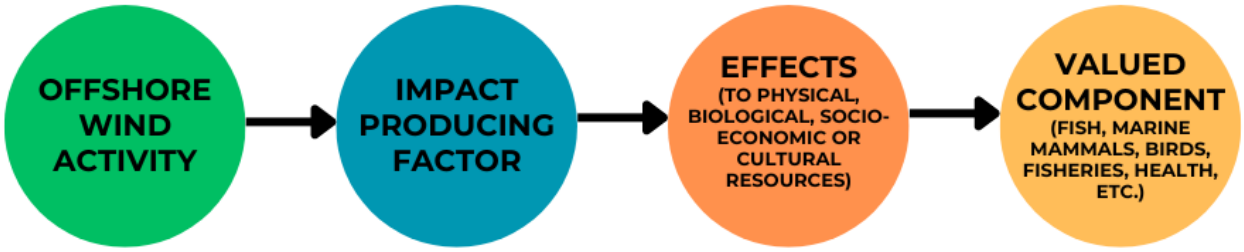


Figure 5.1. Pathway of Effects Associated with IPFs Caused by OSW Activities and Phases

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; and
- 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	Noise and vibrations	Exclusion zones	Seabed disturbance	Electrification of subsea cables	Presence of infrastructure	Movement of turbines	Waste handling and	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 could help Canada and the Province of NS meet their environmental obligations and commitments in respect to climate change (section 1.1). Overall, air contaminant emissions associated with 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).

Offshore lighting in Canada is regulated by the Canadian Aviation Regulations (CARs) Part VI, Subpart 1, Division III – *Obstacles to Air Navigation and the associated Standard 621 – Obstruction Marking and Lighting*. However, Transport Canada Civil Aviation's (TCCAs) jurisdiction only extends 12 nautical miles (~22.2 kms) offshore. As it is likely that OSW development will occur beyond the jurisdictional boundary, TCCA recommend the submission of an Aeronautical Assessment Form (AAF) to enable an assessment of the project lighting requirements against the CARs and associated standard 621. Additional considerations and restrictions regarding lighting in the offshore environment within Canada could originate with NAV Canada (air space restrictions and transitional routing), DND (including areas of air space restrictions) and TC (Navigation Protection Program (NPP)).

In the interests of consistency, recourse might also be made to the recommendations of the US Federal Aviation Administration (FAA). It recommends voluntary marking or lighting, or both, of a meteorological tower less than 200 feet 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.

Marine navigational lighting has an intensity which is expected to be visible up to 18.5 km.; it is located at a height at which, due to the curvature of the earth, it is unlikely to be visible over longer distances (White, 2020). Turbine lighting, however, can be visible over greater distances (over 30 km has been recorded), but the effects tend to be greater the closer the viewer. The spread of turbine lighting on the

horizon can exacerbate how the lighting is viewed. Depending on strength and frequency, OSW lighting viewed from a remote or protected area, e.g., Kejimkujik National Park which is a dark-sky preserve, could be considered a significant factor.

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;[46]
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 relative proximity to 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

[46] The sound from these high-resolution geophysical surveys is very different from seismic airguns used in oil and gas surveys or tactical military sonar. They produce much smaller impact zones because, in general, they have lower noise, higher frequency and narrower beam-width. The area within which these sounds might disturb the environment is orders of magnitude smaller than the impact areas for seismic airguns or military sonar (NOAA, 2024).

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 data 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 recognized 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 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 in 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 on certain fisheries to protect buried and floating cables and anchor/mooring lines from disturbance by fishing gear.

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 to level the seafloor at foundation locations, pre-trenching the cable route to assure sufficient burial depth during the lifetime of the project, creating foundation pits (in the case of gravity-based foundations) and taking electrical cables across navigation channels (Vanden Eede *et al.*, 2014).

Foundation installation and cable laying that require major bottom disturbance, e.g., by dredging, typically create the largest volume of suspended sediment and consequential resettling 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 potentially interact with the seafloor as the foundation moves in response to wind and wave conditions (Maxwell *et al*., 2022).

Depending on the strength of the ocean currents and waves, and the nature of the sediment at the site, 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 the turbine foundation and potentially alter localized benthic habitat (NYSERDA, 2017e). In such circumstances, scour protection (rocks, mats or other hard surfaces) can be installed around the bases of the turbines and over subsea cables (NYSERDA, 2021b).

5.5.7 Electrified 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 the likelihood of 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). Subsea power cables carry either AC (alternating current), or HVDC (high voltage direct current) power, and both systems produce magnetic fields. HVDC 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. Most electric field emissions are virtually eliminated before being released into the surrounding environment because the array and transmission cables used are shielded. Where substrate conditions permit, they are also usually buried and grounded.

EMFs may cause sensitive species, e.g., sharks and skates, to become attracted, deterred, or disoriented, potentially impacting their feeding or migration success (Westerberg and Lagenfelt, 2008; Gill and Bartlett, 2010; Tricas and Gill, 2011; Hutchison *et al.,* 2020; Gillson *et al.,* 2022; Walker *et al.,* 2001). If organisms spend extended periods of time near cables, there may be direct negative effects on health (Öhman *et al.,* 2007). Further research is needed to fully understand potential impacts from EMF on sensitive species in this region (see section 9).

In addition, when electricity is transported through power cables, a portion of the electricity lost in transmission is released as heat (Taormina *et al*., 2018). At equal transmission rates, AC cables will emit more heat from transmission losses than HVDC cables (BOEM, 2023). The heat dissipates quickly within the marine environment, and the amount of heat generated from transmission cables is not enough to

create a discernable change in ocean temperature (Taormina *et al.*, 2018). Colder water has a high capacity for absorbing heat due to the strong hydrogen bonds (Brewer and Peltzer, 2019). In the US, a minimum of about 3 feet is recommended for heat dissipation of AC cable, and up to 6 feet for HVDC (Sharples, 2011). Inter-array cables are generally buried from 3 to 8 feet deep; some are suspended between platforms in the open water.

5.5.8 Presence of Infrastructure

The infrastructure footprints 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).

Other potential effects of the presence of infrastructure include the spread of aquatic invasive species that may adhere to and colonize artificial reef structures (De Mesel *et al.,* 2015; Riefolo *et al.*, 2016; Degraer *et al.,* 2020). Changes in the food supply and loss of habitat structure or cover may result from new infrastructure as well as behaviour changes, i.e., species assemblages, aggregation, trophic interactions. For mitigation, avoidance of sensitive habitats, i.e., corals, sponges, eelgrass and other submerged aquatic vegetation, is of primary importance.

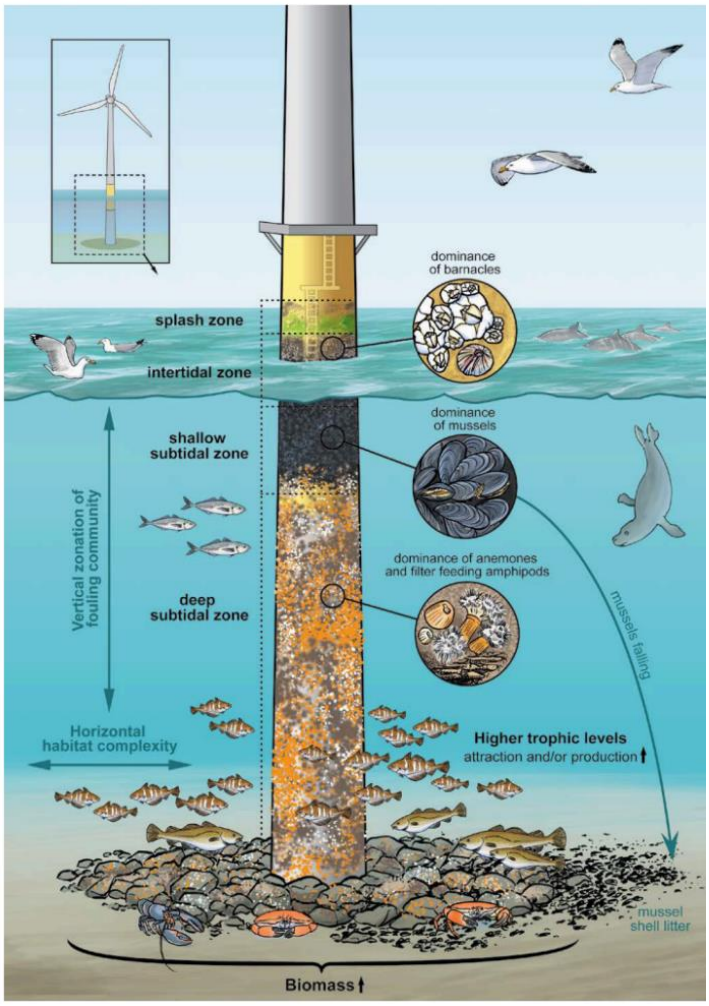


Figure 5.2. Illustration of a Turbine Foundation Providing Habitat
Illustration by Hendrick Gheerardyn (Degraer *et al*., 2020)

According to US Offshore Wind Synthesis of Environmental Effects Research (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 associated habitats because of the limited vertical profile of the floating foundation and possibly a 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

In addition to the environmental changes associated with construction and placement of turbines in an offshore marine environment, there are a number of important effects associated with the turbines during operation. Chief among these are the effects on avifauna: mortality/injury from direct collision with moving blades, for example, or, if the animals avoid the area when turbines are operating, they may lose access to suitable feeding areas, i.e., be displaced, or diverted from a traditional flight path. On the other hand, it is thought that some species congregate in the vicinity of turbines, attracted by their physical features. They may be seen as potential roosting or nesting sites or attracted by lighting, or by insect prey that might similarly congregate around a lighted turbine. More subtle effects relate to the impact of operating turbines on air and water movements, especially downwind of each turbine.

Effects on air flow

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 to 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).

The increased speed 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 (van Burkel *et al.,* 2020; Schultze, *et al*. 2020). 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; it needs to be studied thoroughly.

Collision, avoidance and displacement

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). The 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).

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 at on land wind farms 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 site, 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 because the EMF affects their sonar reception. Alternatively, they may simply 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). It is an area requiring further research.

Shadow flicker

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). The intensity of shadow flicker diminishes with increasing distance from a wind turbine and is less noticeable by an observer 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).

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 wastes will be generated when materials are 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

The nature of possible accidents and malfunctions at OSW projects is both varied and unpredictable. In the event of an accidental event, the subsequent impacts will depend on factors such as quantity of contaminants released, the location of the event, time of year and environmental conditions among other factors (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 and nature of potential impacts (BOEM, 2023).

The 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 in the maintenance of turbines. It is suggested that this represents an order of magnitude increase in safety risk as compared to O&G operations and is something that CNSOER must address when considering risk mitigation in work authorizations, e.g., recommend the use of heave compensated transfer platforms and operating procedures that define acceptable weather conditions.

The presence of icebergs and formation of sea ice is possible within the RA Study Area (see section 4.2.6). This could mean the potential for atmospheric icing (due to water in the air as in-cloud operation, rainfall and sea sprays) which, in turn, could lead to the formation of ice on turbine structures and blades. This possibility must be considered in the engineering design of the installations and in the preparation of personnel safety protocols (Battisti *et al*., 2006).

Lightning strikes, hurricanes and other weather events can also lead to turbine damage and malfunctions. It is noted that climate change has the potential to increase the frequency and scale of extreme weather events, such as hurricanes; these trends must be taken into account in the planning and design of OSW projects. The number of failures associated with OSW components has been small, but as turbine size has increased, there has been a slight increase in turbine blade failures (Bushard, 2024). The latter are typically made of fiberglass materials which are difficult to recycle and have negative environmental effects (Spini and Bettini, 2024). A recent incident that drew attention to the problem involved the unexpected collapse of one of the turbine blades in the Vineyard Wind Farm off the eastern coast of the US where turbine parts subsequently washed up on the shores of Nantucket Island shores (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. Figure 5.3 illustrates a spectrum of possible impacts associated with OSW development.

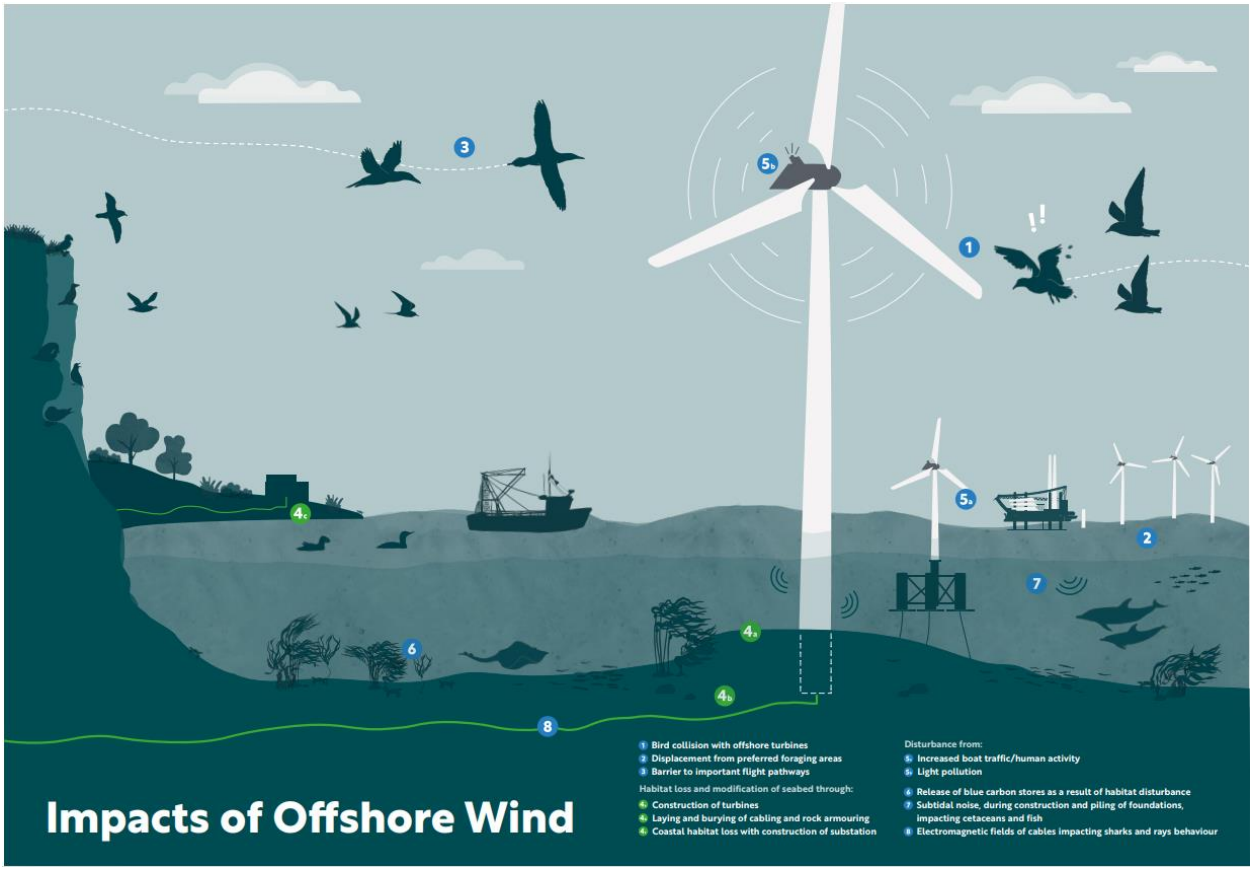


Figure 5.3. Potential Impacts from OSW Development (RSPB, 2022)

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 OSW development, to be supplemented as required by the characteristics of a specific site.

Table 5.2 combines the IPFs from Table 1 with the VCs 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	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 learned much through its own jurisdictional scans and research efforts, the Committee has not examined in detail all applicable legislation (including standards adopted through international conventions) or best practice guidelines from other jurisdictions that may be relevant to a full assessment of IPFs, mitigation and monitoring. As discussed in section 5.2, the Committee recognizes the need for and value of the compilation of best practice guidelines for the NS context. These would inform proponents on expectations with respect to project specific mitigation and monitoring, supplemented by site specific information obtained through the project impact assessment. The RA is not evaluating a project. It is hoped that the following information will be taken into consideration by the CNSOER as one source of information that can inform the development of appropriate best practice guidance.

5.6.1 Atmospheric Environment

Overall, OSW generation produces fewer emissions than most alternative electricity generation methods (US DoE, 2024). Where fossil fuel sources of electricity are replaced by OSW development, there is a net GHG reduction (Government of NS, 2024). Quantifying GHG emissions produced by the construction, operations and decommissioning of OSW power is challenging. No project specific data exist for Canada and 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[47] 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.

[47] 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 the use of low-carbon fuel types such as hydrogen or biofuels to limit GHG emissions from vessels (SA, CI, O&M, RD) • Consider guidance presented in the Government of Canada's 'Strategic Assessment of Climate Change'[1] and related Technical Guides for emission considerations and mitigation (O&M) • Ensure that vessel emissions and air quality standards are aligned with regional and international best practices (SA, CI, O&M, RD) • 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.

Impact Producing Factor	Potential Effects	Key Mitigation and Monitoring Measures
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), Kwilmu'kw Maw-Klusuaqn feedback on Draft RA Report 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 during the construction phase, e.g., pile driving and installation of wind turbines, and during operations;
- the potential for secondary entanglement with fishing gear caught on mooring lines and cables;
- EMF emissions from subsea power cables;
- physical habitat disturbance;
- disrupted migration routes, spawning, foraging and breeding;
- collisions because of increased vessel traffic;
- 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 (cetacean, e.g., whales, dolphins and porpoises, and pinnipeds, e.g., 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 physiological impacts 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
	• Potential impacts to marine surveys that support ongoing regulator-led ocean
		• Monitoring in existing critical habitat areas or areas considered important for species at risk, undertaking baseline surveys to identify critical habitats, seasonal species distributions and monitoring protocols (SA)
		• Avoidance of SARA species/habitat and 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)
		• Undertake research and monitoring measures for the turbulence in the air above the sea caused by turbine blades affecting mixing processes and biological productivity, i.e., circulation/hydrodynamics, change in stratification, upwelling dynamics etc. (O&M)
		• 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 and hydro sound dampers
		  ○ Time of year restrictions, e.g., during migration or breeding / spawning seasons
		  ○ Exclusion buffer zones during pile driving and seismic survey activities
		  ○ Soft start / gradual ramp up for pile driving
		  ○ Conduct acoustic monitoring for any underwater noise generating activities to determine soundscape, sound emission characteristics, and potential species interactions
		• Follow Canada's Ocean Noise Strategy *(under development)* to collaboratively better understand and manage ocean noise and refer to Notices to Mariners; Section A2 - *Marine Mammal Guidelines and Marine Protected Areas* (or any relevant updates)[48] (SA, CI, O&M, RD)
		• Vessel speed restrictions and guideline development around operating limitations (wind, wave height) (SA, CI, O&M)

[48] See https://www.notmar.gc.ca/annual

Impact Producing Factor	Potential Effects	Key Mitigation and Monitoring Measures
	research and monitoring programs	• 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 (SA, CI, O&M) • Reduction of EMF emissions, e.g., cable selection and burial, protective scour protection layers. If cables cannot be adequately buried to reduce EMF to an acceptable level (on a case-by-case basis), an effective monitoring program should be implemented to measure EMF outputs during operation (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) • Monitoring for secondary entanglement in fishing gear caught in mooring lines and cables, e.g., passive technologies (O&M) • Pre-installation seabed assessment surveys to determine sensitive habitat locations (SA) • Avoidance of sensitive seafloor habitat, e.g., eelgrass beds, coral and sponge significant benthic areas, archaeological resources and contaminated areas for cable-laying and anchoring (SA) • Reduce overall footprint of turbine matrix and cable array (SA) • 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 NS Power 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)

Impact Producing Factor	Potential Effects	Key Mitigation and Monitoring Measures
		• Minimize the use of anti-fouling paint on subtidal surfaces to encourage species' colonization on the structures (CI, O&M) • Develop appropriate responses for the presence of rare and protected species (CI, O&M, RD) • Use Best Practices for the detection and monitoring of marine mammals during pile driving activities to note the presence of marine mammals, i.e., whales, prior to noise producing activities (CI) • Develop a plan to prevent deleterious substances from entering the environment and implement a response plan immediately in case of spills (CI, O&M, RD)

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*., 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), Kwilmu'kw Maw-Klusuaqn feedback on Draft RA Report available on the Registry.

5.6.3 Aerofauna

The operations and maintenance phases of OSW development pose the greatest potential threat to aerofauna (birds, bats and flying insects) including attraction, leading to 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.

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). However, the effects of OSW energy development impacts on aerofauna are not limited to collision with infrastructure. As per Williams *et al.*, 2024, effect types are classified into three broad categories:

- collisions;
- behavioural change; and
- habitat-mediated change

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 flying 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 the 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) • Use turbine curtailment during key periods, e.g., migration (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) • Review and incorporate (where relevant) the assessment, review of impacts, and available and proposed mitigation measures to aerofauna as per ECCC/Biodiversity Research Institute study (Gulka *et al.,* 2024) (SA, CI, O&M, RD) • 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 CWS and integration of high-quality data collection to improve its predictive value • Develop colony and species-specific setback metrics (SA)
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;		

Impact Producing Factor	Potential Effects	Key Mitigation and Monitoring Measures
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, 2016b, 2023; True *et al*., 2023; US DoE, 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) and Kwilmu'kw Maw-Klusuaqn feedback on Draft RA Report 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', i.e., 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 fishers 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 of OSW projects. Similarly, and as noted previously, the presence of this infrastructure may also impact fish and fish habitat through habitat alteration and disturbance to migration patterns, reef effects and a decrease in biological diversity which may present associated indirect impacts to fisheries. Indirect impacts to fisheries may 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 steaming time • Increased risk of collision, allision, and vessel/infrastructure damage • Aquatic invasive species • Potential impacts to fishery surveys that support ongoing regulator-led ocean research and monitoring programs	• Engage early with fishing interests in the project design phase to facilitate the establishment of successful co-location/coexistence 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, Automated Identification System (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 and increased steaming times (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) • Develop a plan to prevent deleterious substances from entering the environment and implement a response plan immediately in case of spills) (CI, O&M, RD)

Impact Producing Factor	Potential Effects	Key Mitigation and Monitoring Measures
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. 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) and Kwilmu'kw Maw-Klusuaqn feedback on Draft RA Report 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 and Airspace 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/Increased steaming time • Conflicts with space • Potential interference with ECCC weather radars • Potential impacts to oceanographic and/or other marine surveys that support ongoing regulator-led ocean research and monitoring programs	• 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) ○ 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 and increased steaming time 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) and Kwilmu'kw Maw-Klusuaqn feedback on Draft RA Report 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 4.5.2.6, 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 and specifically dark sky preserves (Kejimkujik National Park and National Historic Site)
	• 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, including traditional fisheries
	• 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), and/or traditional fisheries
	• 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
		• The recommended coastal buffer will minimize 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)
		• Ensure documentation of underwater archaeological, cultural and heritage resources (identification, documentation, and where possible preservation) with involvement of Mi'kmaq archaeologists (SA, CI)

Impact Producing Factor	Potential Effects	Key Mitigation and Monitoring Measures
	including coastal areas that may receive debris • Potential for spills/chemical releases to adversely impact culturally important sites and archaeological features, and marine species that may be part of traditional fisheries or culturally important species • Potential impacts, e.g., delays, area exclusion, to scientific field surveys that support ongoing ocean research and monitoring programs	
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; White, 2020. For more information, see NS Communities, Culture, Tourism and Heritage Advice Response (iaac-aeic.gc.ca), Health Canada Advice Response (iaac-aeic.gc.ca), Transport Canada Advice Response (iaac-aeic.gc.ca), Indigenous Services Canada Advice Response (iaac-aeic.gc.ca) and Kwilmu'kw Maw-Klusuaqn feedback on Draft RA Report 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. There is some information available describing the potential impacts of shadow flicker and visual impacts on OSW farm workers at sea.[49] The proposed 25 km buffer zone will likely serve to mitigate effects of shadow flicker and visual impacts on shore, but this will need to be examined further on a project specific basis as part of the impact assessment process.

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 IAAC and the Environmental Assessment guidelines prepared by the Government of NS 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

[49] For wind farms on land, the total length of the shadow influence in the atmosphere is calculated from the physical dimensions of the turbine blade, the maximum shadow distance for the SG 6.6-170 turbine on land was calculated to be approximately 2 kms (Nortek Resource Solutions Inc., 2023).

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 project sites that might cause headaches, dizziness, fatigue and nausea etc.	• 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; 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 to accommodate 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 by seabed and coastal 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
	• 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 • Potential impact to fishing industry leading to food security and food sovereignty issues • Potential impacts to oceanographic and/or fishery surveys that support ongoing ocean research and monitoring programs	• Develop a community engagement 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) • Utilize Dynamic Positioning Systems on supply and service vessels operating near OSW farms (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) and Kwilmu'kw Maw-Klusuaqn feedback on Draft RA Report 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 socio-economic 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 underrepresented and underserved 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…"[50] 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. The Impact Assessment Act (s. 22) requires developers to consider GBA Plus in the impact assessment process. Following this, as further described in section 5.7.4, developers should include GBA Plus when developing their hiring and employment strategies. 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 lack of local capacity. As a component of the environmental assessment and regulatory process, an OSW project proponent will access the pertinent demographic and labour data to determine the impacts of the project on both the local communities and the province.

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 4.5.2, 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

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

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 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, in turn, may impact traditional or non-traditional use and enjoyment (restrictions to 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 cultural attachment to place.

The above potential changes and consequences are real, need to be anticipated and resources deployed to mitigate potential negative impacts.

5.7.4 Inequities and Barriers to Underrepresented and Underserved 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. 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 recognized as barriers that inhibit the employment of women, Indigenous people (including women), African Nova Scotians, 2SLGBTQI+ and the disabled. The Committee contracted 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 underrepresented and underserved 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 underrepresented and underserved 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, 2SLGBTQI+ and the disabled.
- The historical nature of resource development being a male-dominated industry has led to issues related to domestic violence, sexual harassment, human trafficking 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, human trafficking, 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 underrepresented and underserved 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 underrepresented and underserved 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 at the community-level.

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 as well as ongoing prevention and awareness training through all project development phases. Cultural inclusion and competency training may also be developed to ensure safe space for Indigenous people and Indigenous ways of knowing in this industry. Other factors to consider in the respectful and inclusive development of this industry include capacity funding and reliable, safe community transportation to and from training and work sites for local workers. The impacts associated with an industry work camp, however, are 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 with a consideration of the physical environment and the conditions fundamental to OSW development requirements, e.g., strength of wind resources, seafloor characteristics, followed by an examination of the areas that have been identified for some form of "protection".

The Committee has received considerable feedback from government departments, NGOs, Indigenous groups and others expressing concern that several PDAs infringe upon one or more areas designated pursuant to the *Oceans Act,* the *Fisheries Act* or other legislation as having distinct ecological characteristics and possessing some level of protection or conservation status. The extent of these areas is illustrated in Figure 4.13. In total, they encompass a considerable portion of the RA Study Area between the coastline and the edge of the slope.

The enabling legislation, the nature of the conservation objectives and level of protection afforded to the various designated areas, in some cases including a list of prohibited activities, are detailed in section 4.4. While the Committee is unaware of any specific exclusion for OSW development,[51] it has been encouraged to interpret either the conservation objectives or the description of excluded activities in one or more areas as a prohibition to OSW development; not only for areas that are currently afforded some level of protection or actively under consideration for protection, but also for areas receiving similar designations in the future.

The Committee recognizes both the significance and importance of the conservation designations both in their own context and with respect to the international goals and national targets for protecting the marine environment. At the same time both the federal and provincial governments recognize the threat of climate change and the urgency to reduce GHG emissions. OSW development is widely acknowledged as having a significant contribution to make to achieving this latter goal. While several of the proposed PDAs overlap and/or are located in proximity to one or more of the conservation areas, the Committee is of the opinion that, subject to research and the execution of the necessary field programs, coexistence with several of the conservation designations may be achieved. It requires consideration of the underlying goals and objectives of a particular conservation designation supported by an up-to-date characterization of the protected area, measured against the potential impacts of a proposed OSW project in a specific location at a specific point in time to determine whether and to what

[51] Canada unveils plan for regulating offshore wind energy projects in Atlantic Canada https://www.cbc.ca/news/canada/nova-scotia/canada-unveils-regulatory-regime-offshore-wind-development-1.6859264#:~:text=Wilkinson%20suggested%2C%20but%20declined%2C%20three,may%20be%20permitted%20inside%20MPAs.

extent coexistence is feasible. Indeed, there could be circumstances where OSW development could facilitate conservation, a concept that is being explored in the Dutch part of the North Sea, e.g., Borssele OSW farm. Coexistence is a legitimate aspiration and one that should be explored and embraced as government moves to identify WEAs.

The primary purposes of the Interim Report were to identify PFDAs, i.e., to narrow the spatial focus within the RA Study Area, and to elicit feedback and potential concerns from stakeholder groups. It was recognized at the time that much of the information being relied upon was outdated, incomplete or limited in scope and precision. After the release of the Interim Report in the spring of 2024, the Committee undertook further public and Indigenous engagement in NS, PEI and NB (see section 2.1.2), issued IRs, received additional submissions from government departments, received the completed work of contractors and met with First Nations, NGOs, fishery and industry representatives, all of whom have informed the iterative PDA selection process. After the release of the Draft Report in late October 2024, the Committee continued to meet with interested parties and to receive and take account of submissions. 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 6.5.

6.1 Physical Considerations

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

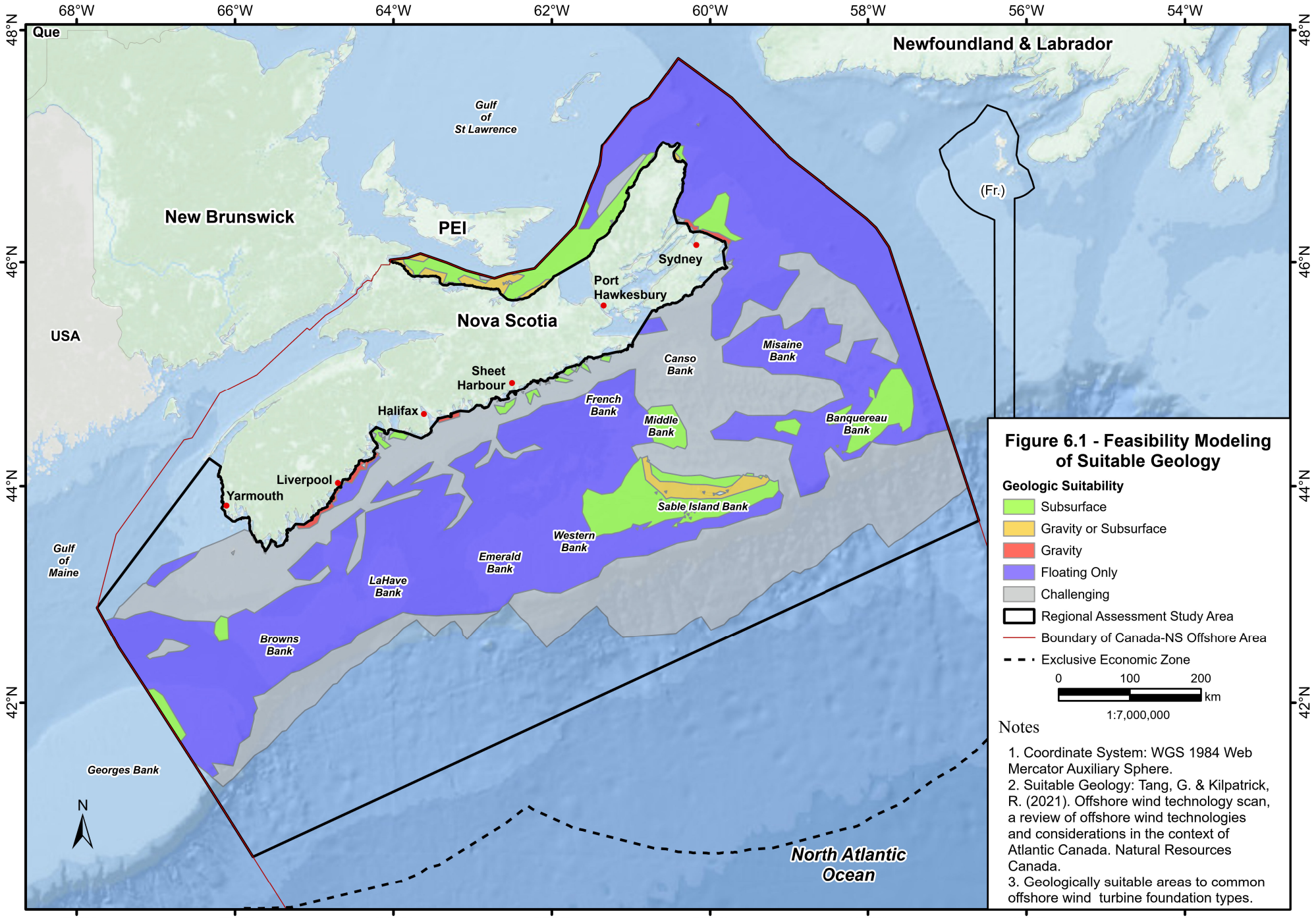
- **wind resource** (Figure 4.2) – it is understood that the wind resource in the entire RA Study Area is conducive to OSW development; however, winds are stronger and more consistent to the east.
- **water depth** (Figure 4.3) – based on existing technology, fixed turbine foundations can be deployed in water depths up to 60 m and floating turbines in water depths between 100 – 300 m (Kurth *et al*., 2024; Lin *et al.*, 2021).
- **surficial geology** (Figure 4.4) – 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 in section 2.2.3). One of the twelve data layers used in the model developed by Canmet was geological information sourced from the Geological Survey of Canada (GSC) in combination with water depth (see Figure 4.3). The seabed was classified into five categories based on the expected compatibility with different turbine foundations 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 sandy, muddy, unconsolidated sediments;
- Category 5: Challenges. Areas where the presence of geohazards, high slopes or a heterogenous seabed presents challenging conditions for any foundation type, or where there is insufficient data available to classify the areas into a defined suitability category.

Figure 6.1 depicts areas of suitable geology associated with turbine foundation technology type. According to CanmetENERGY's 'Preliminary Considerations Analysis of Offshore Wind Energy in Atlantic Canada' (2023).


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
(Fr.)
North Atlantic Ocean
N
Figure 6.1 - Feasibility Modeling of Suitable Geology
Geologic Suitability
Subsurface
Gravity or Subsurface
Gravity
Floating Only
Challenging
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 (up to 30 m required for monopile foundations) and extent of the sand layers, 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 undertaken by NRCan and NRR and work is also underway to reprocess seismic data and re-evaluate core samples acquired for oil and gas exploration. This survey work and associated analysis 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 Conservation and Functional Constraints

6.2.1 Conservation Constraints

The Committee next considered areas that have received some level of protected status or designation (see Figure 4.13). This resulted in several areas being excluded from consideration for OSW development at this time. It does not imply that the Committee accepts OSW development could never be considered in these areas, or areas similarly designated in the future. Rather it is part of the iterative process that attempts to select areas that are potentially suitable for development, while avoiding conflict at a large scale.

The areas currently excluded from consideration, as depicted in Figure 6.2 below, are the following:

- **MPAs** – the Gully, St. Anns Bank, and the Laurentian Channel;
- **Critical Habitat** – North Atlantic right whale, Northern wolffish 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.

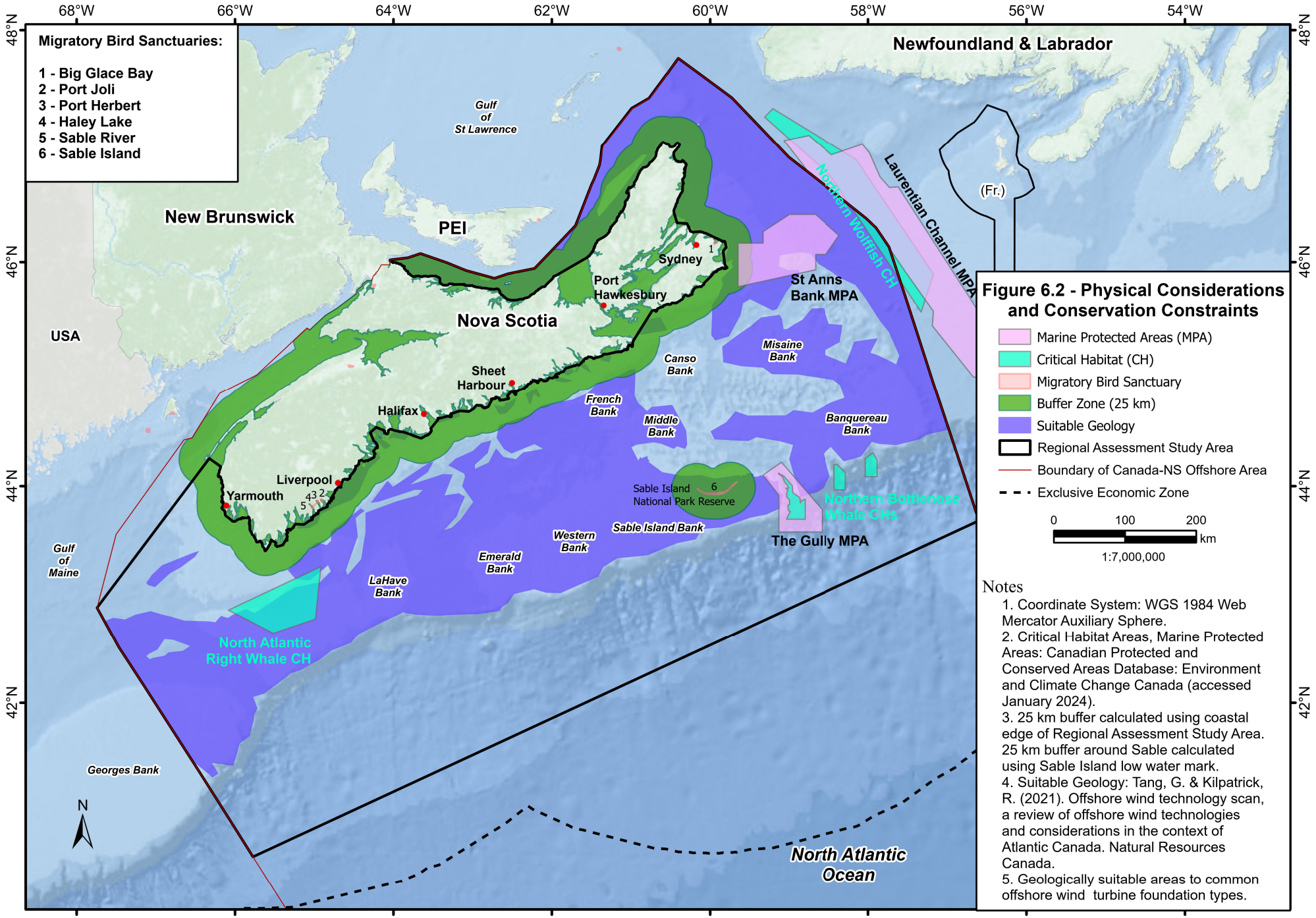
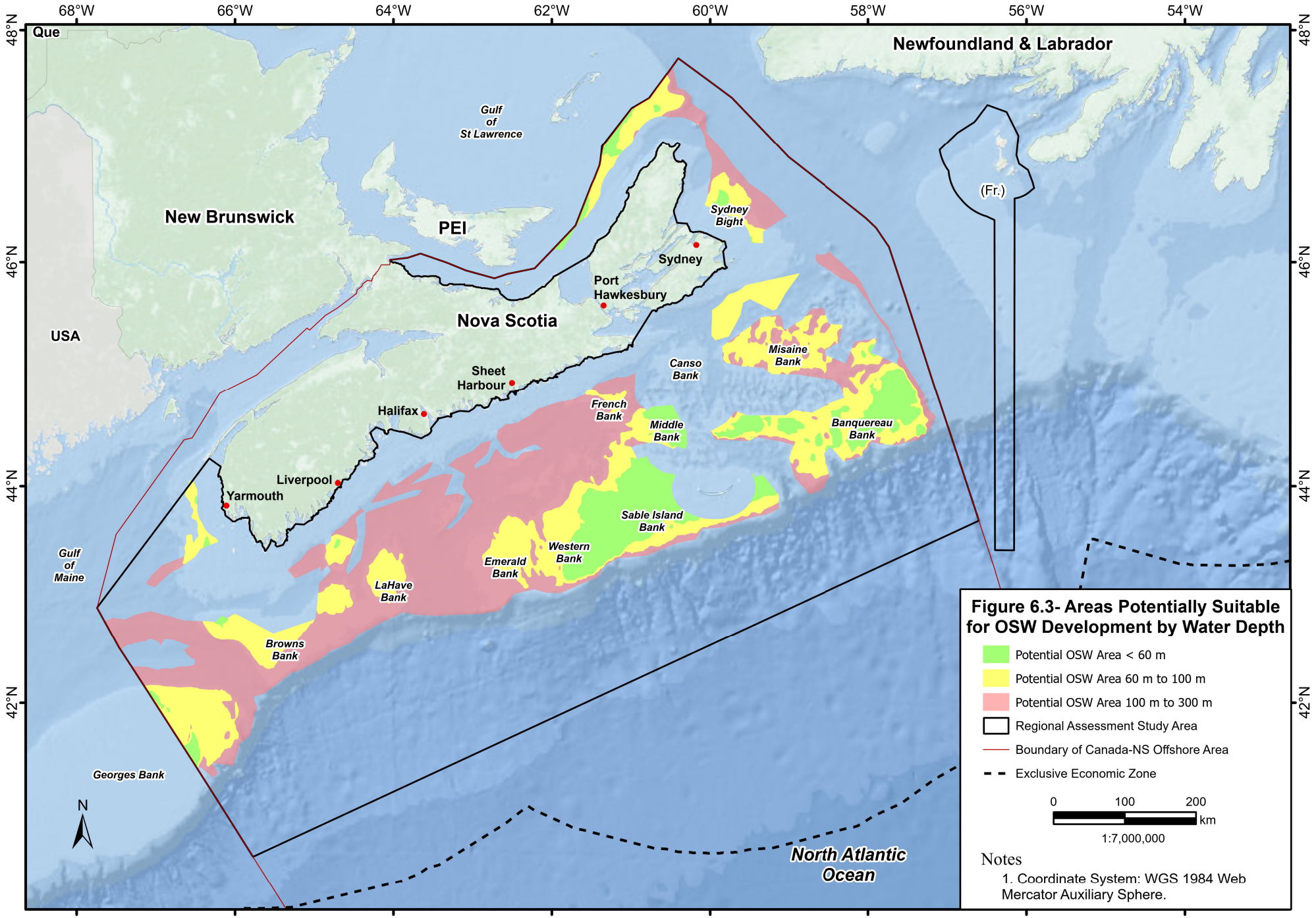

Migratory Bird Sanctuaries:
1 - Big Glace Bay
2 - Port Joli
3 - Port Herbert
4 - Haley Lake
5 - Sable River
6 - Sable Island
Newfoundland & Labrador
Gulf of St Lawrence
New Brunswick
PEI
Nova Scotia
USA
Sydney
Port Hawkesbury
Sheet Harbour
Halifax
Liverpool
Yarmouth
St Anns Bank MPA
Northern Wolffish CH
Laurentian Channel MPA
(Fr.)
Misaine Bank
Canso Bank
French Bank
Middle Bank
Banquereau Bank
Sable Island National Park Reserve
Sable Island Bank
Western Bank
Emerald Bank
LaHave Bank
Northern Bottlenose Whale CHs
The Gully MPA
North Atlantic Right Whale CH
Gulf of Maine
Georges Bank
North Atlantic Ocean
68°W
66°W
64°W
62°W
60°W
58°W
56°W
54°W
48°N
46°N
44°N
42°N
N
Figure 6.2 - Physical Considerations and Conservation Constraints
Marine Protected Areas (MPA)
Critical Habitat (CH)
Migratory Bird Sanctuary
Buffer Zone (25 km)
Suitable Geology
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.

Figure 6.3 (below) illustrates areas potentially suitable for OSW development taking into account the above constraints (section 6.2), the substrate and geological conditions identified in Figure 6.2 and consideration of 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 Bight
Sydney
Port Hawkesbury
Nova Scotia
USA
Canso Bank
Misaine Bank
Sheet Harbour
Halifax
French Bank
Middle Bank
Banquereau Bank
Liverpool
Yarmouth
Sable Island Bank
Western Bank
Emerald Bank
Gulf of Maine
LaHave Bank
Browns Bank
Georges Bank
(Fr.)
North Atlantic Ocean
N
Figure 6.3- Areas Potentially Suitable for OSW Development by Water Depth
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.

6.2.2 Functional Considerations

After consideration of the constraints discussed above, other factors were considered to refine the analysis and inform the selection of PDAs. These included:

- ecological considerations including other prescribed sensitive areas;
- issues that are critical to the economy of the province, e.g., commercial fisheries; and,
- avoidance or mitigation techniques that may enable OSW development to occur.

Table 6.1 identifies several key functional considerations and the Committee's macro-level assessment of OSW compatibility.

Although Banquereau Bank may be suitable for OSW development (Figure 6.3) and has ideal depths for fixed bottom development, it has not been identified as a PDA at this time for several reasons including: a poor understanding of the substrate, the distance and complicated topography to be travelled to bring power to shore, inadequate understanding of what may be dense fisheries in this area, including longlining along the slopes of the bank, and the historic presence of sea ice (Figures 4.7 and 4.8).

Table 6.1. Functional Considerations

Valued Feature / Activity	Recommendations for Further Consideration
Significant Benthic Areas (SiBA) and Ecologically and Biologically Significant Areas (EBSA), i.e., coral and sponge areas and sea pen areas (see Figure 4.13)	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 4.13)	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 4.13)	Coexistence may be possible. Recommend engagement with DFO on a project-by-project basis.
Military exercise areas (see Figure 4.19)	Coexistence is uncertain. Engagement with DND is required by provincial and federal governments.
Marine Atlantic Inc.'s Port aux Basque ferry route (see Figure 6.7)	Coexistence is possible. Setbacks to allow for safe navigation/vessel passage and/or other visible navigational aids, e.g., buoys, may be required.
Fisheries – fixed gear (see Figure 4.17)	Coexistence is generally possible.
Fisheries – mobile gear (see Figure 4.16)	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.

6.3 The 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. In recognition of Parks Canada's submission, the buffer around Sable Island has been extended to 25 km. 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;
- 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 (see Figure 4.19);
- 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 NS'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 IPFs 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 First Nations, 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 cognizant of the many unknowns in the marine environment including the present and future 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 both

the design and execution of OSW projects and enhance data gathering and monitoring techniques. In recognition of all these facts, the Committee supports the adoption of principles of Two-Eyed Seeing and 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 First Nations and fishers, 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.

6.4 Tiered Approach to PDAs

Following the processes described in the preceding sections, eight PDAs were identified. These were then categorized as either Tier 1 or Tier 2 based on an overall understanding of their ecological and physical characteristics; the activities, including fishing activity, associated with the area; information received, including concerns expressed, during the engagement process; and a recognition and consideration of uncertainties or factors that would require either substantial further engagement with one or more parties, e.g., DND, DFO or a fisheries group, study or both. It is acknowledged that there are data gaps and much to learn about conditions within each of the PDAs before any OSW development takes place (see section 9). Based on the research undertaken by others (see section 2.2), the materials considered, and the extensive engagement conducted by the Committee, Tier 1 PDAs represent areas that the Committee believes are better understood and contain fewer constraints compared with other areas. Tier 1 PDAs have been subject to extensive engagement and the Committee has received substantial technical feedback from both government and non-government specialists on these areas since issuance of the Interim Report in the spring of 2024.

Tier 2 PDAs represent areas that show potential for OSW development based on known constraints but have neither been through the same level of engagement nor generated the same level of technical feedback as Tier 1 PDAs. In the case of Canso Bank, the Committee, as a result of the engagement process, was made aware that additional investigation was necessary to fully understand usage on and in proximity to the Bank. As a result, Canso Bank was recategorized as Tier 2 from Tier 1. This is discussed in further detail below.

6.5 Changes Since the Issuance of the Interim Report

The Committee implemented a tiered system for PDAs (see section 6.4 above). The PDAs are shown in Figure 6.4 and represent the following changes from the Interim Report:

- Tier 1 PDAs, which include all the PFDA areas except for Canso Bank, are recommended as areas for priority consideration as prospective Wind Energy Areas (WEAs);
- Tier 2 PDAs are viewed as requiring additional investigation and/or stakeholder engagement, including Indigenous communities, before potentially advancing to Tier 1 status;

- Canso Bank has been placed in the Tier 2 category for several reasons. Engagement with fisheries associations have raised concerns about the level of fishing taking place both on the Bank and on its slopes. Concern has also been expressed about the level of vessel traffic crossing the Bank. The Guysborough County Inshore Fishermen's Association (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 routing a transmission cable from the Bank to shore are also understood to be complex. Furthermore, NRCan expressed concern about bathymetric complexity and the probable presence of boulder-scale sediments on the Bank, conditions that may not be conducive to OSW development. Geotechnical surveys are currently underway that will provide data on this issue. Given these unknowns and uncertainties, the Committee has recategorized Canso Bank as Tier 2;
- Five of the PDAs have been enlarged. Factors that influenced this action include:
    - original PFDA boundaries were identified with significant weight attached to surficial geology (Figure 4.4) and DFO fisheries data. Subsequent engagement with representatives from the GSC and NRR, and the preliminary interpretation of recent survey findings, has indicated that not all areas within an identified PDA will be suitable for development. The Committee also recognized that governments require some flexibility in their efforts to identify technically feasible locations and that developers must also weigh potential siting and development options. Engagement with fisheries representatives also reinforced the fact that the DFO commercial fishing information represents only an approximation of the areas fished and hence its limited use in identifying areas with the least potential for conflict;
    - enlarging PDAs provides more flexibility for OSW development to be micro-sited and avoid conflicts;
    - 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 when avoidance and mitigation fail (see section 10);
    - the rapid pace of technological advances associated with the installation of floating turbines indicates a current feasible water depth deployment of circa 300 m (well beyond the 100 m boundary used in the Interim Report). This depth may increase as many countries grapple with the lack of shallow water for OSW development;
    - 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 areas; 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 6.2, the fisheries data and engagement feedback. Each of these locations had been identified as a potential development

location by OSW developers. The DFO commercial fishing data suggests that these areas pose relatively less potential for conflict. One municipality suggested that the South Shore should have the opportunity to benefit from the opportunities that would inevitably result from proximity to OSW development including potential 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 appreciating that these locations have neither been the subject of engagement, nor subject to the same level of scrutiny as Tier 1 locations, the Committee is satisfied that they have development potential and are plausible candidates warranting further investigation.

Feedback received from both geological experts and developers has confirmed that the relationship between OSW turbine foundation types and water depths and geological conditions is imprecise. As a result, turbine foundation types are not definitively associated with water depths.

If OSW development occurs, there will inevitably be interactions with the marine environment and its users. This was made clear to the Committee during the engagement process. The PDAs are based on currently available information, aimed at minimizing potential conflicts and major adverse interactions. The Committee recognizes that the actual location and configuration of the PDAs may evolve as governments identify WEAs and advance NS's OSW industry. Much work remains to be done. The principles of adaptive management that are advocated by the Committee require an iterative approach that systematically analyzes the changes taking place in the marine environment, takes account of technological developments and established practices that ensure the engagement of Indigenous communities, fishers and other stakeholders when WEAs are to be changed, or new areas identified.

6.6 Potential Development Area Details

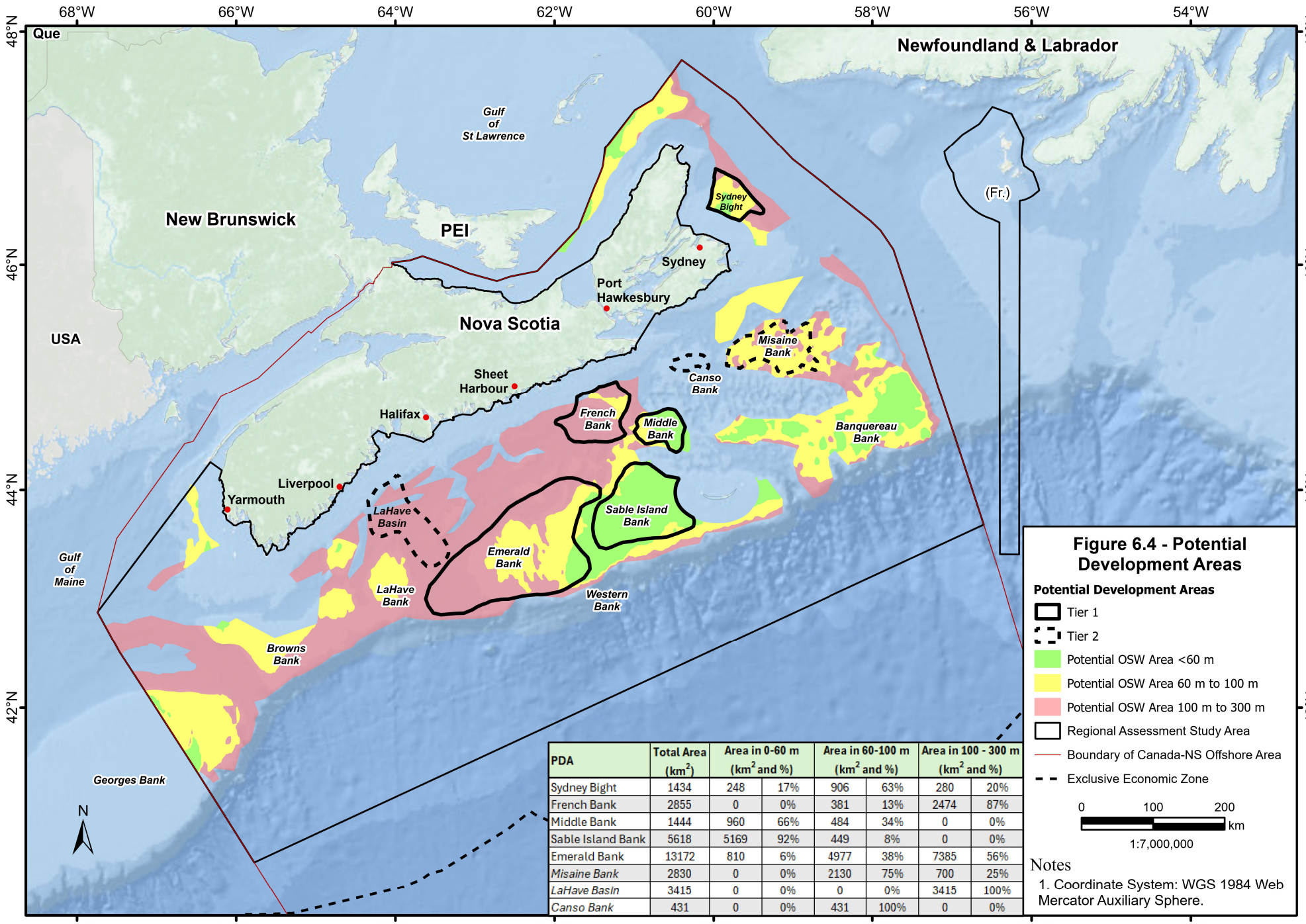
The eight PDAs are presented below in Figures 6.4 and 6.5. Table 6.2 compares the size of the PDAs to the formerly identified PFDAs, rounded to the nearest 5 km^2. It is important to note that the footprint of an OSW farm is dependent on a number of factors including, but not necessarily limited to, the rated capacity of the turbines, the number of turbines and the spacing between the turbines; these factors will define the farm's production capacity per km^2. It has been noted in section 3.1.3 that the trend is moving both to larger sized wind farms (in excess of 1GW) and larger individual turbines (15MW+). While production yields within operating wind farms range from 3MW/km^2 to as high at 19MW/km^2[52], a 5MW/km^2 number is frequently used for planning purposes. Using this number, a 1 GW OSW farm would occupy an area of 200km^2. Applying a density of 5MW/km^2, Table 6.2 shows that the MW capacity within each PDA is large; this theoretical capacity, however, will decrease once site specific factors, e.g., geological suitability and other locational constraints within the PDA are fully understood.

[52] Summary Analysis of Different Offshore Wind Capacity Density Drivers in Proposed U.S. Projects and Impacts on Progress Towards State and Federal Deployment Targets - National Renewable Energy Laboratory

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 100-300m	Theoretical Maximum MW Capacity (5MW/km^2)
Sydney Bight	1,435	1,020	250 km^2, 17%	905 km^2, 63%	280 km^2, 20%	7,175
French Bank	2,855	495	0 km^2, 0%	381 km^2, 13%	2,474 km^2, 87%	14,275
Middle Bank	1,445	910	960 km^2, 66%	485 km^2, 34%	0 km^2, 0%	7,225
Sable Island Bank	5,620	5,195	5,170 km^2, 92%	450 km^2, 8%	0 km^2, 0%	28,100
Western/Emerald Bank	13,170	3,460	810km^2, 6%	4,975km^2, 38%	7,385km^2, 56%	65,850
Misaine Bank	2,830	n/a	0 km^2, 0%	2,130km^2, 75%	700km^2, 25%	14,150
LaHave Basin	3,415	n/a	0 km^2, 0%	0 km^2, 0%	3,415km^2, 100%	17,075
Canso Bank	430	430	0 km^2, 0%	430 ^{2}, 100%	0 km^2, 0%	2,150

Note: Tier 2 PDAs identified in italics.



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%

Figure 6.4 - Potential Development Areas

Potential Development Areas

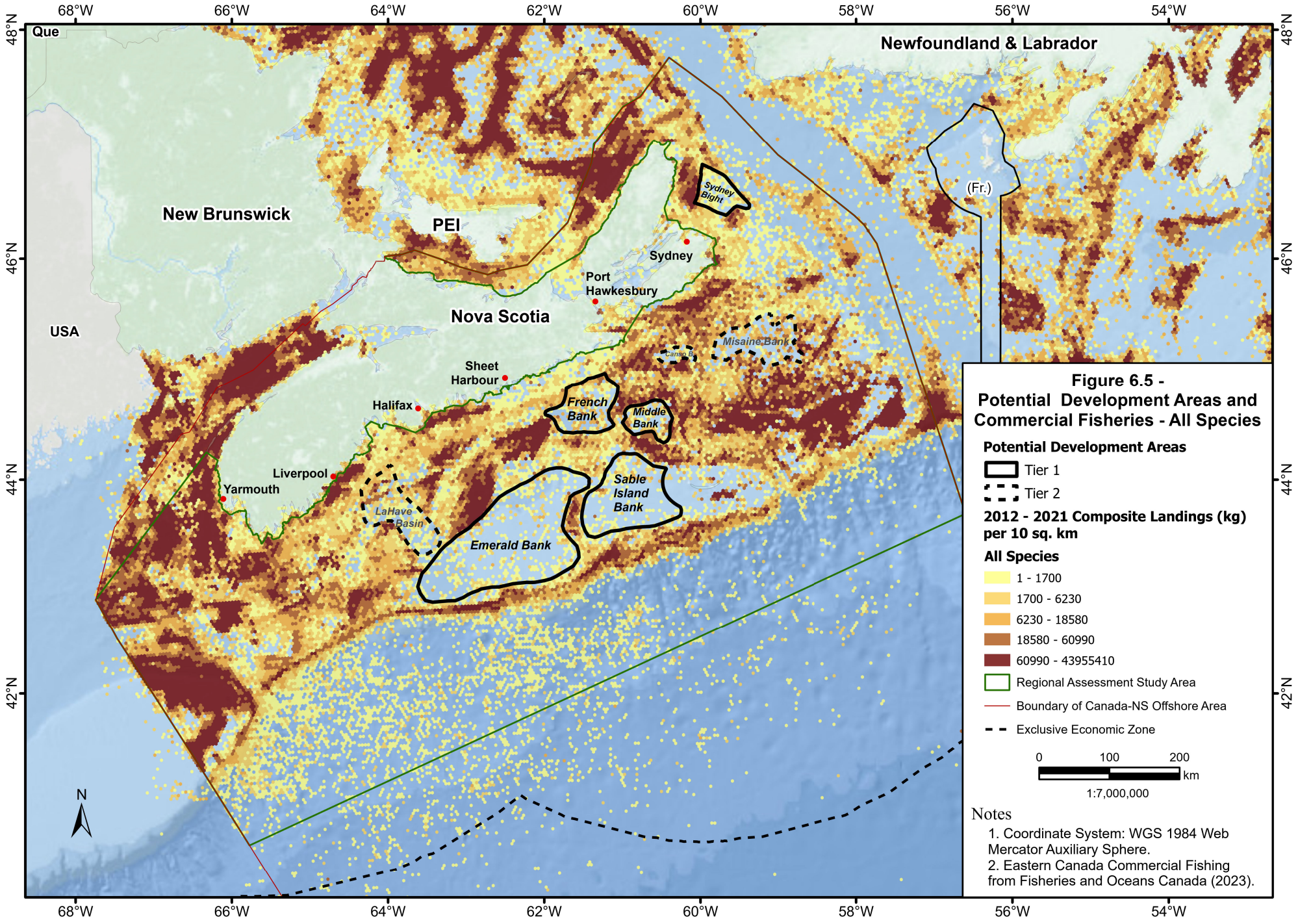
- Tier 1
- Tier 2
- Potential OSW Area <60 m
- Potential OSW Area 60 m to 100 m
- Potential OSW Area 100 m to 300 m
- Regional Assessment Study Area
- Boundary of Canada-NS Offshore Area
- Exclusive Economic Zone

0 100 200 km

1:7,000,000

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 Bight
(Fr.)
Sydney
Port Hawkesbury
Misaine Bank
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 - All Species
Potential Development Areas
Tier 1
Tier 2
2012 - 2021 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).

Part of ECCC's feedback on PFDAs outlined 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 6.3-6.10. The basic data used in the modelling came 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.

Tables 6.3-6.10 in the following sections present the feedback received during the engagement process throughout the entire RA for all PDAs. Where feedback was provided for the original PFDAs in the Interim Report (prior to PFDA enlargement) the Committee has continued to rely on the PFDA feedback as generally representative of the enlarged PDAs. Where these circumstances dictate, the following sections continue to use the term PFDA.

6.6.1 Sydney Bight

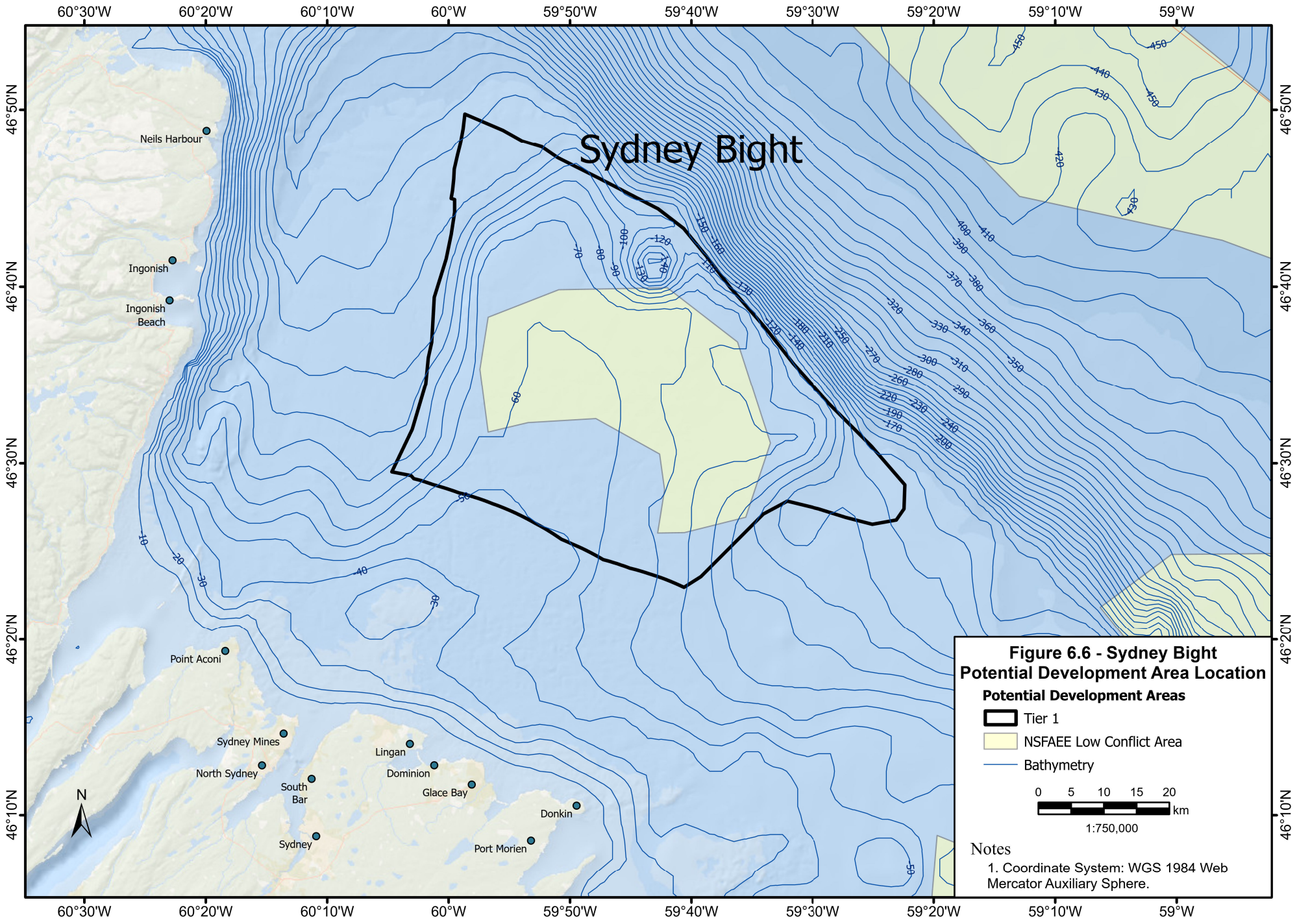
The Sydney Bight PDA is approximately 1,435 km^2 in area comprising water depths of less than 60 m (17% of the PDA), 60-100 m (63% of the PDA) and 100-300 m (20% of the PDA). Figures 6.6 to 6.7 show the location of the PDA and key surrounding features. Table 6.3 summarizes the information that has informed 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", i.e., areas considered by NSFAEE of low current or potential utilization by the fishing industry. 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 taken into account 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).

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 which will be considered in future deliberations over Critical Habitat designations. 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 UXO Legacy Sites and three identified shipwrecks.


Sydney Bight
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
Neils Harbour
Ingonish
Ingonish Beach
Point Aconi
Sydney Mines
North Sydney
South Bar
Sydney
Lingan
Dominion
Glace Bay
Donkin
Port Morien
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.

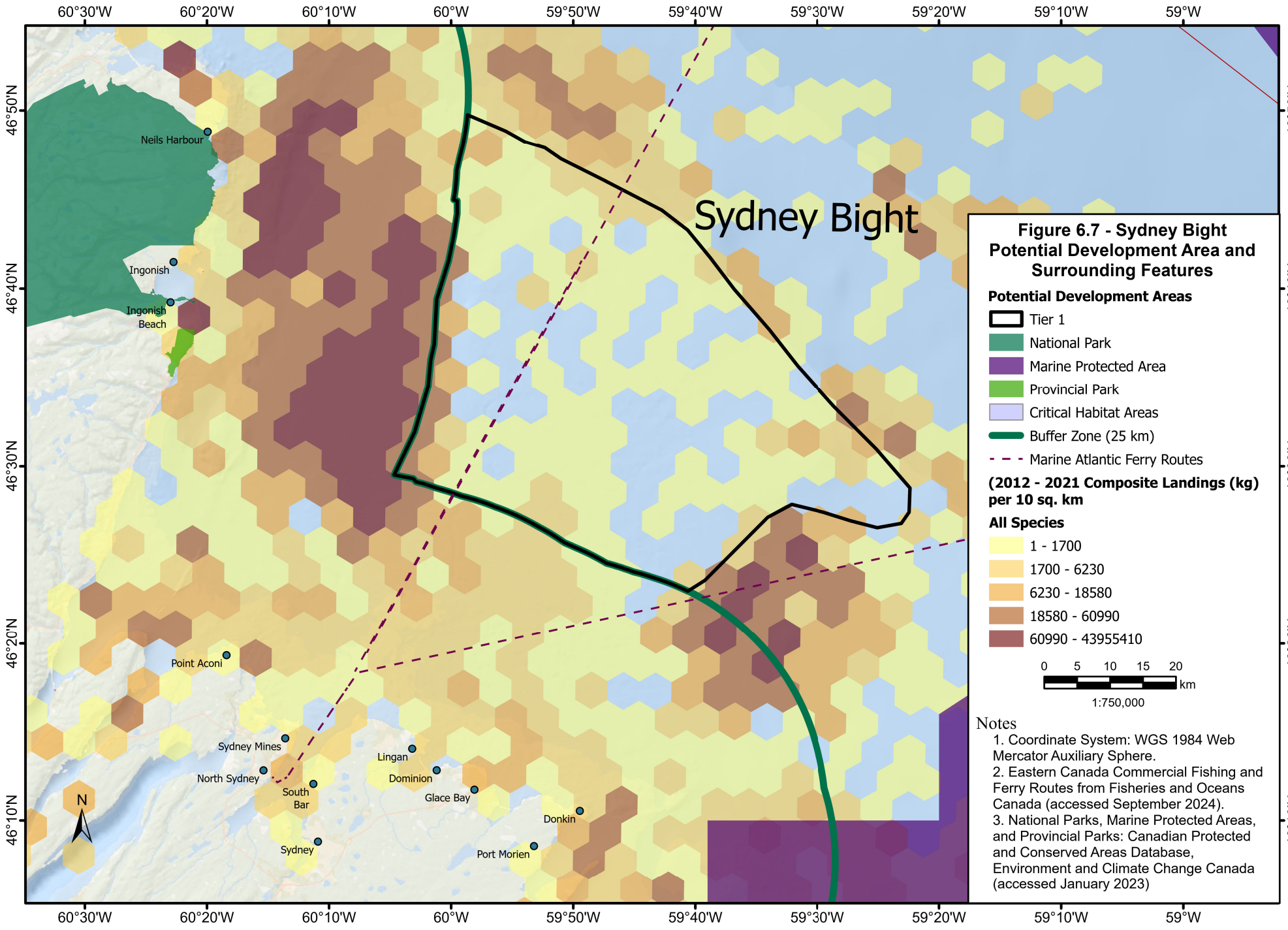

60°30'W
60°20'W
60°10'W
60°W
59°50'W
59°40'W
59°30'W
59°20'W
59°10'W
59°W
46°50'N
46°40'N
46°30'N
46°20'N
46°10'N
Sydney Bight
Neils Harbour
Ingonish
Ingonish Beach
Point Aconi
Sydney Mines
North Sydney
South Bar
Sydney
Lingan
Dominion
Glace Bay
Donkin
Port Morien
N
Figure 6.7 - Sydney Bight Potential 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
(2012 - 2021 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 (July/Aug 2024)	**Species at Risk Habitat and Presence** Sydney Bight is a known distribution and migration area for several marine mammals/animals listed on Schedule 1 of the SARA including blue whale (Endangered), North Atlantic right whale (Endangered), fin whale (Special Concern), white shark (Endangered) and leatherback sea turtles (Endangered). PDA 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.	Potential interactions between OSW development and sensitive species, necessitating avoidance, mitigation and monitoring techniques to be determined at the project level.

		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. Anns 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).	
	*DFO Feedback (January 2025)	• The PDA overlaps with a SiBA for sea pens.	Any OSW project proposed in or near future Critical Habitat would be subject to an assessment to determine if the activity will result in destruction of that CH, and/or if the activity would jeopardize the survival or recovery of the species and if all reasonable alternatives and feasible measures were taken to avoid/mitigate the impact of the activity on the species or its Critical Habitat (DFO, 2025*).
	ECCC Feedback (October 2024) and ECCC Feedback (December 2024)	• 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, ring-billed gull 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.

Category	Engagement Feedback		Considerations
	Source	**Comment**	
		• Tracking data indicates Northern gannets may migrate through this area in both fall and spring; great shearwater high use areas overlap with Sydney Bight in the fall.	
	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.
Fisheries and Other Ocean Users	DFO Feedback (July/Aug 2024)	• Fish species (other than SAR listed) present 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 fisheries will need to be determined at project level.
	DFO Feedback (December 2024)	• The Sydney Bight PDA is described as being designed to minimize conflict with the inshore lobster fishery; however, Cook *et al.* (2024) indicates that the LFA 27 fishery extends to the 60-m bathymetric line which overlaps the Sydney Bight PDA.	
	*DFO Feedback (January 2025)	• The largest overlap with a fishery unit and the PDA is with the crab fishery unit. • Other fisheries unit areas that overlap the PDA include lobster, halibut, flounder, hagfish, halibut fixed, redfish and scallop.	
	NSFAEE Feedback (February 2024) and NSFAEE Feedback (February 2024) and NSFAEE Feedback (September 2024) and NSFAEE Feedback	• 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.	

Category	Engagement Feedback		Considerations
	Source	**Comment**	
	(December 2024)		
	Fishers and public at the Sydney Open House (April 25, 2024)	• 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 (August 2024) and GCIFA Feedback (December 2024)	• No PFDA specific comments provided.	
	MRC Feedback (December 2024)	• A proposed transmission line from the PDA to Sydney would transverse the red ground lobster fishing area. An understanding of this interface would be required to assess the permitting and stakeholder risks.	
Physical and Human Use Conditions	Canmet (Kilpatrick *et al.*, 2023) (see Figure 4.4)	• 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. • 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.	Analysis of substrate is ongoing by NRCan and 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.

Category	Engagement Feedback		Considerations
	Source	**Comment**	
	MRC Feedback (December 2024)	• The depth of sediment may be insufficient for monopiles. This will require additional modeling to understand the risks of mobile sea ice for floating foundation types and may impact project concepts and add risk to development. A substrate evaluation would likely be necessary prior to foundation determination.	More detailed analyses to determine the engineering (foundation) conditions associated with the geology would be required to better understand and characterize the future foundation type with regards to viability and cost.
	Parks Canada Feedback (June 2024) and Parks Canada Feedback (December 2024)	• 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.	Visual impacts will need to be evaluated at the project level.
	NS CCTH Feedback (July 2024)	• 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 (August 2024)	• 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.
	DFO Feedback (December 2024)	• Shipping navigation risks associated with the Marine Atlantic Inc.'s ferry routing in the PDA would be greater beyond the 25-km buffer due to increased wind exposure, wave heights, and sea ice combined with the potential presence of OSW infrastructure. • In light of increased shipping risks, international guidance and standards on shipping route avoidance by OSW development should be considered in the RA Committee's report	
		• There are 3 active telecom cables in the Sydney Bight PDA	

Category	Engagement Feedback		Considerations
	Source	**Comment**	
	Emera Newfoundland and Labrador (December 2024)	• There is a risk of contact with and disruption of the Maritime Link submarine cables that extend between NS (Point Aconi) and NL (Cape Ray)	Project design would need to account for avoidance to existing telecom cable infrastructure and submarine cables.
	DND Feedback (October 2024)	• 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.

[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)*

** Some feedback from DFO contained confidential information that cannot be released to the public.*

6.6.2 Middle Bank

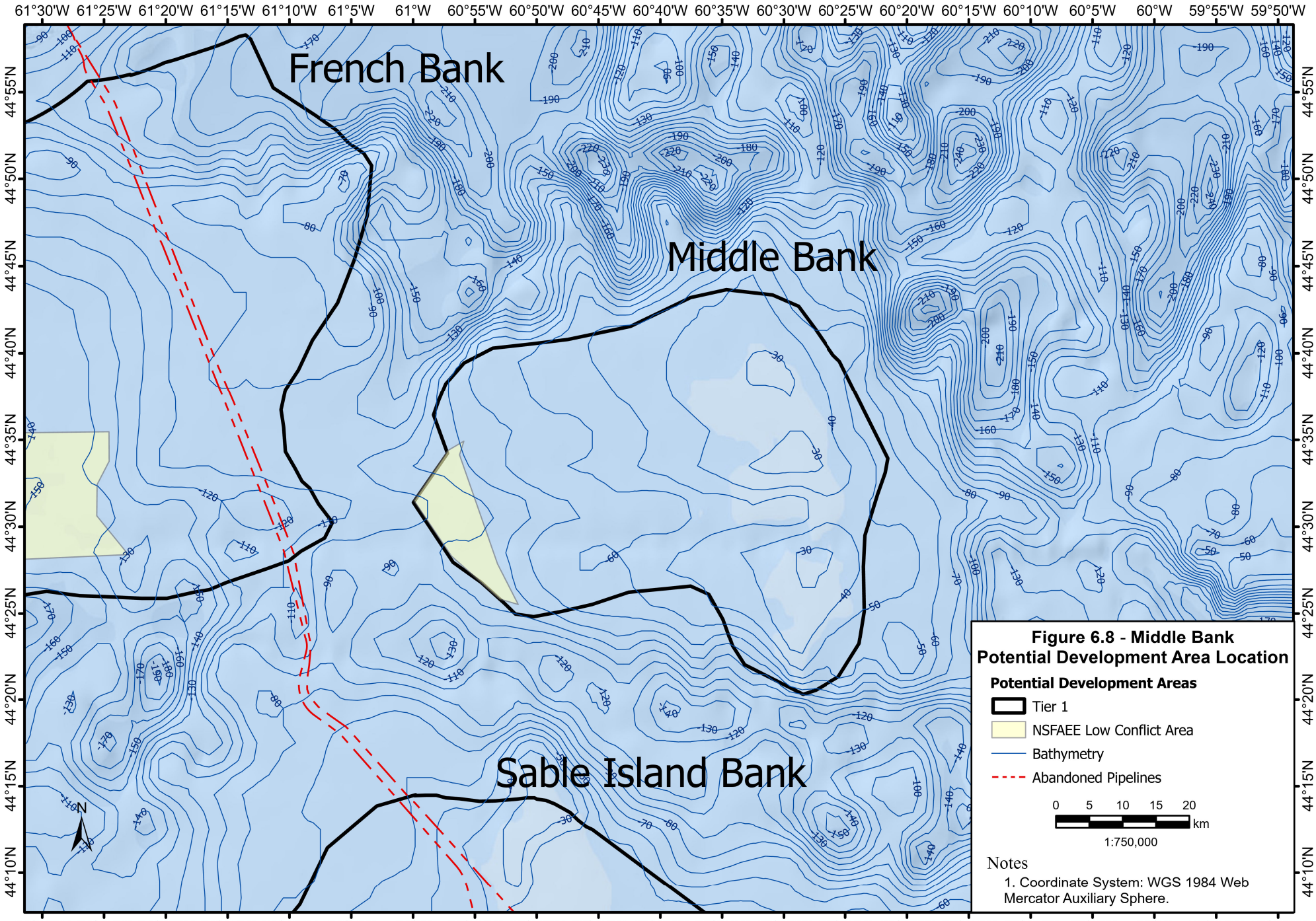
The Middle Bank PDA is approximately 1,445 km^2 in area comprising water depths less than 60 m (66% of the PDA) and 60-100 m (34% of the PDA). Figures 6.8 to 6.9 show the location of the PDA and key surrounding features. Table 6.4 summarizes the information that has informed the Committee's evaluation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

The Middle Bank PDA is located ~60 km from shore and ~120 km from the port of Port Hawkesbury, a port that could provide 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 6.1).

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 harbour 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 gear damage 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 PDA.


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.

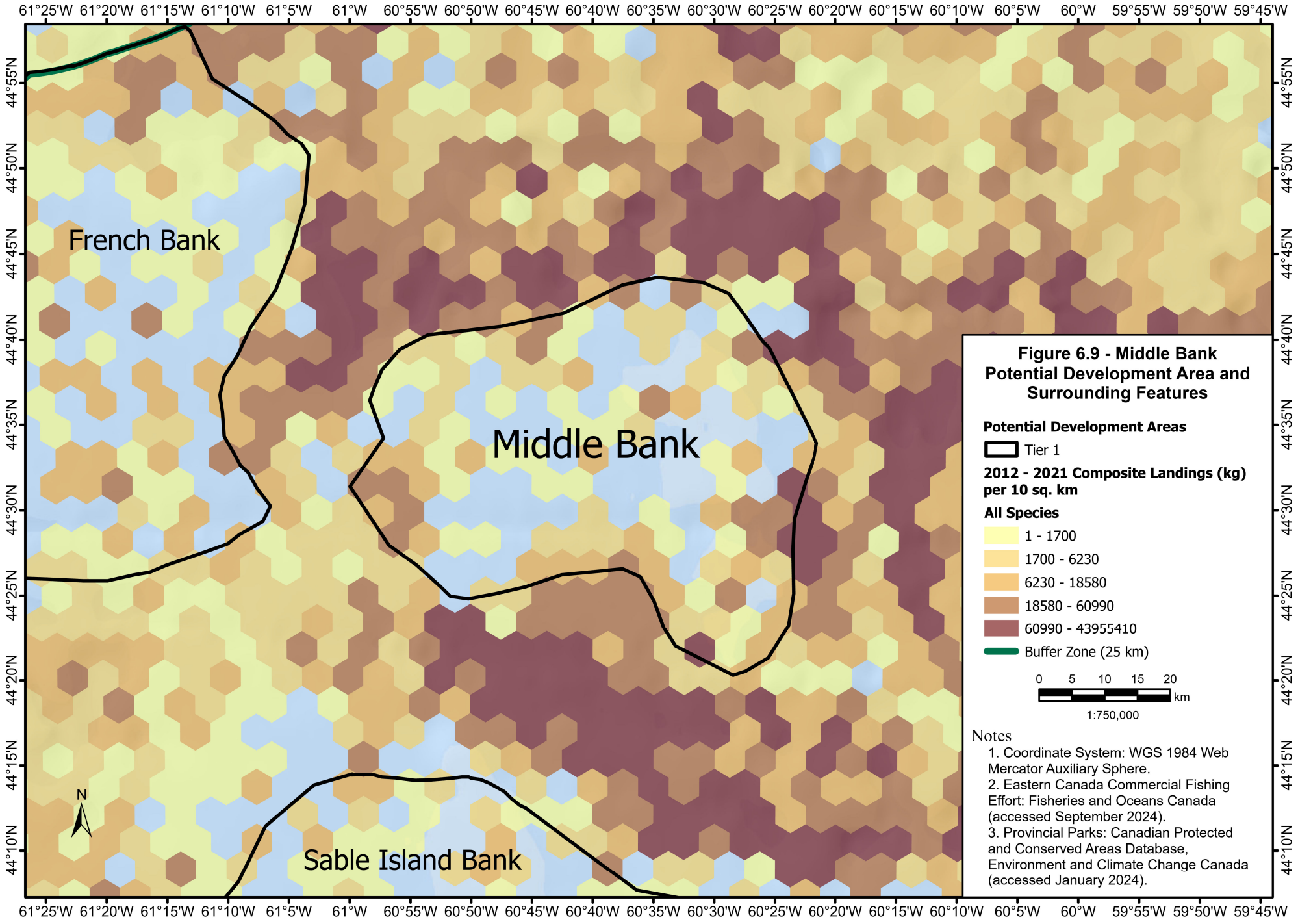

61°25'W 61°20'W 61°15'W 61°10'W 61°5'W 61°W 60°55'W 60°50'W 60°45'W 60°40'W 60°35'W 60°30'W 60°25'W 60°20'W 60°15'W 60°10'W 60°5'W 60°W 59°55'W 59°50'W 59°45'W
44°55'N
44°50'N
44°45'N
44°40'N
44°35'N
44°30'N
44°25'N
44°20'N
44°15'N
44°10'N
French Bank
Middle Bank
Sable Island Bank
N
Figure 6.9 - Middle Bank Potential Development Area and Surrounding Features
Potential Development Areas
Tier 1
2012 - 2021 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 (July/Aug 2024)	**Species at Risk Habitat and Presence** The PDA: • overlaps with blue whale and northern bottlenose whale important habitat. • within the distribution area of the following SAR species, i.e., species that are known/likely to occur: North Atlantic right whale, leatherback sea turtle, fin whale, Atlantic wolffish, spotted wolffish, northern wolffish, white shark.	Potential interactions between OSW development and sensitive species; avoidance, mitigation and monitoring techniques will need to be determined at the project level.

		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
			Confirmation of sea pen presence should be confirmed through underwater benthic habitat surveys (UBHS) during the planning stage.

	ECCC Feedback (October 2024) and ECCC Feedback (December 2024)	• Several marine bird species frequent the area in high numbers during different seasons, e.g.:
		  ○ Spring: murres, razorbill
		  ○ Summer: dovekie
		  ○ 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
			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

Category	Engagement Feedback		Considerations
	Source	**Comment**	
		suggests that for these species, there may be high collision vulnerability in the fall and moderate-high Collision and Displacement vulnerability in the spring, fall and summer. • Northern gannet tracks may migrate through Middle Bank at moderate levels in both spring and fall. There may be overlap with landbird migratory routes from Sable Island, e.g., savannah/Ipswich sparrows, that requires additional follow up. Opportunity for MOTUS tagging studies	monitoring techniques will need to be determined at the project level.
Fisheries and Other Ocean Users	DFO Feedback (July 2024)	• Fish species (other than SAR listed) present 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 fisheries will need to be determined at the project level. Engagement with longline fishers at the project stage to determine setbacks and minimise adverse impacts to that fishery.
		• 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.	
	DFO Feedback (December 2024)	• The shrimp trawl fishery occurs on the northern and eastern parts of the bank. • The area is annually surveyed by DFO under an agreement with the fishing fleet. They show consistent productivity; however, it is variable and currently low, but with consistent settlement. These areas have a history of significance to the offshore scallop fishery that could become important in the future.	

Category	Engagement Feedback		Considerations
	Source	**Comment**	
	*DFO Feedback (January 2025)	• There is a large overlap with the midshore sea cucumber fishery unit and the PDA. • Other fisheries unit areas that overlap the PDA include whelk, VMS Pelagics, crab, shrimp mobile, halibut, silver hake (mobile) and scallop.	
	W.T. Grover Fisheries Ltd. and Ocean Pride Fisheries (sea cucumber fishers) (August 2024)	• Exclusive harvest zones exist within the Middle Bank PFDA (and PDA). • Bottom trawl harvesting technique.	
	Nova Scotia Swordfishermen's Association (long line fishers) (Meeting on August 19, 2024)	• Longline fishery takes place adjacent to Middle Bank.	
	MRC (July 2024)	• 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).	

Category	Engagement Feedback		Considerations
	Source	**Comment**	
	GCIFA Feedback (August 2024) and GCIFA Feedback (December 2024)	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 (February 2024)	• 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.	
	SPANS (August 2024)	• 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.	
	SPANS (December 2024)	• DFO's scallop surveys continue to show that there are significant and healthy scallop populations on the Western/Emerald, Sable and Middle banks (albeit not of commercial size at the moment and therefore provided with no weight in certain analyses to date).	

Category	Engagement Feedback		Considerations
	Source	**Comment**	
		• This period of increased abundance predates the impacts of climate change that are currently being observed, meaning that these areas of importance might play an even more important role for the Eastern Canadian Offshore Scallop Fleet (ECOSF) in the near future. • There are potential oceanographic/hydrodynamic impacts to scallop beds on the Western/Emerald, Sable and Middle banks associated with OSW development. • OSW development on historic scallop beds will impact the flexibility operators have in harvesting scallop pulses on these banks and materially impact license holders in the fishery.	
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.	
	NS CCTH Feedback (July 2024)	• 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 Feedback (October 2024)	No PDA specific feedback.	N/A
	MRC Feedback (December 2024)	• A greater understanding of the existing natural gas pipeline corridor benefits and routing advantages would be beneficial. This is dependent on a proposed project point of	These aspects will be part of future work once potential OSW project/s have been identified in the Sable Island PDA.

Category	Engagement Feedback		Considerations
	Source	**Comment**	
		interconnection, and additional geotechnical analysis would be necessary to determine burial depth feasibility along with seabed mobility implications of an export cable route. • Middle Bank and Sable Island Bank are sizeable PDAs with capacity for several OSW development projects. An optimization of the area would be beneficial, including avoidance of marine and fisheries habitats to de-risk development opportunities.	

** Some feedback from DFO contained confidential information that cannot be released to the public.*

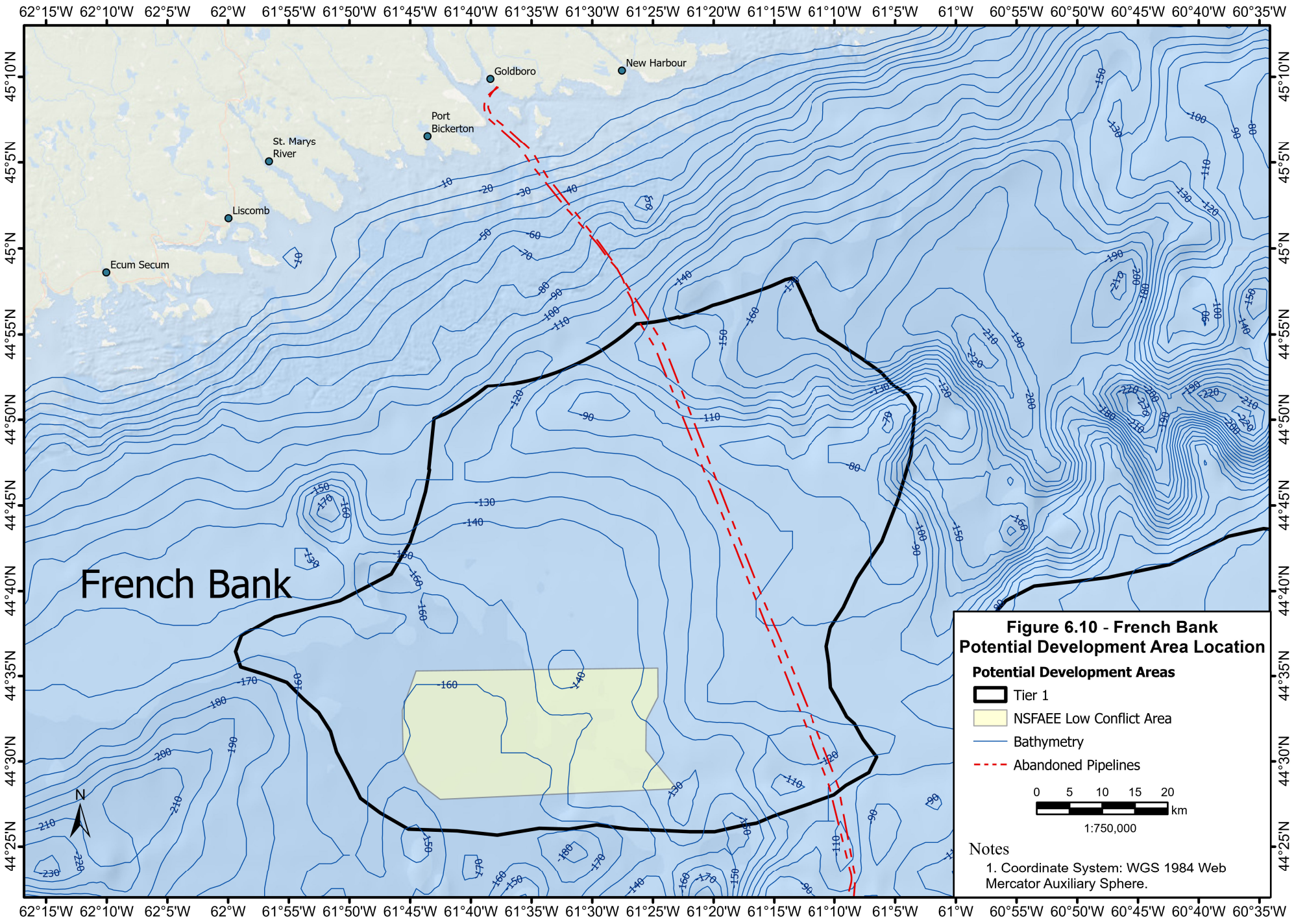
6.6.3 French Bank

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 and 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 6.1).

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.


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 6.10 - 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.

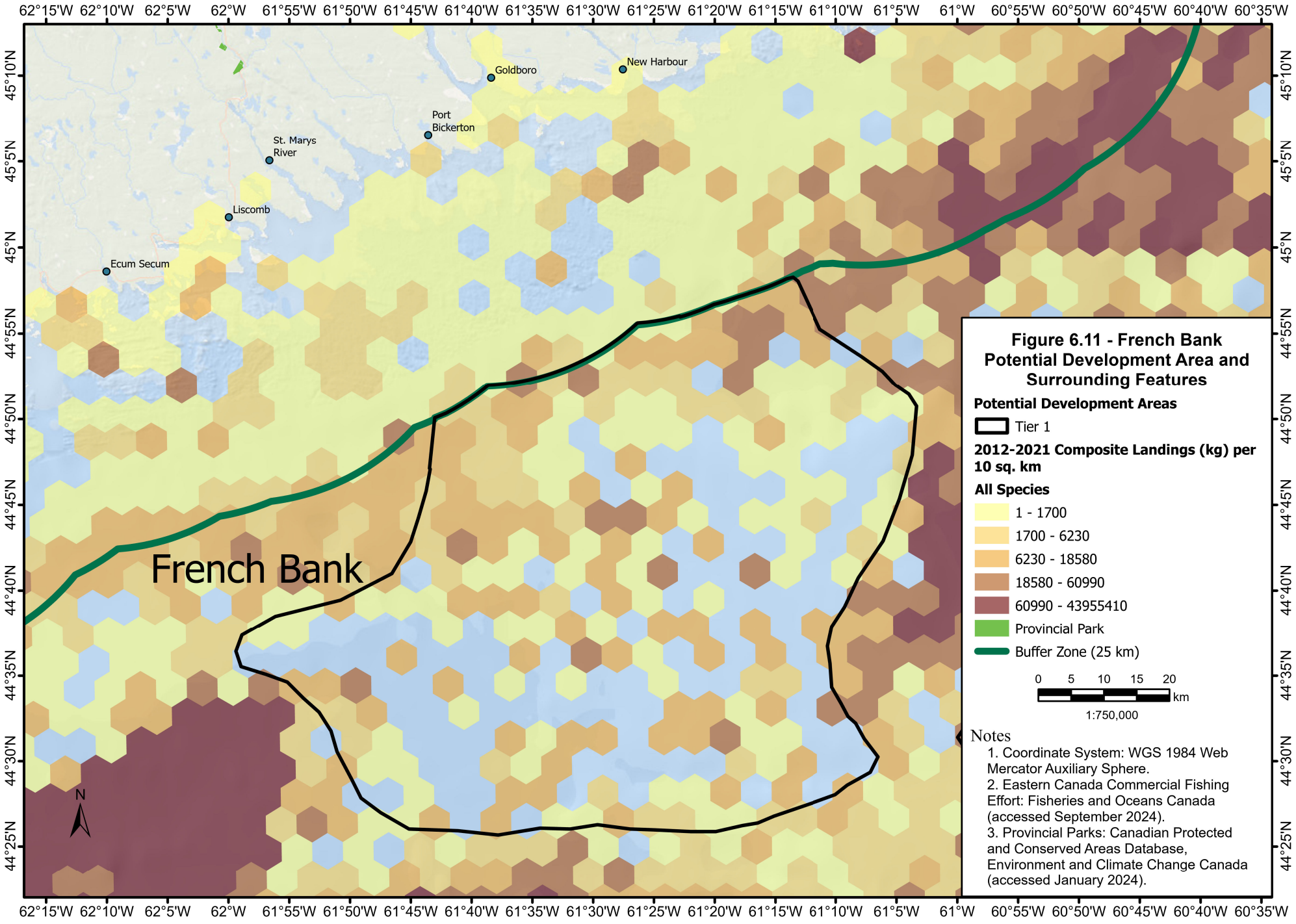

62°15'W 62°10'W 62°5'W 62°W 61°55'W 61°50'W 61°45'W 61°40'W 61°35'W 61°30'W 61°25'W 61°20'W 61°15'W 61°10'W 61°5'W 61°W 60°55'W 60°50'W 60°45'W 60°40'W 60°35'W
45°10'N 45°5'N 45°N 44°55'N 44°50'N 44°45'N 44°40'N 44°35'N 44°30'N 44°25'N
Goldboro
New Harbour
Port Bickerton
St. Marys River
Liscomb
Ecum Secum
French Bank
N
Figure 6.11 - French Bank Potential Development Area and Surrounding Features
Potential Development Areas
Tier 1
2012-2021 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 (July/Aug 2024)	Species at Risk Habitat and Presence • The PDA is within what is known to be the overall distribution of the following SAR species: North Atlantic right whale, leatherback sea turtle, blue whale, fin whale, Atlantic wolffish, northern wolffish, white shark.	Potential interactions between OSW development and sensitive species avoidance, mitigation and monitoring techniques will need to be determined at the project level.
		PFDA overlaps with: • Potential sea pen presence in the southern portion of the PFDA.	Confirmation of sensitive benthic habitats should be confirmed through underwater benthic habitat surveys (UBHS) during the planning stage (DFO, 2024).
	*DFO Feedback (January 2025)	• The PDA overlaps with an EBSA (Middle Bank), SiBA for sea pens, and several fisheries.	
	Canmet (Kilpatrick *et al.*, 2023)	• A mapped extent of sea pen significant benthic area extends within the southern portion of the revised PDA boundary (Figure 4.11).	

	ECCC Feedback (October 2024) and ECCC Feedback (December 2024)	• 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 and Arctic terns.
		• Collision vulnerability has been modelled as high during the fall season and moderate-high displacement vulnerability has been modelled in the fall 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**	
		• Northern gannets migrate through French Bank in both the fall and spring. • French Bank overlaps with high use areas of tracked herring gulls in spring and summer, and Northern gannets in fall. • There may be overlap with landbird migratory routes from Sable Island, e.g., savannah/Ipswich sparrows, that requires additional follow up. Opportunity for MOTUS tagging studies.	
Fisheries and Other Ocean Users	DFO Feedback (July 2024)	• 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 fisheries will need to be determined at project level.
		• Overlap with the 4W midshore sea cucumber fishing area.	
	DFO Feedback (December 2024)	• The PDA overlaps with the snow crab trap fishery and the hagfish barrel trap fishery.	
	*DFO Feedback (January 2025)	• The largest overlap with a fishery unit and the PDA is with the hagfish fishery unit. • Other fisheries unit areas that overlap the PDA (other than those listed above) include VMS Pelagics, lobster, silver hake, scallop, swordfish and shrimp (mobile).	

Category	Engagement Feedback		Considerations
	Source	**Comment**	
	GCIFA Feedback (August 2024) and GCIFA Feedback (December 2024)	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. • 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 (February 2024) and NSFAEE Feedback (September 2024)	• 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. • The region is transited regularly to and from fishing grounds. • NSFAEE recommends 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.	

Category	Engagement Feedback		Considerations
	Source	**Comment**	
	Sipekne'katik First Nation Feedback (December 2024)	• This area is important for culturally significant species, e.g., American eel and Atlantic salmon, for Food, Social, and Ceremonial (FSC) fisheries.	
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.	
	NS CCTH Feedback (July 2024)	• 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 Feedback (October 2024)	No PFDA specific feedback.	N/A
	DFO Feedback (December 2024)	• There are active telecom cables in the French Bank PDA	Project design would need to account for avoidance to existing telecom cable infrastructure.

** Some feedback from DFO contained confidential information that cannot be released to the public.*

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 and 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 over multiple projects with potential to plan for shared infrastructure and services. The PDA offers access to an existing decommissioned 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). The conservation objectives of WEBMR aim to "manage the disturbance of benthic habitat that supports juvenile and adult haddock and other groundfish species" (DFO, 2024). Prohibited activities within this area include all commercial and recreational fisheries activities that use bottom-contact gear, or activities that are known to interact with groundfish.

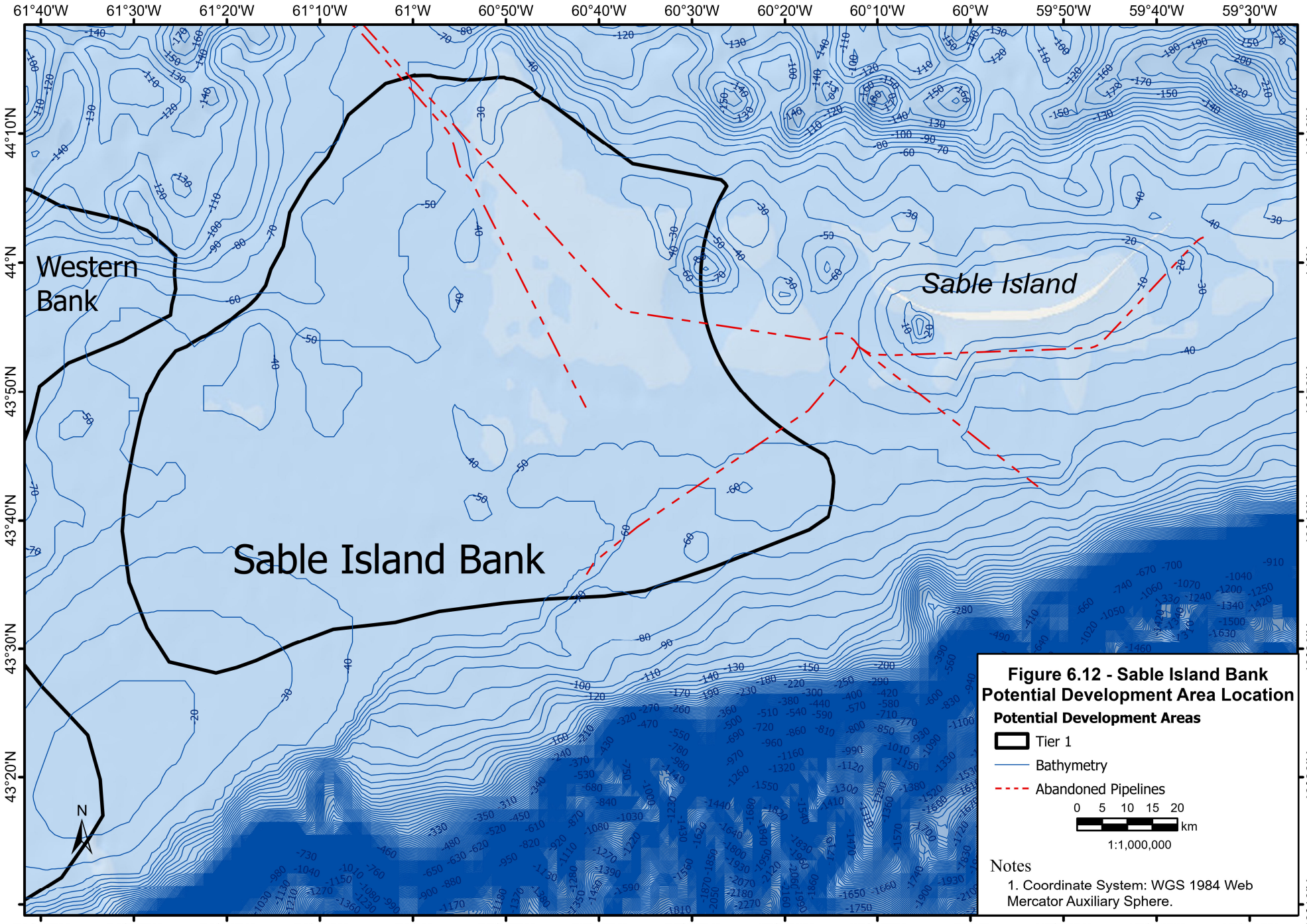
DFO's preferred approach is for OSW development to take place outside any area identified as a Marine Refuge, but that a risk management assessment be completed at the time of any proposed development to ensure that risks to the biodiversity conservation benefits associated with such areas can be avoided or mitigated (DFO, 2024). In addition, DFO noted that "if OSW development were to occur within the existing Marine Refuge the area would need to be reassessed to determine if the site is still meeting the OECM assessment criteria, which could result in the site or part of the site no longer contributing to Canada's Marine Conservation Target initiative" (DFO, 2024).

The Committee accepts that development within a Marine Refuge would require a determination that the conservation objectives that gave rise to the designation 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 conservation/protection 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.

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).

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 investigated by one exploratory license holder, but since this is a fixed gear pot fishery, coexistence 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 coexistence 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 PDA.


61°40'W
61°30'W
61°20'W
61°10'W
61°W
60°50'W
60°40'W
60°30'W
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
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.

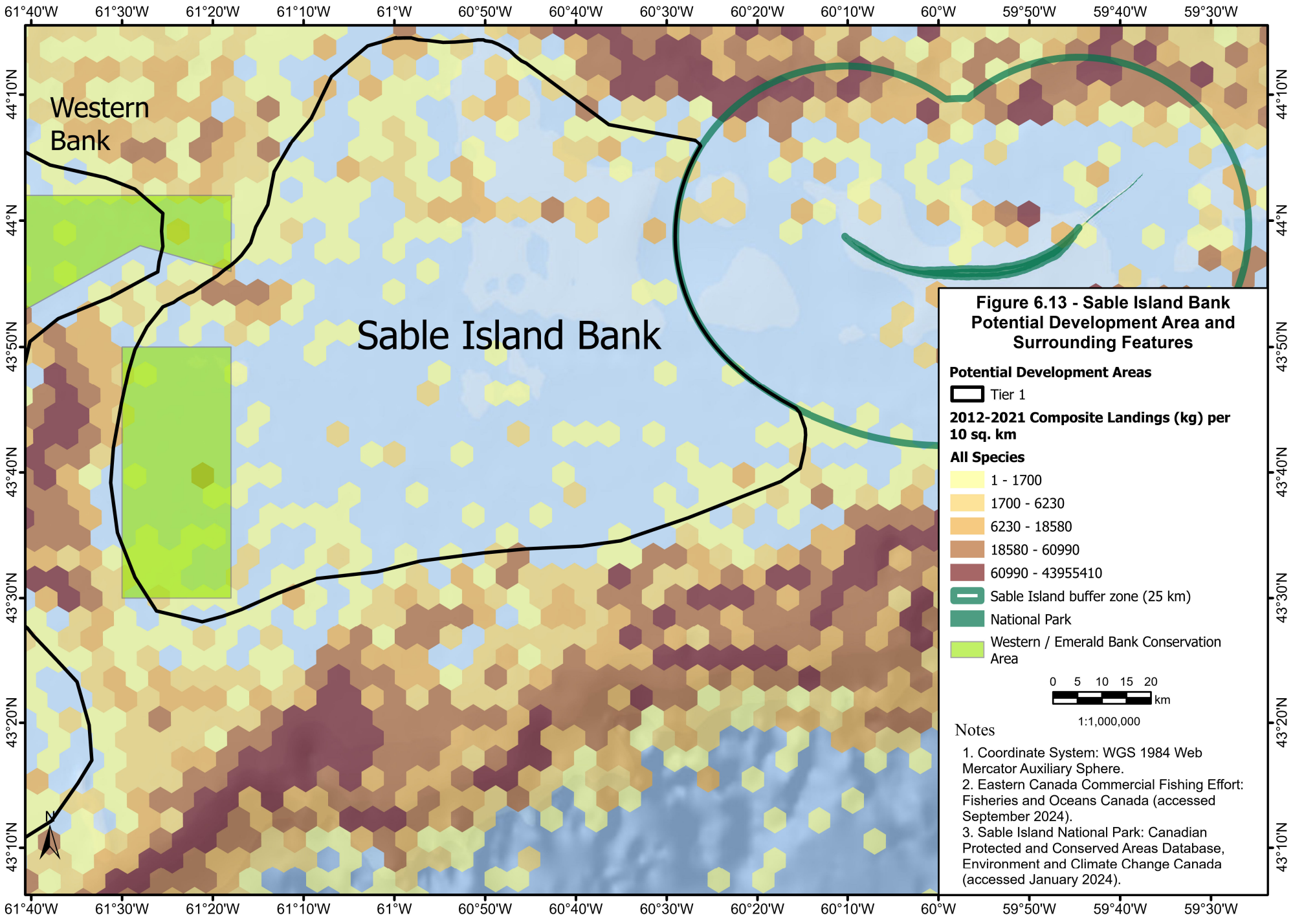

61°40'W
61°30'W
61°20'W
61°10'W
61°W
60°50'W
60°40'W
60°30'W
60°20'W
60°10'W
60°W
59°50'W
59°40'W
59°30'W
44°10'N
44°N
43°50'N
43°40'N
43°30'N
43°20'N
43°10'N
Western Bank
Sable Island Bank
N
Figure 6.13 - Sable Island Bank Potential Development Area and Surrounding Features
Potential Development Areas
Tier 1
2012-2021 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 (July/Aug 2024)	**Species at Risk Habitat and Presence** The PDA: • Overlaps with blue whale and northern bottlenose whale important habitat. • Is within what is known to be the overall distribution of the following SAR species, i.e., species are known/likely to occur: North Atlantic right whale, leatherback sea turtle, fin whale, Atlantic wolffish, spotted wolffish, northern wolffish, loggerhead sea turtle.	Potential interactions between OSW development and sensitive species; avoidance, mitigation and monitoring techniques to be determined at the project level.
		Unique Habitat PDA 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: ○ Spawning and nursery area for groundfish, particularly haddock ○ Important fish habitat ○ Area of high invertebrate, fish and larval fish diversity ○ Western/Emerald Banks Marine Refuge located to the west ○ Representative example of bank and basin habitat ○ Unique oceanography (partial gyre) ○ 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 sensitive benthic habitats should be confirmed through underwater benthic habitat surveys (UBHS) at the project planning stage.
	*DFO Feedback (January 2025)	• There is overlap with the PDA and the Sable Island Shoals EBSA	
	ECCC Feedback (October 2024) and ECCC Feedback (December 2024)	• Several marine bird species frequent the area in high numbers during different seasons, e.g.: ○ Spring: shearwaters ○ 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. • Sable Island Bank overlaps with high use areas from tracked great shearwater in the fall.	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**	
Fisheries and Other Ocean Users	DFO Feedback (July 2024)	• 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 fisheries will need to be determined at project level. Engagement with longline fishers at the project stage to determine setbacks and minimise adverse impacts to that fishery.
		• Overlap with the 4W offshore sea cucumber fishing area. • Overlap with the experimental 4W offshore whelk fishery.	
	DFO Feedback (December 2024)	• The area is annually surveyed by DFO under an agreement with the fishing fleet. They show consistent productivity; however, it is variable and currently low, but with consistent settlement. These areas have a history of significance to the offshore scallop fishery that could become important in the future.	
	*DFO Feedback (January 2025)	• The largest overlap with a fishery unit and the PDA is with the sea cucumber fishery unit. • Other fisheries unit areas that overlap the PDA include whelk, VMS Pelagics, crab, hagfish, whelk, flounder, mackerel fixed, halibut fixed, silver hake (mobile), swordfish, redfish and scallop.	
	W.T. Grover Fisheries Ltd. and Ocean Pride Fisheries (sea cucumber fishers) (August 2024)	• Exclusive harvest zones exist within the Sable Island Bank PFDA 9and PDA). • Harvested using drag trawls.	
	Nova Scotia Swordfishermen's	• Longline fishery takes place adjacent to Sable Island Bank. • OSW would result in loss of access due to gear setback requirements.	

Category	Engagement Feedback		Considerations
	Source	**Comment**	
	Association (long line fishers) (Meeting on August 19, 2024)		
	GCIFA Feedback (August 2024) and GCIFA Feedback (December 2024)	• GCIFA recommends utilizing Sable Island PFDA instead of French Bank and Canso Bank to reduce the impact to commercial fisheries.	
	NSFAEE Feedback (February 2024)	• 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 (August 2024)	• 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.	
	SPANS (December 2024)	• DFO's scallop surveys continue to show that there are significant and healthy scallop populations on the Western/Emerald, Sable and Middle banks (albeit not of commercial size at the moment and therefore provided with no weight in certain analyses to date). • This period of increased abundance predates the impacts of climate change that are currently being observed, meaning that these areas of importance might play an even more important role for the Eastern Canadian Offshore Scallop Fleet (ECOSF) in the near future.	

Category	Engagement Feedback		Considerations
	Source	**Comment**	
		• There are potential oceanographic/hydrodynamic impacts to scallop beds on the Western/Emerald, Sable and Middle banks associated with OSW development. • OSW development on historic scallop beds will impact the flexibility operators have in harvesting scallop pulses on these banks and materially impact license holders in the fishery.	
	Louisburg Seafoods; Whelk Fishery (Meeting on August 15, 2024)	• 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.	
	Clearwater Seafoods Feedback (December 2024)	• Clearwater harvests a significant ocean quahog resource on Sable Island Bank. There is a significant ocean quahog resource remaining on the bank (see registry link for specific locations).	
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.	
	NS CCTH Feedback (July 2024)	• 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.

Category	Engagement Feedback		Considerations
	Source	**Comment**	
	DND Feedback (October 2024)	No PFDA specific feedback.	N/A
	MRC Feedback (December 2024)	• A greater understanding of the existing natural gas pipeline corridor benefits and routing advantages would be beneficial. This is dependent on a proposed project point of interconnection, and additional geotechnical analysis would be necessary to determine burial depth feasibility along with seabed mobility implications of an export cable route. • Middle Bank and Sable Island Bank are sizeable PDAs with capacity for several OSW development projects. An optimization of the area would be beneficial, including avoidance of marine and fisheries habitats to de-risk development opportunities.	These aspects will be part of future work once potential OSW project/s have been identified in the Sable Island PDA.

** Some feedback from DFO contained confidential information that cannot be released to the public.*

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 and 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). 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). The conservation objectives of WEBMR aim "to manage the disturbance of benthic habitat that supports juvenile and adult haddock and other groundfish species" (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). In addition, DFO noted that "if OSW development were to occur within the existing Marine Refuge the area would need to be reassessed to determine if the site is still meeting the OECM assessment criteria, which could result in the site or part of the site no longer contributing to Canada's Marine Conservation Target initiative" (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 portion of the Sable Bank PDA that overlaps with the Western/Emerald Banks Marine Refuge (WEBMR), 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.

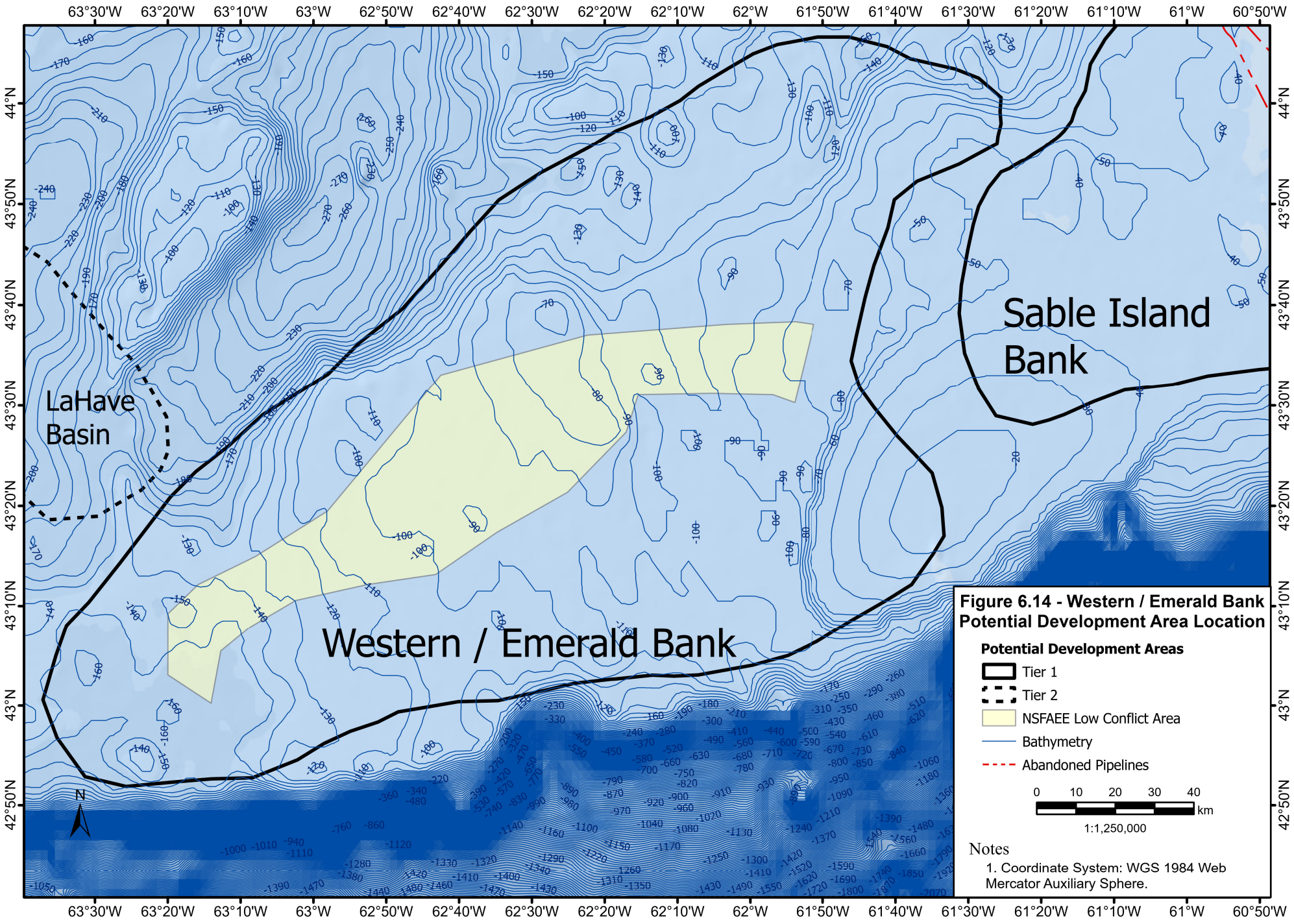
In addition to the WEBMR, DFO identify that sponge and sea pens may be present and that a great number of whale sightings of multiple species have been recorded in the area. Multiple SAR fish species have distributions that overlap the PFDA, and blue whale important habitat abuts the southern PDA boundary; 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. However, as depicted on Figure 6.5, the lack of fishing activity (and subsequent classification of “low conflict by the NSFAEE”) is unsurprising at this location because WEBMR has been closed to various fisheries since 1987 for the protection and conservation of biodiversity. 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 PDA 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 4.19 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
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43°N
42°50'N

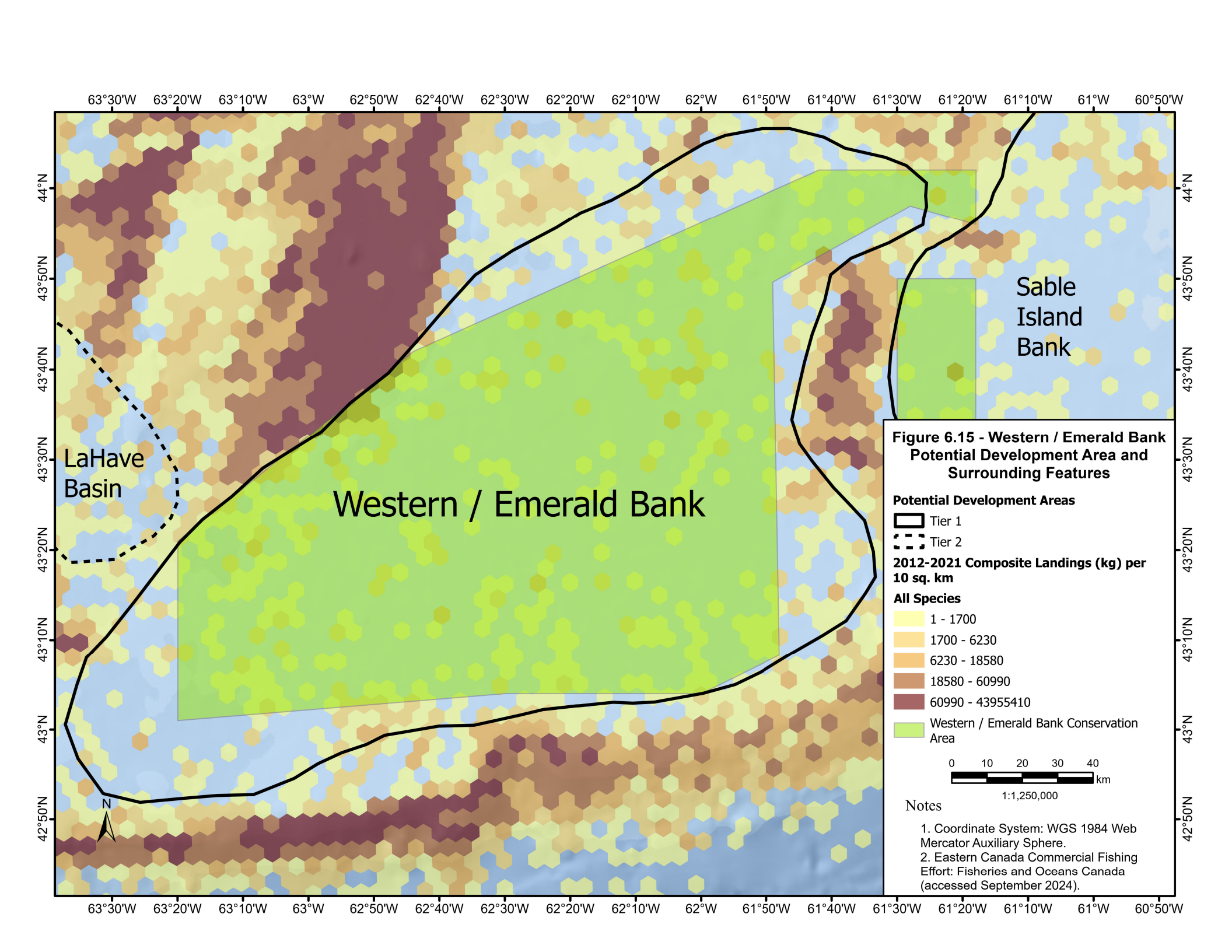

63°30'W
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61°30'W
61°20'W
61°10'W
61°W
60°50'W
44°N
43°50'N
43°40'N
43°30'N
43°20'N
43°10'N
43°N
42°50'N
Sable Island Bank
LaHave Basin
Western / Emerald Bank
N
Figure 6.15 - Western / Emerald Bank Potential Development Area and Surrounding Features
Potential Development Areas
Tier 1
Tier 2
2012-2021 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 (July/Aug 2024)	**Species at Risk Habitat and Presence** • SAR species with distribution that overlaps with this area: Northern Atlantic right whale, 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 and northern bottlenose whale important habitat overlaps the PDA.	Potential interactions between OSW development and sensitive species; avoidance, mitigation and monitoring techniques will need to be determined at the project level.
		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). • DFO have identified a diverse whale presence in the PFDA. These conditions are expected to apply to the PDA.	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 benthic features like corals and sponges within the WEBMR. Sea pen presence to be confirmed through underwater benthic habitat surveys (UBHS) during the project planning stage.
	DFO Feedback (December 2024)	• The PDA has overlap with two EBSAs (Emerald Basin and Scotian Gulf, Scotian Slope) as well as SiBA for sponges, sea pens, and large gorgonian corals.	
	*DFO Feedback (January 2025)	• In addition to the whales listed above sperm whales are observed in the area.	

Category	Engagement Feedback		Considerations
	Source	**Comment**	
	ECCC Feedback (October 2024) and ECCC Feedback (December 2024)	• 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. • There is high displacement vulnerability for the Western/Emerald Bank PDA in the winter and moderate to moderate-high collision and displacement vulnerability occurs across all seasons. • Tracking data indicate great shearwaters migrate through Emerald Bank in fall, and possibly similar trends for sooty shearwater. This PDA overlaps with high use areas from tracked great shearwater in fall and Northern gannet in winter	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.
	KMKNO Feedback (December 2024)	• Western Emerald Banks is a groundfish protection zone closed to fishing. KMKNO considers the ground disturbance of an OSW project would be detrimental to the conservation objectives of the site. • KMK respectfully request the RA consider that no development will be considered in federal MPAs or other legislated areas of marine conservation. • KMKMO requests that that the PDA that overlaps with the Western Emerald Bank Marine Refuge be scaled down to scope out the Marine Refuge from the PDA.	See considerations related to WEBMR provided above.
	MAPC MAARS Feedback (December 2024)	• Concerns about the Western/Emerald Bank Marine Refuge (WEBMR) being considered as a PDA for OSW including many unknowns to determine whether OSW development will compromise the conservation objectives of the WEBMR. • The level of disturbance to benthic habitats as a result of floating wind turbine installation is not well known. It is recommended that we expand the understanding of WEBMR	

Category	Engagement Feedback		Considerations
	Source	**Comment**	
		and floating OSW before recommending WEBMR as a potential site for development.	
Fisheries and Other Ocean Users	DFO Feedback (July/Aug 2024)	• 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, haddock, 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 fisheries will need to be determined at the project level. Engagement with longline fishers at the project stage to determine setbacks and minimise adverse impacts to that fishery.
	DFO Feedback (December 2024)	• The area is annually surveyed by DFO under an agreement with the fishing fleet. They show consistent productivity; however, it is variable and currently low, but with consistent settlement. These areas have a history of significance to the offshore scallop fishery that could become important in the future.	
	*DFO Feedback (January 2025)	• Overlap with the PDA and fishery units is low due to the fishery closure area associated with WEBMR. • Fisheries unit areas that overlap the PDA include scallop, VMS pelagics, silver hake mobile, halibut, hagfish, swordfish, halibut, redfish, cod and haddock fixed, halibut fixed, bluefin tuna, mackerel fixed, pollock mobile and crab.	
	Nova Scotia Swordfishermen's Association (long line fishers) (Meeting on August 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 (August 2024) and GCIFA Feedback (December 2024)	• GCIFA recommends development within Western/Emerald Bank PFDA instead of French Bank and Canso Bank to reduce the impact to other commercial fisheries.	

Category	Engagement Feedback		Considerations
	Source	**Comment**	
	NSFAEE Feedback (February 2024)	• Area of "low conflict" identified by NSFAEE in Western/Emerald Bank PDA (see Figure 6.14).	
	Groundfish ITQ Association Feedback (December 2024)	• The large expansion of the Emerald Bank PDA is a concern. • This area is critically important to the silver hake resource residing in Northwest Atlantic Fisheries Organization (NAFO) Divisions 4VWX. • The expansion of the Emerald Bank PDA is now dangerously close to important silver hake fishing grounds, in particular on the northern edge of the boundary which is quite near the Emerald Basin (one of the few areas silver hake harvesters are permitted to catch their quotas).	
	Sipekne'katik First Nation Feedback (December 2024)	• This area is important for culturally significant species, e.g., American eel and Atlantic salmon, for Food, Social, and Ceremonial (FSC) fisheries).	
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.	
	NS CCTH Feedback (July 2024)	• 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 Feedback (October 2024) (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 Emerald Bank 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.

** Some feedback from DFO contained confidential information that cannot be released to the public.*

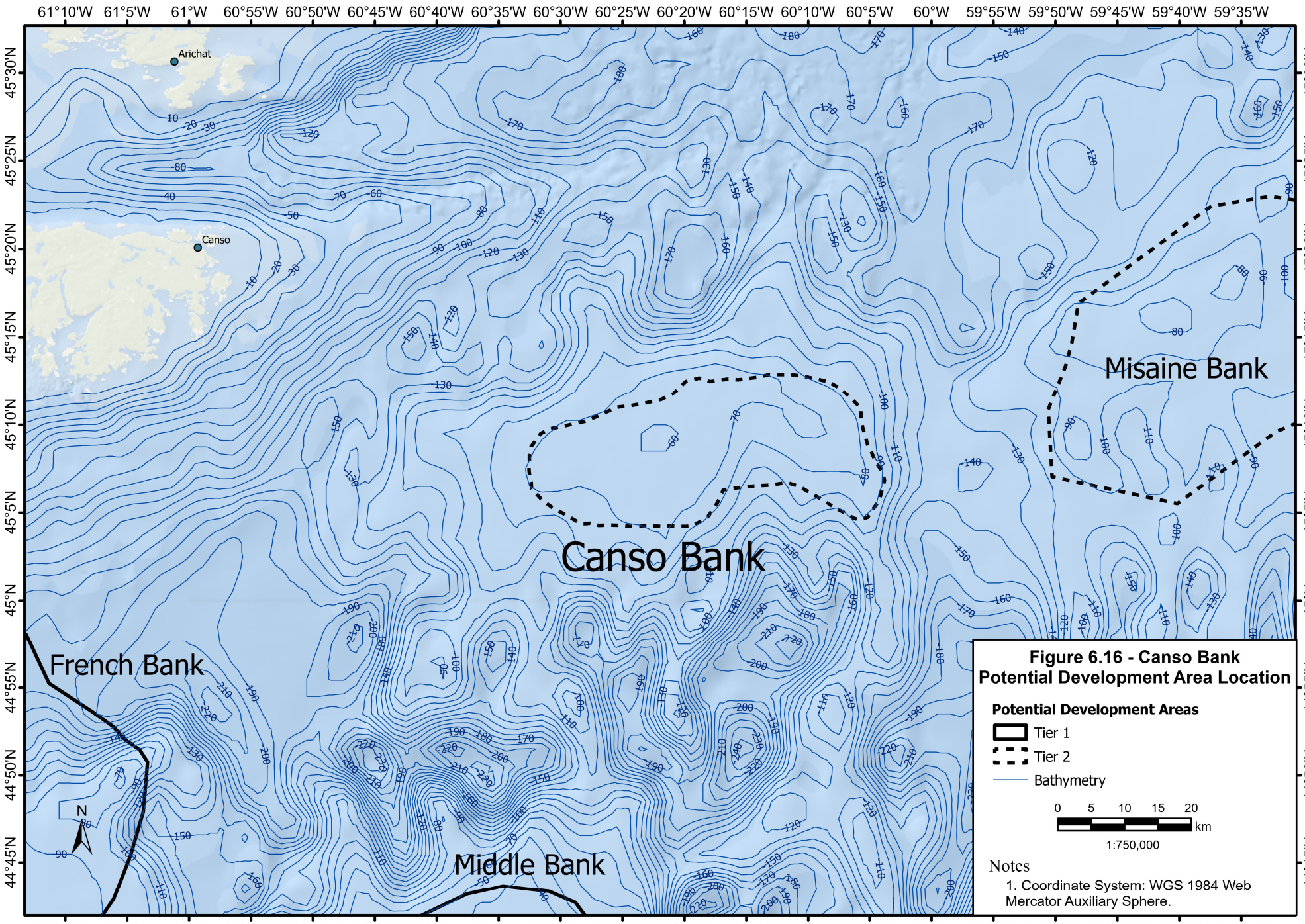
6.6.6 Canso Bank

The Canso Bank PDA is unchanged in size compared to the original PFDA. It 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 and ~ 85 km from Port Hawkesbury. The Port of Sydney lies ~ 160 km to the north. Figures 6.16 and 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. 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).

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
45°30'N 45°25'N 45°20'N 45°15'N 45°10'N 45°5'N 45°N 44°55'N 44°50'N 44°45'N
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.

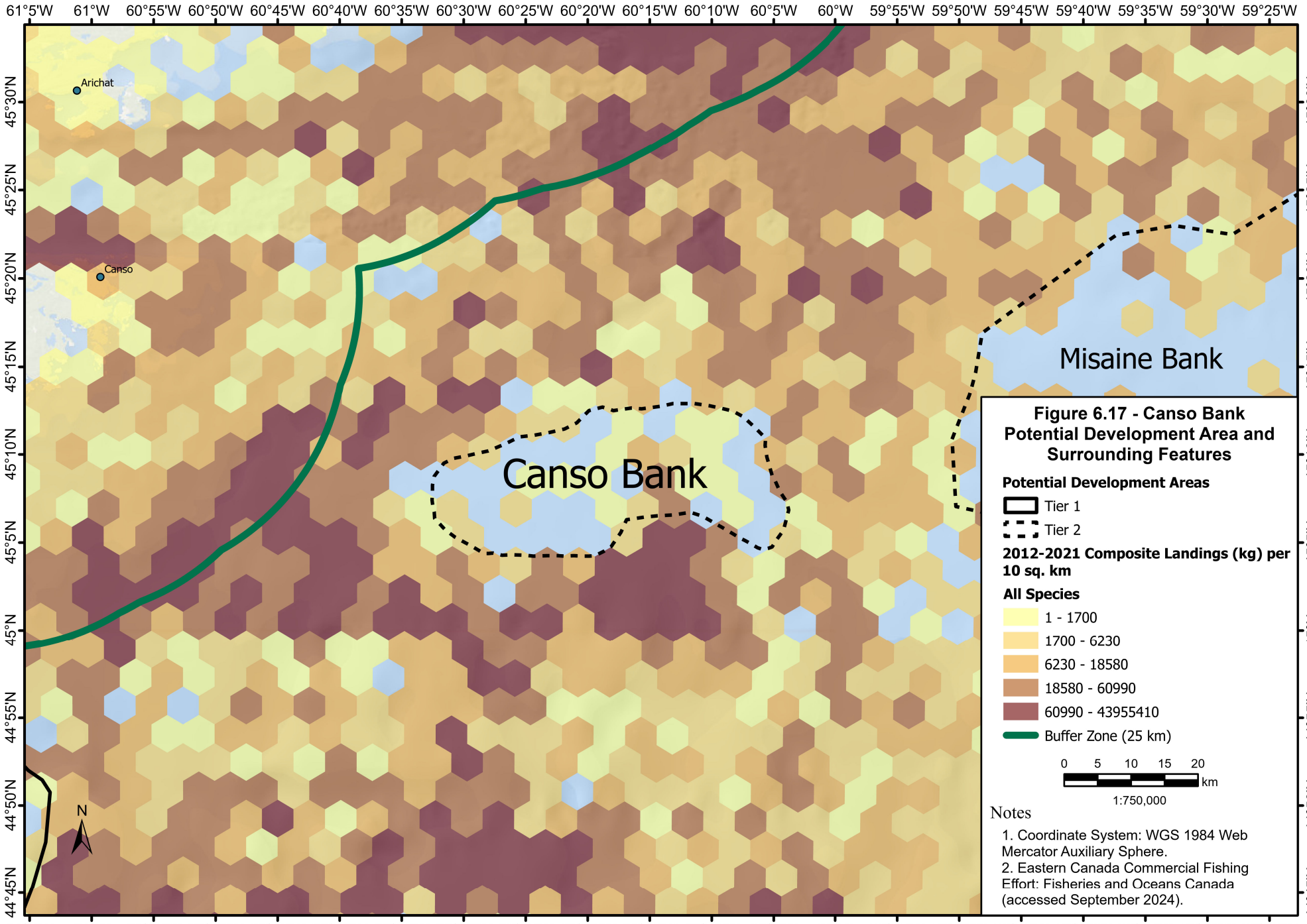

61°5'W
61°W
60°55'W
60°50'W
60°45'W
60°40'W
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60°25'W
60°20'W
60°15'W
60°10'W
60°5'W
60°W
59°55'W
59°50'W
59°45'W
59°40'W
59°35'W
59°30'W
59°25'W
45°30'N
45°25'N
45°20'N
45°15'N
45°10'N
45°5'N
45°N
44°55'N
44°50'N
44°45'N
Arichat
Canso
Canso Bank
Misaine Bank
N
Figure 6.17 - Canso Bank Potential Development Area and Surrounding Features
Potential Development Areas
Tier 1
Tier 2
2012-2021 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 (July/Aug 2024)	**Species at Risk Habitat and Presence** The 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 Feedback (January 2025)		Any OSW project proposed in or near future Critical Habitat would be subject to an assessment to determine if the activity will result in destruction of that Critical Habitat, and/or if the activity would jeopardize the survival or recovery of the species and if all reasonable alternatives and feasible measures were taken to avoid/mitigate the impact of the activity on the species or its critical habitat.

	DFO Feedback (December 2024)	**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
			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

Category	Engagement Feedback		Considerations
	Source	**Comment**	
		○ 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.	benthic habitat surveys (UBHS) during the planning stage.
	ECCC Feedback (October 2024) and ECCC Feedback (December 2024)	• Several marine bird species frequent the area in high numbers during different seasons, e.g.: ○ Spring: murres, razorbill ○ Summer: dovekie, northern gannet ○ 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. • There is moderate-high collision and displacement vulnerability in spring, summer and fall for the Canso Bank PDA. • There is overlap with high use areas of tracked Northern gannets in fall	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.
Fisheries and Other Ocean Users	DFO Feedback (July/Aug 2024)	• 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 fisheries will need to be determined at project level.

Category	Engagement Feedback		Considerations
	Source	**Comment**	
	GCIFA Feedback (August 2024) and GCIFA Feedback (December 2024)	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. • 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 (September 2024)	• 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.	

Category	Engagement Feedback		Considerations
	Source	**Comment**	
Physical and Human Use Conditions	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 processes. This will inform the design including the identification of turbine structure suited to the physical conditions.
	NS NRR Subsurface and Offshore Energy Branch (See Figure 4.4)	• PDA entirely located within Post-Glacial Sand and Gravel unit.	
	NS CCTH Feedback (July 2024)	• No known shipwrecks exist within the PDA boundaries.	N/A
	DND Feedback (October 2024)	• No PDA specific feedback.	N/A
	DFO Feedback (December 2024)	• There are active telecom cables in the Canso Bank PDA	Project design would need to account for avoidance to existing telecom cable infrastructure.

** Some feedback from DFO contained confidential information that cannot be released to the public.*

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 km2. The PDA has water depths ranging from 100 to 300 m. Figures 6.18 and 6.19 show the location of the PDA and key surrounding features. 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).

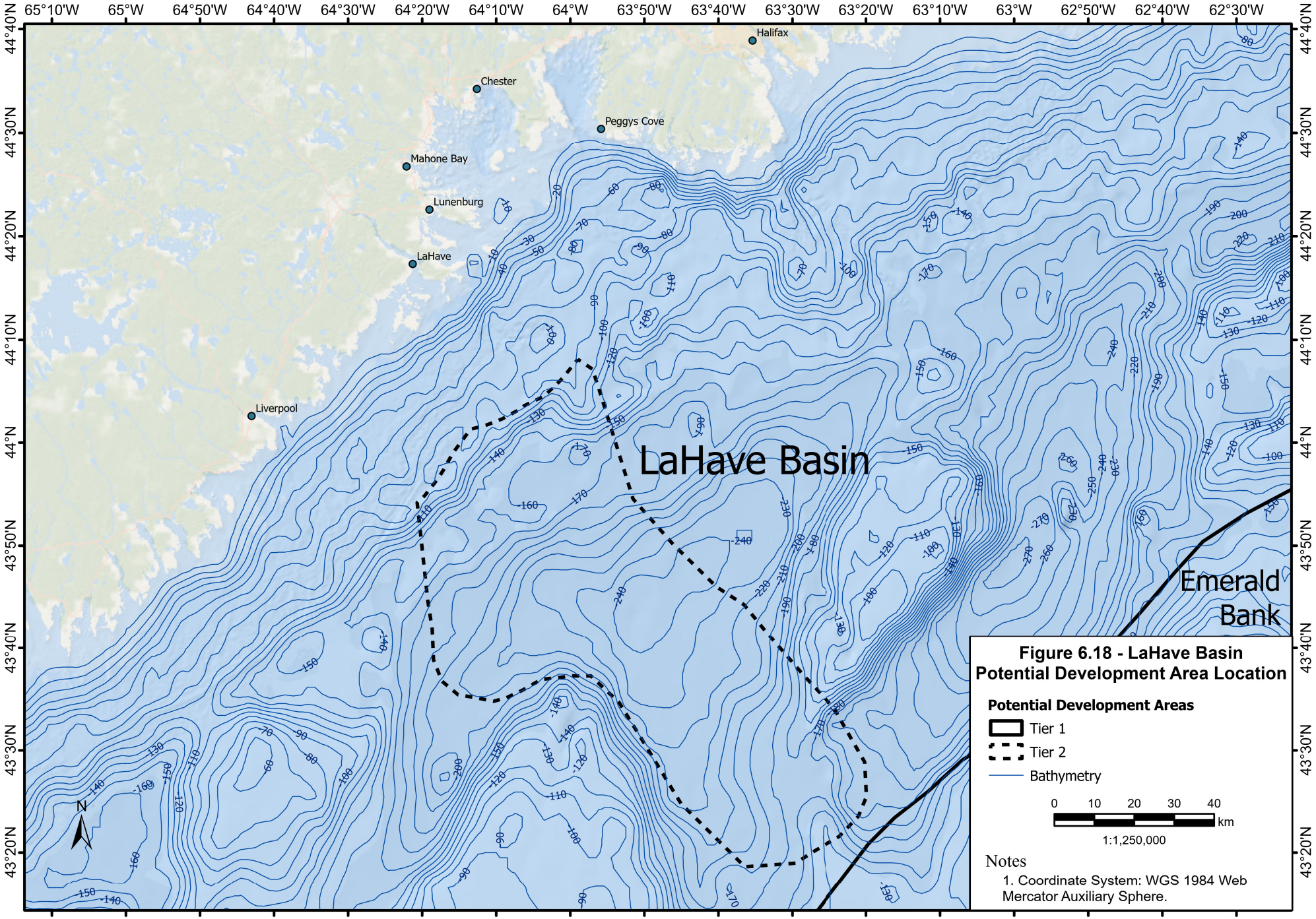
Although the south shore region is generally associated with dense fishing activity, the PDA boundary has been designed with reference to the DFO published data which indicate an area of relatively less fishing density. Feedback from the NSFAEE however suggested that the area within the LaHave Basin PDA is heavily fished by a variety of sectors; the Groundfish ITQ Association indicated that the area is critically important to the silver hake resource, and it is one of the few areas that the current silver hake fishery is permitted to operate within.

The LaHave Basin PDA overlaps the proposed Pemsik National Marine Conservation Area (NMCA). “The Pemsik NMCA is representative of the Scotian Shelf Marine Region, including basin, bank, and shelf habitat, as well as biophysically diverse coastal estuaries, inlets, and beaches. It is part of a broader Indigenous-led vision that connects several terrestrial and marine conservation initiatives” (Parks Canada, 2024).

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 6.1.

Over half of the PDA exists within the Royal Canadian Navy’s (RCNs) Maritime Local Operating Areas (MARLOAs). These areas present a potentially significant development constraint for the same reasons discussed in section 6.6.5 (Western/Emerald Bank) and presented in 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.

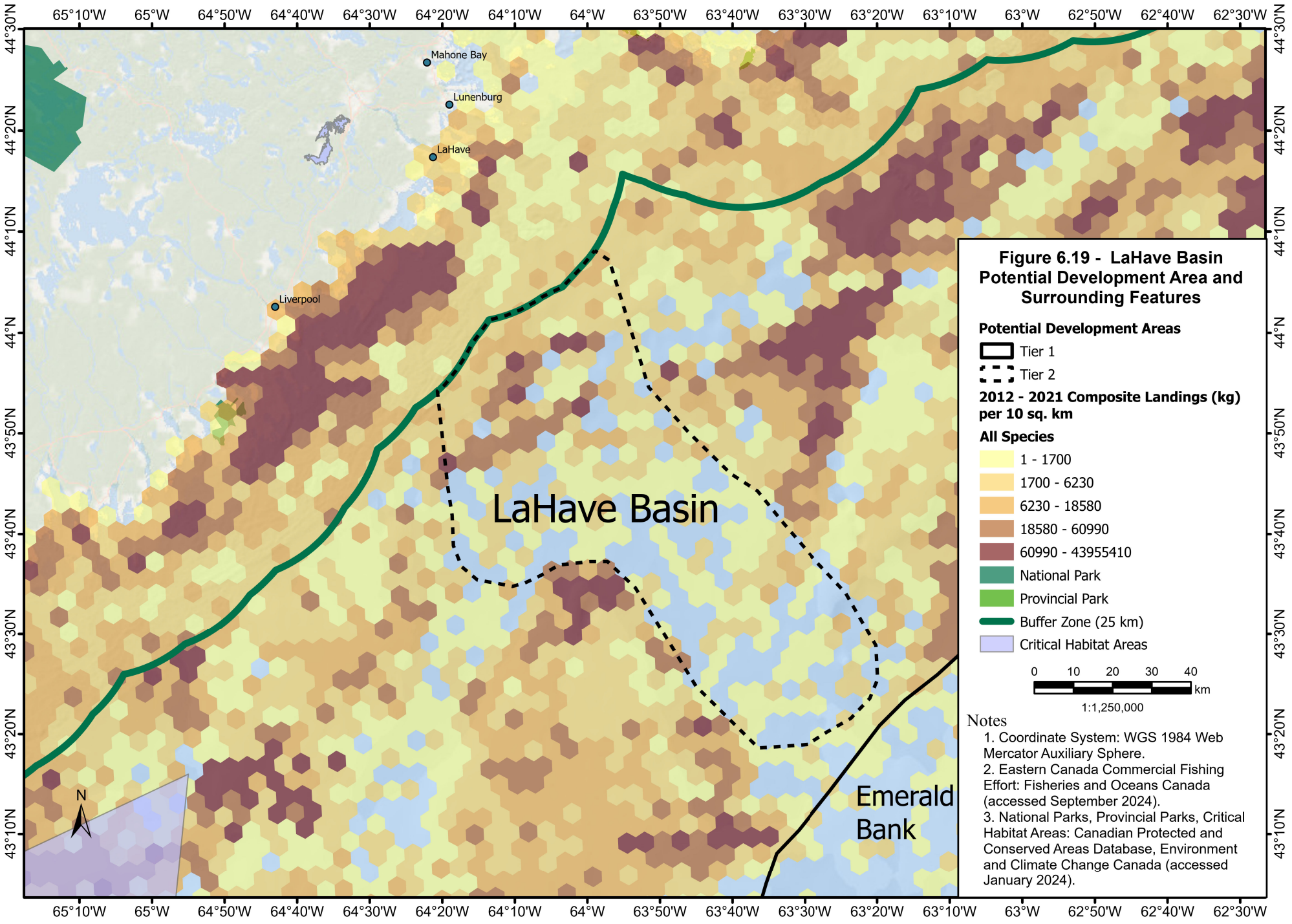

65°10'W
65°W
64°50'W
64°40'W
64°30'W
64°20'W
64°10'W
64°W
63°50'W
63°40'W
63°30'W
63°20'W
63°10'W
63°W
62°50'W
62°40'W
62°30'W
44°30'N
44°20'N
44°10'N
44°N
43°50'N
43°40'N
43°30'N
43°20'N
43°10'N
Mahone Bay
Lunenburg
LaHave
Liverpool
LaHave Basin
Emerald Bank
N
Figure 6.19 - LaHave Basin Potential Development Area and Surrounding Features
Potential Development Areas
Tier 1
Tier 2
2012 - 2021 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).

Table 6.9. LaHave Basin PDA Suitability Summary Table

Category	Engagement Feedback		Considerations
	Source	**Comment**	
Ecological Sensitivity	DFO Feedback (December 2024)	**Species at Risk Habitat and Presence** The PDA overlaps with: • SAR species with distribution that overlaps with this area: North Atlantic right whale.	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.
		Unique Habitat • We recommend that DFO Tier 1 conservation network sites be avoided. This includes the Pemsik NMCA which the PDA overlaps.	
	*DFO Feedback (January 2025)	• PDA overlaps with a DFO Tier 1 marine conservation network site (Pemsik), an EBSA (Emerald Basin and the Scotian Gulf), SiBA for sea pens and sponges. • The LaHave Basin is a very productive area and notably, endangered Blue Whales have been observed there, though the PDA's importance for this species is not well understood.	
	Parks Canada Feedback (December 2024)	Overlaps with proposed Pemsik NMCA.	
	ECCC Feedback (December 2024)	• There is a high density of gulls, including great black-backed gull, and herring gull, as well as Northern gannet in the summer. • There is high density of common murres, dovekies and murres in the winter. • Herring gulls forage at disproportionately high densities in the PDA compared to the rest of the RA Study Area. • There is high collision and displacement vulnerability in summer, and high displacement vulnerability in winter.	

		• Tracking data indicates Northern gannet migrates through this PDA at high proportions in fall and spring, similarly with great shearwater in fall. This corresponds to overlap with high use areas for Northern gannet in the fall and winter.	
Fisheries and Other Ocean Users	DFO Feedback (December 2024)	• LaHave Basin PDA overlaps with groundfish bottom trawling inside the PDA about 35-40 km from shore and at > 100 m depth.	Potential interactions between OSW development and fisheries will need to be determined at project level.
	*DFO Feedback (January 2025)	• The largest overlap with a fishery unit and the PDA is with the lobster fishery unit. • Other fisheries unit areas that overlap the PDA include redfish, halibut, hagfish, swordfish, VMS pelagics, cod and haddock (fixed and mobile), mackerel fixed, crab, bluefin tuna, silver hake (mobile), pollock (mobile), herring (fixed), pollock gillnet, halibut fixed and flounder.	
	NSFAEE Feedback (December 2024)	• The area within the LaHave Basin PDA is heavily fished by a variety of sectors.	
	Sipekne'katik First Nation Feedback (December 2024)	• This is an important area for diadromous fish migrating from the ocean to fresh waters and vice versa, including two culturally important species for the Mi'kmaw: the Atlantic salmon and the American eel. • The area is important for Food, Social, and Ceremonial (FSC) fisheries.	
	Groundfish ITQ Association Feedback (December 2024)	• The addition of LaHave Basin as a Tier 2 PDA is concerning. • This area is critically important to the silver hake resource residing in Northwest Atlantic Fisheries Organization (NAFO) Divisions 4VWX. • LaHave Basin, is now identified as a Tier 2 PDA, another one of the few areas that the current silver hake fishery is permitted to operate within.	

Physical and Human Use Conditions	Canmet (Kilpatrick *et al.*, 2023)	• PDA is in an area identified by substrate modelling as a combination of “Challenging” and suitable for "Floating Only” (see the discussion above under section 6.1).	Suitability of substrate will be evaluated by developers to determine appropriate turbine foundation
	NS CCTH Feedback (July 2024)	• No PDA specific feedback.	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 Feedback (October 2024)	• No PDA specific feedback.	N/A
	DFO Feedback (December 2024)	• There are active telecom cables in the LaHave Bank PDA.	Project design would need to account for avoidance to existing telecom cable infrastructure.

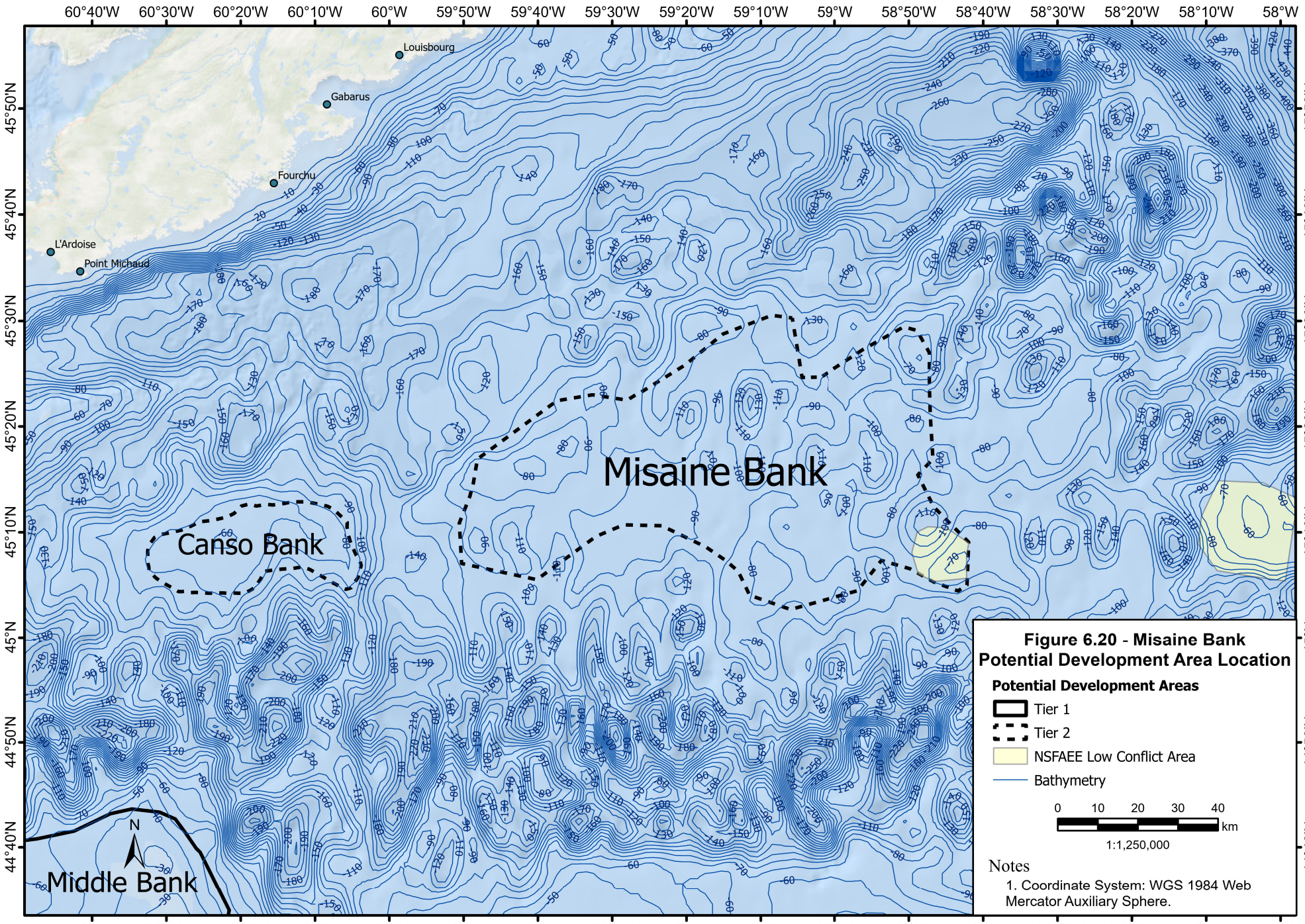
** Some feedback from DFO contained confidential information that cannot be released to the public.*

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). Figures 6.20 and 6.21 show the location of the PDA and key surrounding features. 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. Feedback from the NSFAEE however suggest that the area within the Misaine Bank PDA is heavily fished by a variety of sectors including snow crab and the commercial whelk trap fishing area.

The Misaine Bank PDA overlaps with a DFO Tier 2 marine conservation network site (Canso Bank and Channels), one EBSA (Misaine Bank) and one SiBA for gorgonian corals.


60°40'W
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
58°50'W
58°40'W
58°30'W
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.

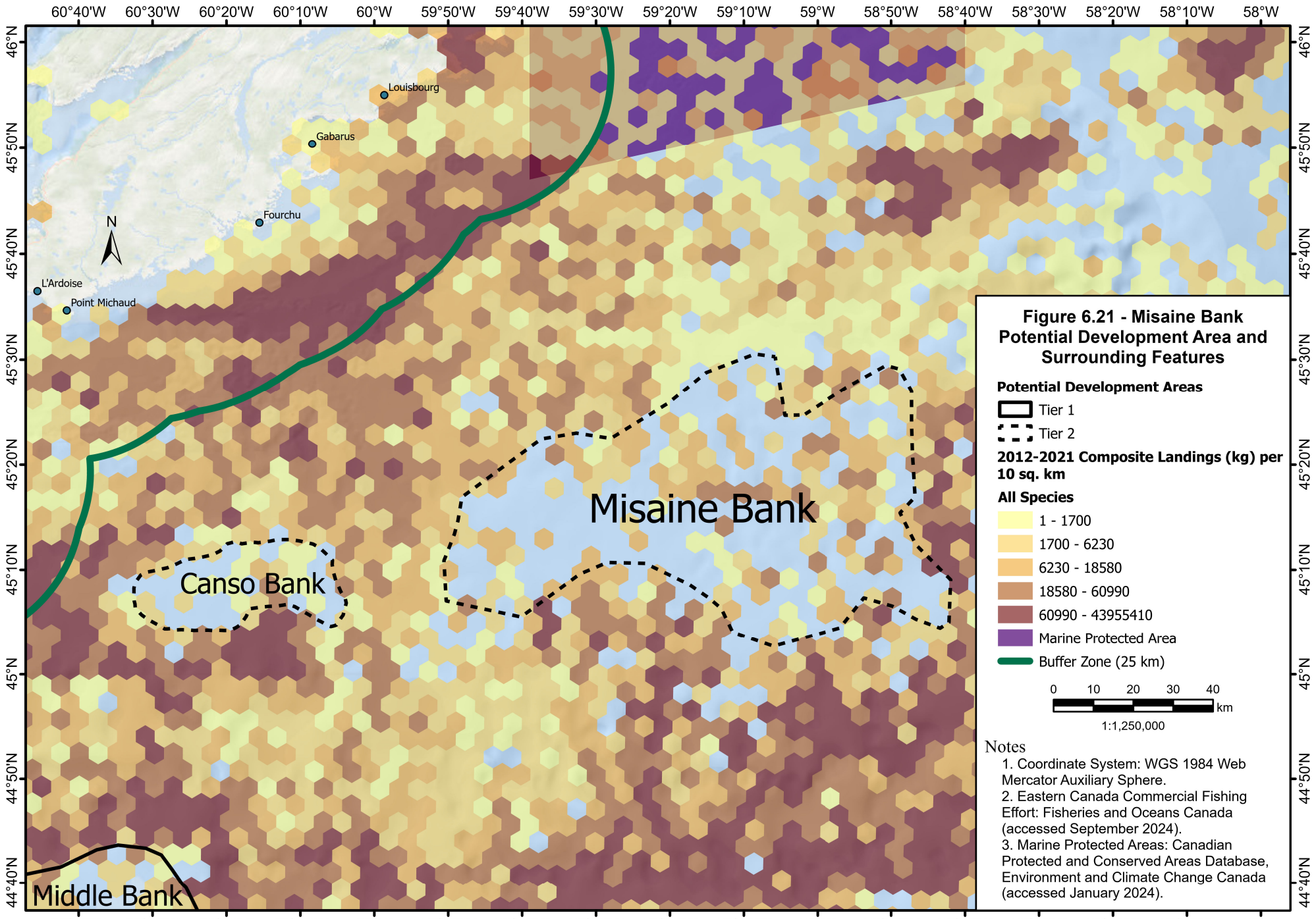

60°40'W
60°30'W
60°20'W
60°10'W
60°W
59°50'W
59°40'W
59°30'W
59°20'W
59°10'W
59°W
58°50'W
58°40'W
58°30'W
58°20'W
58°10'W
58°W
46°N
45°50'N
45°40'N
45°30'N
45°20'N
45°10'N
45°N
44°50'N
44°40'N
Louisbourg
Gabarus
Fourchu
L'Ardoise
Point Michaud
N
Misaine Bank
Canso Bank
Middle Bank
Figure 6.21 - Misaine Bank Potential Development Area and Surrounding Features
Potential Development Areas
Tier 1
Tier 2
2012-2021 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).

Table 6.10. Misaine Bank PDA Suitability Summary Table

Category	Engagement Feedback		Considerations
	Source	**Comment**	
Ecological Sensitivity	DFO Feedback (July/Aug 2024)	**Species at Risk Habitat and Presence** The PDA overlaps with: • SAR species with distribution that overlaps with this area: North Atlantic right whale.	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 Feedback (January 2025)	• PDA overlaps with a Tier 2 marine conservation network site (Canso Bank and Channels), one EBSA (Misaine Bank) and one SiBA for gorgonian corals.	
	ECCC Feedback (December 2024)	• There is high density of Atlantic puffin, black-legged kittiwake, and dovekie in the fall; black-legged kittiwake, common murre, gulls, herring gull, murres, Northern gannet and razorbill in the spring; black-legged kittiwake and murres in the winter. • Northern gannet forages at disproportionately high densities within the PDA compared to the rest of the RA Study Area. • There is high displacement vulnerability across all seasons, and high collision vulnerability, particularly in spring and summer, with moderate-high to high collision vulnerability in the winter. • There is overlap with high use areas of tracked great shearwater in fall and Northern gannet in spring.	
Fisheries and Other Ocean Users	DFO Feedback (July 2024)	• Snow crab is targeted on Misaine Bank within the PDA, and the PDA overlaps with the commercial whelk trap fishing area in 4Vs.	Potential interactions between OSW development and fisheries will need to be determined at project level.
	*DFO Feedback (January 2025)	• The largest overlap with a fishery unit and the PDA is with the crab fishery unit.	

		• Other fisheries unit areas that overlap the PDA include shrimp fixed, halibut, shrimp mobile and halibut fixed.	
	NSFAEE Feedback (December 2024)	• The area within the Misaine PDA is heavily fished by a variety of sectors.	
Physical and Human Use Conditions	Canmet (Kilpatrick *et al.*, 2023)	• PDA is in an area identified by substrate modelling as suitable for "Floating Only" (see the discussion above under section 6.1)	Suitability of substrate will be evaluated by developers to determine appropriate turbine foundation.
	NS CCTH Feedback (July 2024)	No PFDA specific feedback.	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 Feedback (October 2024)	No PFDA specific feedback.	N/A
	DFO Feedback (December 2024)	• There are active telecom cables in the Misaine Bank PDA	Project design would need to account for avoidance to existing telecom cable infrastructure.

** Some feedback from DFO contained confidential information that cannot be released to the public.*

7.0 Cumulative Effects

7.1 Approach, Operating Principles, Work Undertaken and Limitations

7.1.1 Definitions and Approach

The 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 (s.2).

Section 2 of the 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 or may happen in the future. The importance of considering cumulative effects is that the single 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. Cumulative effects assessment (CEA) requires an assessment of OSW activities in combination with other physical activities such as, but not limited to climate change; changes in fishing techniques and gear types; harvesting of different species; pollution; military activities; and changes in the movements of commercial and recreational vessels. The Committee recognizes the IPFs, including climate change, the VCs, the range of activities that occur in the marine environment and the range of potential effects associated with OSW development. The Committee also emphasizes the need for all involved interests to recognize the tiered and shared responsibilities that are associated with the CEA of OSW development.

This RA was instigated to examine how a new industry, OSW development, might best be accommodated in the Study Area. The preceding sections detail the approach taken, the requirements and characteristics of the OSW industry and identify the IPFs and the VCs that are associated with its development. Section 6 identifies PDAs and proposes a 25 km coastal buffer. These recommendations were made to protect the most valued and highly used marine areas and based on existing knowledge, to minimize conflict. That there will be impacts is recognized (section 5); that there are data gaps and much research is still required are also recognized (sections 5, 8 and 9).

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 (Gusatu *et al.,* 2021; Willsteed *et al.,* 2018). It is therefore not only an important part of assessing the effects of OSW development, but a critical factor in planning for OSW (Ferguson *et al.*, 2024). Put simply, it is important to determine what is possible and where responsibility for action resides. In executing this RA, the Committee has identified:

- PDAs, where OSW development, after all regulatory requirements have been met, may be accommodated with minimal adverse impacts to the receiving environment (see section 6);
- IPFs associated with the OSW industry and VCs associated with the RA Study Area (see section 5);
- Mitigation measures and implementation strategies to reduce or offset potential adverse impacts (see section 5);
- Need for monitoring and research to identify and assess the actual impacts of OSW development on the ecosystems and wildlife of the RA Study Area (see sections 5, 9 and 10); and
- Importance of establishing clear policies and requirements for OSW development to ensure that projects are managed effectively and sustainably (see sections 5,9 and 10).

The above, taken together, provide a framework to ensure that all interests including developers, regulators, and the broader community, understand their respective roles in minimizing cumulative effects and fostering responsible OSW development.

7.1.2 Operating Principles

As indicated in section 1, 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 impact 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.

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 where 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). Research and experiences in other jurisdictions indicate that potential consequences of OSW development on the physical, ecological and socio-economic environments have been relatively moderate while the economic benefits have been substantial. Investment in research and technological innovation to address identified challenges continues to develop.

In section 5, the Committee identified the IPFs associated with the development of an OSW project, the important 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 Study Area.*
>
> *This will include consideration of:*
>
> *i) the potential effects of planned physical activities associated with offshore wind development activities in the Study Area;*
> *ii) the potentials effects of possible malfunctions or accidents;*
> *iii) any cumulative effects that may result from the effects of offshore wind developments in the Study Area in combination with other physical activities that have been or will be carried out; and*
> *iv) the result of any interaction between the effects referenced above.*

The TOR identifies the environmental, health, social and economic components that should be considered. The TOR also stressed the importance of engagement. It is an ambitious scope. The Committee considered the scope, weighed what was possible and approached the challenge of CEA as follows:

i) considered approaches to CEA undertaken elsewhere;
ii) examined the requirements and guidance provided by the IAAC with respect to cumulative effects assessment;
iii) prepared an account of the physical, ecological and socio-economic conditions in the RA Study Area;
iv) undertook extensive engagement with people with special interests, including Indigenous interests, across NS and in PEI and NB;
v) took into consideration the expertise and research undertaken by DFO, ECCC and TC with respect to OSW project impact assessment;
vi) identified the likely effects of OSW development on the receiving waters of the RA Study Area;

vii) 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;
viii) developed offshore development scenarios;
ix) 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
x) identified data gaps, made recommendations pertinent to collaborative research and identified other actions required to improve both project level and other CEA processes.

Items i) -iii) and v) - vii) have been or will be discussed in section 7; item iv) is described in section 2; items viii) and ix) are addressed in section 8; and item x) 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. The Committee, however, is cognizant not only of the extensive data gaps that exist at the regional level, but of the gaps that exist with respect to the PDAs. The latter are identified in section 9 and recommendations made in section 10 as to how they might be addressed. It is also recognized that CNSOER has the discretion to identify studies necessary to address data gaps.

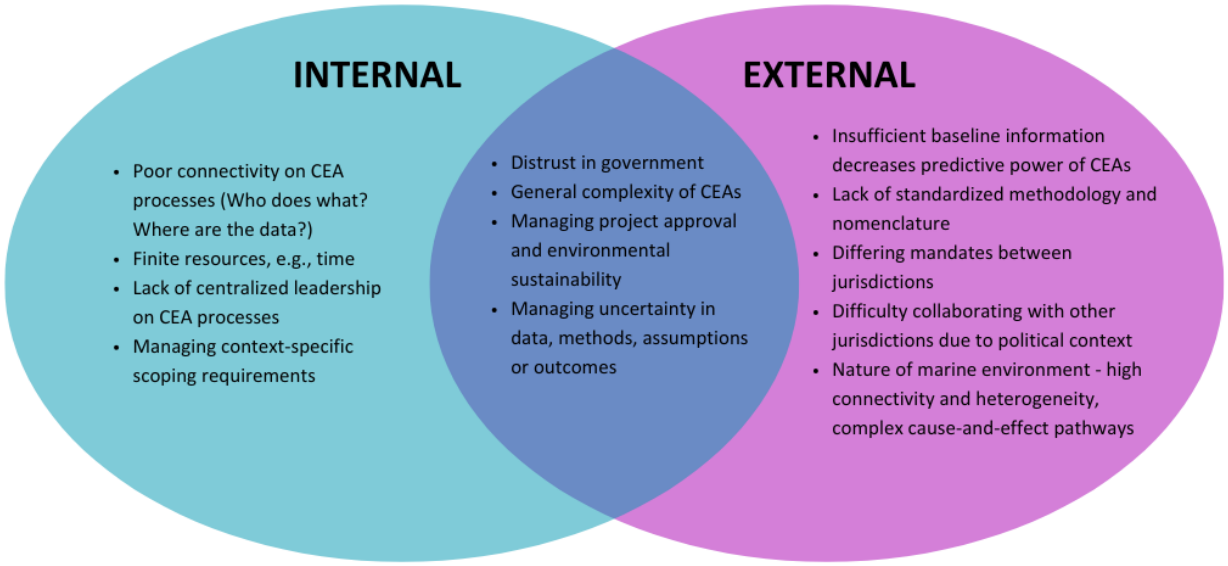
7.1.4 Limitations

One of the primary challenges of CEA, particularly at the regional scale, is identifying and accounting for complex interactions between various stressors in space and over time and how the stressors interact with identified VCs. To do it well necessitates time and sophisticated resources, including modelling capacity. The Committee's time and resources were limited; the RA Study Area is large, and it was known at the outset that data for much of the area were limited. The TOR were broad and, as indicated above, included an emphasis on engagement. The Committee recognizes that decisions were made that influenced the format of this RA. Engagement across the province and beyond was deemed essential both to the validity of the recommendations that were sought and to ensure that key interests, including Indigenous communities and fishers, had opportunities to learn about OSW and to discuss their concerns and aspirations. The design, planning and execution of the engagement program took time, but its value in how the input received shaped the recommendations was enormous.

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, particularly at the regional level. In part, the approach taken will reflect the regulatory objectives that underpin the RA. For example, a sector-based CEA will adopt a different focus than a species-based CEA (Murray *et al.,* 2020). The

underlying intent of this RA was to identify PDAs that minimized conflict in the marine environment and thereby enabled the federal and provincial governments to advance consideration of OSW development as a means of mitigating climate change. This RA does not purport to be species-based. Where the latter is considered desirable, perhaps in considering OSW development at scale in a single PDA, reference should be made to Ferguson *et al.,* 2024: they provide a comprehensive framework that accommodates information on species and pressures, supported by a review of CEA approaches in regions with advanced OSW industries. Figure 7.1 identifies some of the factors complicating CEA 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 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 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 VC 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 project approval process in Canada under the IAA. 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 RA, however, 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 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 (see section 8). It is evident that the scope far exceeds the capacity of any single province (see 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 whereas 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 CEA 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

the National Ocean and Atmospheric Administration (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
    - Mitigation – 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 CEA to address responsibilities pursuant to specific legislative requirements. The *Fisheries Act,* for example, sets the parameters as to how DFO approaches CEA and ensures that their work is aligned with specific departmental priorities. Section 34.1(1)(d) of that 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 CEA 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 has developed a cohesive and flexible framework for assessing the cumulative effects of OSW development, other human activities and natural processes on wildlife. This framework synthesizes the best available knowledge on the approaches to assessing the cumulative impacts of OSW energy on aerofauna from the US and Europe. The first four sections of the framework serve as a practical guidance resource laying out fundamental steps of a regional, species focused, CEA. These steps address many critical considerations, such as setting baselines, scenario development, uncertainty and the integration of expert knowledge. 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).

TC looks at CEA 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, e.g., Chedabucto Bay and the Strait of Canso, 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 relatively 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 CNSOER and its role in developing Best Practice Guidelines for the OSW industry with reference to international precedents. The latter must 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 Western Emerald Bank Marine Refuge, now encompassed by the Sable Island Bank and Emerald 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, but other fishing techniques have their own adverse consequences on the marine environment that should be considered. 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 engagement 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 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	All of the municipalities in NS contain at least one section of coastline. Currently, Nova Scotian coastal communities are under pressure from a variety of natural

		electricity grids, and construction in general. Coastal construction projects can negatively affect birds, marine mammals, and prey species, while also creating added visual disturbance for nearby communities.	hazards, most commonly coastal erosion, high winds, storm surges/flooding and sea level rise. Coastal locations are also in 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, e.g., 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 from several nations 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. Further engagement with DND as to their use of these areas and the possibility of accommodating OSW development is essential.
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	There are currently no active OSW projects in NS. The provincial government has set the target of issuing 5 GW of OSW leases 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

		the main project area. OSW 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 5 GWs and more (see section 8). The province has decided to focus on building the regulatory framework for OSW energy development in areas jointly managed with the federal government before considering development in "internal waters".
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 both a transmission pipeline and a	There are no current plans to construct an LNG terminal in or adjacent to the RA Study Area. The Bear Head site on the Strait of

		storage facility. They can be situated onshore or offshore, and are associated with increased vessel traffic, noise and risk of chemical discharge.	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 aquaculture 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 NS, 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 NS, 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; the identified PDAs cover an area of 31,200 km^2, representing approximately 10% of the RA Study Area. The PDAs have been identified to minimize conflict with other marine users and valued ecological areas. In doing so, the Committee has aimed to avoid significant cumulative environmental effects from OSW projects on VCs. The Committee does recognize that there are data gaps, and that further field work is required. Each proposed OSW development will be subject to a project impact 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 proximity to each other 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;
- likelihood of direct impacts, such as collision, mortality or injury to marine mammals, sea turtles, birds and bats;
- displacement, disturbance, or loss of habitat for marine mammals and sea turtles;
- displacement, disturbance or loss of foraging area and migratory pathways 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 Mi’kmaw Ecological Knowledge Study (MEKS). The execution of a MEKS 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 MEKS analysis

through other means, including discussions with subject matter experts at KMKNO. The need for MEKS 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 Indigenous activities and historic associations with the RA Study Area, the necessity of extensive engagement with both Indigenous communities and their representative organizations, a MEKS should be undertaken on a WEA basis as opposed to a project basis. The Terms of Reference of the study should be prepared by the CNSOER in conjunction with KMKNO, the Unama'ki Institute of Natural Resources (UINR) and other Indigenous interests and with regard to the MEKS Protocol. The results should be made available by CNSOER to developers with interests in the WEA together with direction on any further engagement necessary to meet IAA requirements including engagement with the KMKNO archaeological team to determine appropriate field programs with respect to the siting of individual turbines and associated infrastructure, especially cabling (see section 10).

7.4.1 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. Such changes occur across provincial and international boundaries and reflect changes in ice coverage in Arctic waters and Greenland as well as climate driven changes in currents in the Atlantic. The sum of these changes could be significant to Canada, the Atlantic provinces and NS. Given the geographic and temporal scale of such changes in the marine environment, 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.

Nationally, 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 federal and provincial objectives with respect to attaining net-zero. This includes the work being undertaken by DFO and referenced above and in section 2.2.4 with respect to Cumulative Impact Mapping and the Marxan with Zones Analysis. This work, and the initiatives of other federal and provincial departments including those responsible for socio-economic modelling, must become better coordinated and those responsible must more fully engage with academia and the users of the waters in the RA Study Area including fishers and Indigenous interests. The underlying imperative is to mitigate climate change thereby meeting the federal and provincial objectives referenced in section 2.1.

Considering the above, the Committee believes that responsibility for the data and research necessary for effective CEA at both the regional and project level 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.

Undertaking this RA ahead of the identification of WEAs and any call for bids has ensured that all stakeholders including Indigenous peoples, fishers, developers 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 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 to be effective the approach must be multi-tiered:

- the work being undertaken by NOAA and the IPCC, for example, are representative 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 level of responsibility is shared in Canada between the federal and provincial governments, and while reference to federal departmental initiatives have been referenced, the Committee encourages greater 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 CNSOER. The developer will take direction and guidance from the CNSOER, 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.

7.4.2 Project Related Cumulative Assessment

Given the tiered reality of cumulative assessment, the following summarizes the primary responsibilities of an OSW developer:

- Discuss the requirements with CNSOER, before beginning the CEA, to:
  - determine sources of pertinent information and current guidance on CEA including what is available from federal and provincial departments;
  - 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 CNSOER Best Practice Guidelines, and determine spatial and temporal boundaries (Willsteed *et al.,* 2018);
  - ensure that the scoping phase of a CEA begins 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).
- Identify stressors, valued components and baseline information:
  - 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 the most sensitive receptors to reduce assessment bulk and focus in on meaningful monitoring data (Willsteed *et al.,* 2018).
- Analysis:
  - 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).
- Identification of mitigation measures:
    - work with the CNSOER 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).
- Design an 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);
    - increase inclusivity during engagement 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).
- 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 impact 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 databases 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 Challenges and Opportunities

8.1 The Challenges

As noted 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 4.5.2), 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 then 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 referenced throughout the balance of this section and is posted to the Registry.

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);
- The available labor force in NS: 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 NS'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 NS 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 22 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 those of NS (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 WEI 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 a NS 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, in a report commissioned for the RA, 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).

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 DMDE 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 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 NS'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 an 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 NS'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 manage a request for expression of interest process, provide seed funding to facilitate robust (Class C)[53] cost estimates for upgrades, determine 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 a 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 also be explored.

8.3 The Benefits Associated with Port Investment

Subject to how quickly the industry evolves and to what scale, it is reasonable to assume that some portion of the estimated $1 billion noted in the DMDE report (DMDE, 2024) needs to be spent. Table 8.2

[53] 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).

below shows the economic impacts of a 4-5 year $1 billion CAD port construction and upgrade program.

Table 8.2. Impact of Harbor Construction and Upgrade at $1 Billion Investment, 2023 Dollars

	Direct	Indirect	Induced	Total
Nominal GDP ($ millions)	$600.02	$103.99	$138.23	$842.24
Labour Income ($ millions)	$458.03	$65.10	$56.32	$579.46
Employment (FTEs)	6,524	1,011	1,127	8,662
Provincial Revenue ($ millions)	$58.6	$8.3	$7.2	$74.1

Source: Table is sourced from Table 3 in 21FSP, 2024, based on an analysis performed by the NS Department of Finance using the provincial Input/Output (I/O) model.

The total contribution to GDP (the spend on goods and services) would be $842 million with total labour impacts of just under $580 million resulting in annual employment of between 1300 and 1600 Full Time Equivalents (FTEs). 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 requirements for the latter undertaking (considered below) 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 Table 8.3 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, based on an analysis performed by the NS Department of Finance using the provincial Input/Output (I/O) model.

While the total economic impacts related to operating/maintenance of the port assets are not insignificant at $7.5 million per year creating over 100 total FTEs, 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 by 21FSP (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 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 section 8.6.4).

8.4 OSW Infrastructure

8.4.1 Capital Costs and Impacts

Development scenarios A, B and C as set out in the DMDE Report (DMDE, 2024) were adopted to estimate capital costs and impacts and are detailed below. Note that alternative scenarios A and B are comprised of 2 phases each notionally representing the provincial 5 GW target. Scenario C is an additional 10GW notionally representing the Peter Nicholson "nation building" approach (Nicholson, 2023) to be constructed on the completion of either scenario A or B.

- **Scenario A1:** a 600 MW project, to be constructed over 5 years and in service for 2032 at Sydney Bight.
- **Scenario A2:** three sequential 1.5 GW projects to be constructed over 15 years on Canso/Middle/Sable Banks.
- **Scenario B1:** a 600 MW phase to be constructed over 5 years an in-service for 2032, located on Eastern Shore/Canso Bank.
- **Scenario B2:** two sequential 2.5 GW projects constructed over 10 years with in-service dates of 2035 located at Middle Bank and Sable Bank and another 2.5 GW phase with an in-service data of 2040 at Middle Bank/Sable Bank.
- **Scenario C3:** a 10 GW phase comprising two 2.5 GW and one 5 GW project constructed over 12 years with an in-service date of 2050, with turbines located at Middle Bank, Sable Bank and Emerald Bank.

In the economic impact tables that follow, the estimated impacts of these scenarios are sometimes presented by numbers 1 through 5; A1=1, A2=2, B1=3, B2=4 and C3=5.

Determining order of magnitude cost estimates for the development scenarios is a complex exercise requiring consideration of many, many variables. For the purpose of this report, a benchmarking approach was adopted that examined the projected costs of delivering OSW projects in other jurisdictions. The methodology used is described in the 21FSP report:

- an evaluation of benchmarked costs from other jurisdictions produced an estimated $7 billion CAD capital cost per GW for NS;[54]
- the $7 billion was allocated into expenditure categories for each development scenario (Table 5);
- the cost per expenditure category was further broken down and allocated in accordance with the North American Industry Classification System (NAICS) (Table 6); and
- the expenditure per NAICS category was then adjusted for NS based on an assumed average overall local capture of 8% (modified within categories as required based on assessed local supply chain capacity) and run through the provincial IO model. The summary results are presented below in Table 8.4.

[54] 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, or the costs of constructing grid infrastructure beyond provincial borders to facilitate the export of power such as the Atlantic Loop or a subsea connection to New England.

Table 8.4. Impact of Offshore Windfarm Capital Expenditure on Average Per Year, 2023 Dollars

	Direct	Indirect	Induced	Total
Scenario A1				
Nominal GDP ($ millions)	$34.14	$7.27	$16.38	$57.80
Labour Income ($ millions)	$24.04	$4.72	$8.44	$37.20
Employment (FTEs)	347	77	151	576
Prov Revenue ($ millions)	$2.99	$2.56	$0.52	$6.06
Scenario A2				
Nominal GDP ($ millions)	$123.62	$26.46	$59.00	$209.08
Labour Income ($ millions)	$86.73	$17.14	$30.39	$134.25
Employment (FTEs)	1,257	280	545	2,083
Prov Revenue ($ millions)	$10.77	$9.25	$1.86	$21.88
Scenario B1				
Nominal GDP ($ millions)	$38.15	$8.21	$18.45	$64.82
Labour Income ($ millions)	$26.75	$5.33	$9.50	$41.58
Employment (FTEs)	388	87	170	647
Prov Revenue ($ millions)	$3.32	$2.85	$0.58	$6.75
Scenario B2				
Nominal GDP ($ millions)	$166.84	$36.10	$79.70	$282.65
Labour Income ($ millions)	$116.65	$23.31	$41.07	$181.02
Employment (FTEs)	1,697	381	737	2,816
Prov Revenue ($ millions)	$14.48	$12.44	$2.49	$29.41
Scenario C3				
Nominal GDP ($ millions)	$237.41	$50.79	$113.37	$401.57
Labour Income ($ millions)	$166.54	$32.89	$58.39	$257.82
Employment (FTEs)	2,417	538	1,048	4,003
Prov Revenue ($ millions)	$20.68	$17.78	$3.58	$42.03

Source: Table sourced from Table 7 in 21FSP, 2024, based on an analysis performed by the NS Department of Finance using the provincial Input/Output (I/O) model.

The results show direct impact on nominal GDP of between $34 million and $237 million *per year*, including direct labour income of between $24 million and $166.5 million, and up to 2,417 direct FTEs on average per year of construction. The total impact on nominal GDP ranges from $289 million to $4,819 million, including $186 million to $3,094 million in labour income. Total employment over the construction periods ranges from 2,881 FTEs to 48,045 FTEs, depending on the scenario.

21FSP concluded that "even at a fraction of these estimates, the total CAPEX impacts are considerable and, in our view, exceeds the current labour market capacity today in the sectors impacted by these potential investments, particularly in the context of concurrent and competing projects." This point is illustrated by Table 8.5 below, which identifies the requirements for labour per scenario with reference to the existing employment in the industries. Heavy and civil engineering construction as well as

electrical equipment manufacturing require the largest number of workers. Current numbers of FTEs that were reported in 2023 in the select industries is less than the required amount for the project for nearly half of the scenarios.

Table 8.5 Direct FTEs required for CAPEX by industry versus FTEs currently employed in 2023

Scenarios	1	2	3	4	5	FTEs 2023
NAICS 2371 - Utility System Construction BS23C3	205	2,236	244	2,004	3,477	547
NAICS 237 - Heavy and Civil Engineering Construction BS23C5	681	8,041	727	7,504	12,255	1,780
NAICS 3353 - Electrical Equipment Manufacturing	556	5,478	641	4,625	8,533	40
NAICS 3366 - Ship and Boat Building	174	1,620	175	1,276	2,450	2,597
NAICS 4883 - Support Activities for Water Transportation	121	1,494	159	2,297	2,297	3,451

Source: Table sourced from Table 8 in 21FSP, 2024, based on an analysis performed by the NS Department of Finance using the provincial Input/Output (I/O) model.

Based on these results, 21FSP concluded that that a regional and possibly even a national approach would be required to successfully meet supply chain and labour requirements:

> "Successful models for building supply chain and workforce capacity for offshore wind include taking a regional or multi-nation approach to build on multiple jurisdiction's existing strengths and assets. While the province can accrue significant local benefits with targeted investments and policies to build the supply chain benefits in Nova Scotia communities, it is unlikely all requirements can be met within its provincial borders.... However, exploring partnership options with the other Atlantic Canadian provinces and provinces such as Ontario that produce the majority of the nation's raw steel and cement products could be explored while the province builds its critical mass. There could be a case for positioning offshore wind in Nova Scotia as a nation-building project for Canada."

The size of the task for NS is brought into perspective by comparing its 5 GW target with the US target to deploy 30 GW of OSW by 2023; NS's objective is approximately 17% of the US target, with an economy that is less than half of 1% of the US economy, 0.3% of the labour force and 0.2% of the current energy production capacity. A regional or national collaborative approach appears necessary not only from a project execution perspective, but also to identify the pathways to market and the demand for NS OSW that will attract the investment capital to make it happen.

8.5 Offshore Wind Operations Phase

Given the timelines and uncertainties associated with each of the scenarios, and the fact that the first OSW developments will be operational as construction proceeds on subsequent developments, there are challenges associated with determining operating expenditures (OPEX) in an average year. Table 8.6

presents data for each scenario at full operation assuming a capture rate of 20% for the province, but no FTEs are predicted. The capture rate figures, however, would suggest that the provincial labour pool could in theory capture the OPEX FTEs. The qualifier, however, is the fact that OSW operations will be taking place as further construction proceeds, i.e., operational activities will exacerbate what is a very tight labour market and the need for both specialised skills and labour. In addition, the 20% capture rate assumption is intentionally a conservative figure with reasonable expectation that it should increase over time as the industry matured; the incremental labour demand potentially further straining the existing labour pool.

Table 8.6. Anticipated OPEX per Scenario at Full Operation

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
	Stage A1	**A Stage 2**	**Stage B1**	**B Stage 2**	**C**
OPEX at full operation	$52,374,000	$457,650,000	$52,374,000	$541,080,000	$1,017,540
Occurs at year	6	7	8	14	26
20% capture for NS	$10,474,800	$91,530,000	$10,474,800	$108,216,000	$203,508,000

Source: 21FSP, 2024,

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 report (21FSP, 2024). That said, when looking at the projected expenditures on the cost of constructing 1 GW of OSW in NS at circa $7 billion CAD and assuming a local capture rate of 8%, the nominal total impact to GDP over the construction phase for 5 GW of power would be in the range of $2 billion. This does not include some percentage of the estimated $850 million of nominal total impact to GDP for port upgrades (determined by the scale of the port investment) or the estimated circa $100 million of yearly operating costs spent in the province to operate and maintain 5 GW of power over a projected project life span of 25-30 years. Cumulatively, these numbers paint a picture of a generational opportunity that may be unparalleled with anything else on the provincial horizon. At least that is how the province sees it. 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 NS, 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 other provinces 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 OSW 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

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):[55]

- **Tier 1 suppliers:** Companies contracted as primary suppliers for OSW 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 NS's overall benefit's capture

[55] For a further breakdown of the supply chain see the discussion at s.7.8 of the DMDE report (DMDE, 2024).

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 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 individual residents in Canada.[56]

NS certainly has strengths on which to build, summarized in the Nova Scotia Offshore Wind 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'[57] approach is highlighted through multi-jurisdiction comparative analysis as a critical success factor to supply chain development (21FSP, 2024), and in addition to NS's robust university and community college resource the 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 (NRC), MRC and NZA. 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

[56] NS Accord, s.98.7
[57] 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).

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

NS's demographics have been discussed in section 4.5.2. 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). Stated another way, the total labour inputs required for the construction and installation phase for just one GW of OSW energy comprise between one quarter and one third of the total non-residential construction workforce in the province ignoring the competing demand imposed by pending projects such as the Everwind H2 project and the QEII expansion (21FSP, 2024).

There are things that can be done to help redress this skills gap. The opportunities to tap into the considerable resources of NS'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 disabilities in workforce planning for the OSW 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. At higher levels of education, the Nova Scotia Community College (NSCC) is introducing new renewables/OSW programming and with many campuses located in close proximity to ports, e.g., Shelburne, Sydney, Dartmouth etc., could offer hands-on opportunities to students for various stages of the OSW industry.

Furthermore, the general topic of NS'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.[58] 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 participation of the Department of Education and Early Childhood Development and Department of Labour, Skills and Immigration 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

[58] 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

apprenticeship programs and micro-credentialling initiatives can be successfully introduced to increase the size and competence of the available labour 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 inter-provincial transmission infrastructure or sub-sea infrastructure that would connect NS directly to New England 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 NS to develop its OSW 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 NS Independent Energy System Operator 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 NZA 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.). 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 (Nicholson, 2023) 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."[59]

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 communities. The importance Nova Scotians 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

[59] 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.

want, and it is suggested are now prepared for 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. Success cannot be achieved on port upgrades or OSW development activities without at the same time engaging with and supporting the host communities.

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 dynamics 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, engineers, ocean scientists, Indigenous organizations and 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, Indigenous organizations, 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 remains limited and is 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 have limited applicability to the situation on the Scotian Shelf. Accurately assessing impacts to wildlife requires knowledge of species' presence and activity 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 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 initiative proposed in section 10.

9.1.2 Pelagic Habitat

Over 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, as well as the number of different species being studied. 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 versus 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 socio-economic point of view. Unfortunately, publicly available information about the production and harvesting of these species is limited. In the information provided to the 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. The effects of vibrations, noise and temperature alteration in these new habitats, compared to natural habitats, however, is uncertain. Understanding these new relationships will be crucial to the regulatory authorities in their determination of the need and scope of infrastructure removal when an 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 Flying 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 NGOs 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 very 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, remain 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, but systematic visual monitoring effort on the Shelf remains limited. 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. Passive acoustic monitoring (PAM) has been conducted since the early 2010s; however, for this type of surveying the effort has been biased to the continental slope rather than the Shelf where most OSW development would occur.

For the areas where fewer sightings are noted, it cannot be assumed that no marine mammals are present; it may be that there was simply a lower survey effort. The existing data needs to be interpreted with a level of caution, and additional site-specific studies over all seasons and areas of the Shelf, particularly the eastern areas which have drawn the most interest from OSW developers, need to be designed and conducted to gather information.

In addition to visual survey data, continuation of PAM to detect marine mammal vocalizations is also key to addressing data gaps for these species. PAM offers 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. This is particularly important for those species considered at risk, e.g., fin whale, blue whale. Precise information regarding abundance and distribution is needed to ensure that development does not interfere with federal recovery objectives and to inform mitigation techniques and monitoring programs. Van Parijs *et al.* (2021) recommend that a long-term 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), Marine Environmental Observation Prediction and Response Network (MEOPAR) 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.

Current literature suggests that the risk of marine life becoming directly entangled with a floating OSW cable system (primary entanglement) is low because mooring lines and cables have a large diameter and are sufficiently heavy that looping and entangling marine life is less likely (SEER, 2022). However, due to the high diversity of marine mammals in NS compared to other jurisdictions with OSW, the risk of entanglement cannot be fully understood; this remains a data gap to be addressed.

Disinformation is rife as indicated by claims of mortality of whales in New England associated with OSW development.[60] This highlights the need for comprehensive and efficient monitoring across the Scotian Shelf, particularly for marine mammals.

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. Also, key considerations are the implications of climate change on OSW resource availability.

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 the Scotian Shelf Collaborative Research Initiative (SSCRI) (see section 10).

9.2 Socio-economic Concerns

9.2.1 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

[60] Axelrod and Thompson, 2024 Whales Are Dying but Not from Offshore Wind | Scientific American; US Department of Energy, 2023 Addressing Misinformation on Offshore Wind Farms and Recent Whale Mortalities | Department of Energy; Drenon, 2024 14 whale deaths along US East Coast remain a mystery

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 (although all fisheries do require logbook data).
- 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 thorough research and 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 4.5.2, 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 any 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 its 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 OSW 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.

Additional health considerations, such as gender-based violence, which has been deemed a public health issue by the World Health Organization, will require project studies be undertaken to identify and acknowledge the linkage between Canadian resource development projects and gender-based violence (section 5.7.4).

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 section 4.5 and section 8). 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 recommend that this be incorporated into the development of a revised version of the provincial Offshore Wind 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 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 section 4 and section 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 (see section 10).

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 and social services, recreational facilities and other social infrastructure will increase. These issues are discussed in section 4 and section 8 and need to be considered in the development of the 'Community Profiles' being recommended by the Committee (see section 10).

9.3 Effects of Offshore Wind Technology

9.3.1 Turbine Technology

Since the OSW industry began more than 3 decades ago, technology has been constantly changing, especially in terms of the size of turbines. Consequently, relatively little of the ongoing research and monitoring conducted overseas is directly applicable to the challenges facing a Nova Scotian industry. Despite ongoing research and development activities, the OSW industry is still in its infancy in North America, 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 monopile foundations dominate current research due to their dominance in installed capacity worldwide, interest in floating technologies that could be established in deeper waters is growing rapidly. A 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 and movement, and the use of space by other marine users around floating OSW turbines to better understand the risk for entanglement (including secondary 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, schedules and costs (Hong *et al*., 2024).

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). The Ocean Noise Strategy will be important to guide future action, but the strategy itself acknowledges that there are many knowledge gaps surrounding ocean noise in general (DFO, 2024). Research undertaken in Europe on OSW farm noise monitoring, such as Mooney *et al*. (2020) and Svendsen *et al.* (2022), may provide further insight and inform the knowledge gaps that remain.

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 EMF on marine life have either not been studied or have contradictory results. Some species are repelled by EMFs, while others are attracted. Species that use electromagnetic signals to detect prey, or use their lateral line, are likely to respond differently to the same impulse. Some studies, e.g., 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). More information should be forthcoming regarding a study on EMF undertaken for the Maritime Link by EMERA Newfoundland and Labrador.

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).

There are limited studies available that investigate the environmental effects of HVDC substations, none of which study deep water effects, e.g., >60m (NREL, 2024). HVDC substations at OSW farms are often cooled using open-loop systems and the AC to HVDC conversion process creates heat through withdrawing seawater, pumping it through a heat exchanger, and discharging it back to the ocean (NREL, 2024). This process creates a warmed plume of water and has been shown to alter sea turtle movements (NREL, 2024). Closed loop cooling systems would not have the same scale of discharges but would also discharge significant amounts of heat into the ocean and air cooling would discharge heat to the air (CBD, 2024). More research is needed on the scale of heat that would be discharged at these substations and the potential impacts of these temperature changes (CBD, 2024).

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

This section has outlined 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 OSW 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. The Committee has made recommendations for how to start to fill these data gaps in section 10.

10.0 Recommendations

The Committee, based on the work undertaken, the insights gained from the engagement process, including the public comment period, the materials received from federal and provincial government departments and submissions from other interested parties, respectfully makes 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 engagement 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.

Some of the feedback the Committee has received on its recommendations during the public comment period sought clarification on responsibility for follow-up action, precise identification of accountability, timelines and detailed action plans. Given that it is up to the respective governments receiving this report to determine which recommendations will be accepted and/or modified for implementation, the Committee has resisted being overly prescriptive in advancing detailed follow-up measures. The urgency

of implementation has in many cases been specifically identified or is necessarily implied, e.g., creating the Scotian Shelf Collaborative Research Initiative (SSCRI) and filling critical data gaps prior to the construction of the first wind farm, the need for the CNSOER to develop Best Practice Guidelines; and the need for comprehensive delineation of fishing activity and a government initiated MEKS triggered on the identification of a WEA. In some instances, the "lead" agency is obvious or identified. In others, such as the recommendation around the formation of the SSCRI, the Committee has identified the key participants that need to be involved in the work with the first order of business being the creation of a governance structure that will drive the recommended activity including prioritization of the agenda and the sourcing of participation and research funding.

On the anticipated proclaiming into force of the amendments to the Accord Acts legislation, a significant new player enters the OSW arena in the form of the CNSOER. While the CNSOER is directed by government in certain activities and relies on government funding in the execution of its mandate, it has both legislative responsibilities, e.g., to prepare operational guidelines, and discretion to initiate studies and work programs that can be responsive to some of the identified gaps, e.g., with respect to the fisheries and biophysical data.

It is suggested that the government response to the report is the foundational step to if and how the Committee's recommendations will be implemented. While the Committee has resisted being either presumptuous or overly specific on the prioritization or mechanics of implementation, it has attempted to provide enough detail to enable and guide effective implementation should the recommendations and the spirit of the report be adopted and the industry advanced.

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, and contribute to, 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 within the RA Study Area
T1-7	Open discussions with third parties to contribute to and develop a mutually supportive research agenda associated with floating OSW
T1-8	Establish Participant Funding to last at least five years

T1-1 Develop a Scotian Shelf Collaborative Research Initiative

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 Indigenous organizations 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 from public and private sectors for at least five years, accompanied by participant funding for this same period 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, NGOs 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, the DFO Atlantic Zone Monitoring Program, which collects and analyzes biological, chemical and physical oceanographic field data for the Atlantic Region, could be incorporated into the SSCRI to inform and support research priorities. ECCC, CWS, NRCan and other agencies utilize different numerical models to describe and investigate their subjects; these should also be incorporated within the SSCRI's activities.

The 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:

- Establish a governance structure;
- Prioritize research and identify pathways to funding;
- Establish research objectives and timelines that can accommodate the expected timing of OSW development phases;
- 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 (the Fundy Environmental Studies Committee) 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, 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 are also exemplified by local programs such as the Eastern Scotian Shelf Integrated Management (ESSIM), Environmental Studies Research Fund (ESRF), and Net Zero Atlantic (NZA), and international programs such as the United States' Regional Wildlife Science Collaborative for Offshore Wind (RWSC). 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 (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.

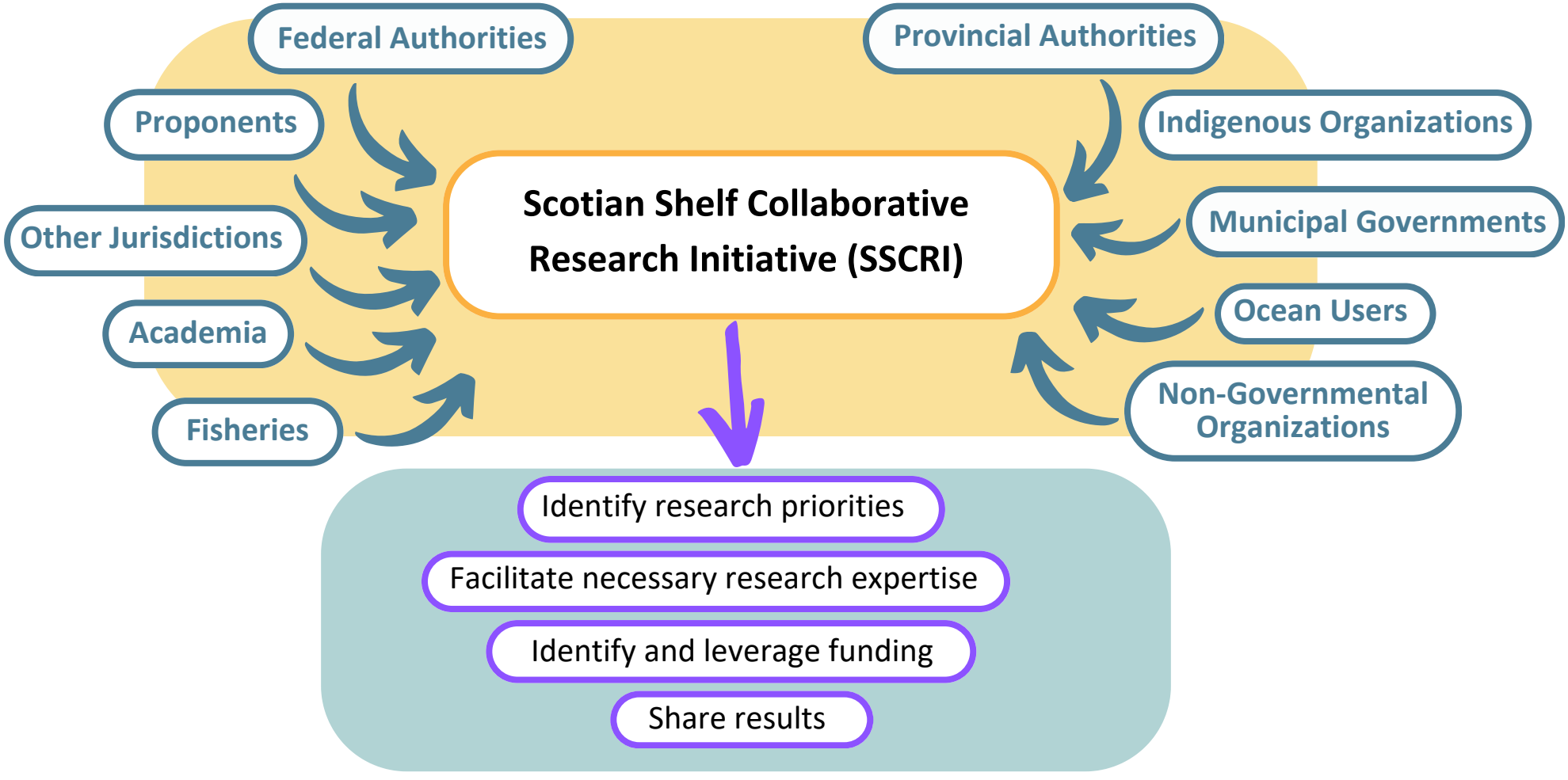


Figure 10.1 Recommended Strategy to Address OSW Environmental Issues

T1-2 Fund *Mi'kmaw Ecological Knowledge Studies (MEKS)*

The *Impact Assessment Act* (IAA) requires consideration of Indigenous knowledge for projects/activities listed under the Physical Activities Regulations (the Project List) of the Act. The experience from offshore oil and gas project development suggests both limited availability of relevant expertise to conduct multiple MEKS and some level of unnecessary duplication of effort occurred. The Committee therefore 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 engagement 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 Atlantic Policy Congress and KMKNO, the Confederacy of Mainland Mi'kmaq (CMM) and Maritime Aboriginal Peoples Council (MAPC).

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.

This data repository should recognize and interact with existing databases, e.g., the Open Data Portal, the Open Science Data Platform, the Nova Scotia Open Data Portal and the Canadian Integrated Ocean Observing System.

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 as the repository of project specific data. The CNSOER should also maintain, through liaison with the SSCRI and others, a record of the research being undertaken. Details of the research underway and the results should be available on open-source data platforms.

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 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 Confederacy of Mainland Mi'kmaq (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, 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 marine species behaviour and habitat use in and adjacent to the PDAs and the development of a multi-year plan to increase the knowledge of different species' behaviour and habitat use in the RA Study Area. The following are representative examples of research topics and are not exhaustive or exclusive.

Bathymetric and substrate characteristics

NRCan in collaboration with NS NRR have initiated work on further defining the bathymetry and substrate characteristics in selected PDAs. This should include further study on the gyres and flows in the area, which are important for fish lifecycle processes. 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 conduct 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 are 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 more than 21 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 Sea, areas accommodating much of the OSW development serving Europe. Yet because of the movement of marine mammals across large distances, the database is fragmented. There is a need to learn more about:

- their seasonal abundance and distribution;
- how different species react to the different technologies associated with OSW development phases, i.e., fixed or floating installations; and
- the effectiveness of applied mitigation measures.

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 utilizing 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. Through the RA process, multiple groups have proposed various research priorities that should be considered.

T1-7 Open discussions with third parties to contribute to and develop a mutually supportive research agenda associated with floating OSW

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, for example, by the State of Maine, by Scotland and by others. The State of Maine 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/coexistence 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.

Although the waters of the RA Study Area may have more in common with the Gulf of Maine than with the North Sea, it should be noted that the University of the Highlands and Islands' Environmental Research Institute and the University of Aberdeen have deployed instruments on the site of the proposed Salamander wind farm[61] as part of a multi-year program to assess the potential impact of floating OSW installations on marine ecosystems and to develop a deeper understanding of fish migration patterns. This initiative also provides further opportunity for collaboration.

The underlying objective of this recommendation is to identify research partners and instigate collaborative work that will further the understanding of the complex ecological challenges that exist within the RA Study Area.

T1-8 Establish Participant Funding to last at least five years

The Committee recommends that specific funding be established to enable key participant groups, e.g., fisheries, Indigenous organizations, 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 socio-economic assessment of the challenges and opportunities 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 these 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

[61] Salamander, a proposed floating steppingstone project instigated by Orsted, Simply Blue and Subsea 7, is designed to deliver up to 200MW of power. The site is located 35km off the northeast coast of Scotland to test the supply chain, to de-risk floating wind technologies and to provide opportunities for ecological research. See Scottish Floating Wind Project Completes Metocean Campaign | Offshore Wind

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 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 coexistence between the OSW and fishing industry and compensation to fishers are discussed below in section 10.4. 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.

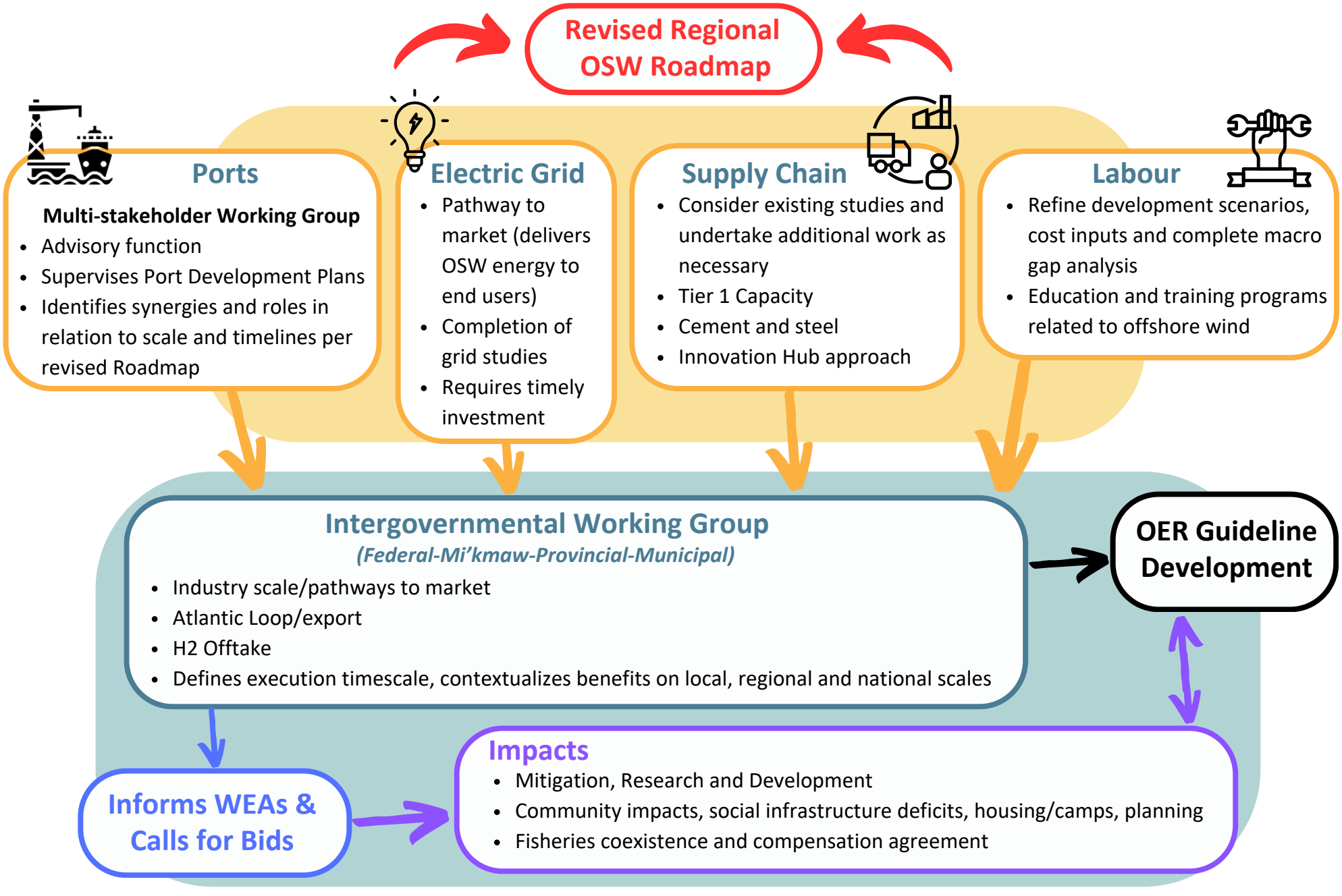


Figure 10.2 Recommendation Scheme for Offshore Wind Energy Development Infrastructure and Governance Requirements

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 Nova Scotia Department of Education and Early Childhood Development and Department of Labour, Skills 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 Plus 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 NS'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 Atlantic Canada 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 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), 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 Nova Scotia Offshore Wind 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 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 NS's hydrogen production aspirations through its MOU with Germany.

The 21FSP 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. 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, including Indigenous communities, most likely to be impacted by pending impact 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 community 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, 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 Nova Scotia Department of Education and Early Childhood Development and Department of Labour, Skills 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" (21FSP, 2024).

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 assess skills gaps, identifying training needs and ensuring that the supports are in place to enable participation in the opportunities presented by OSW development including employment and in the supply chain;
- outline approaches for engaging First Nation and African Nova Scotian businesses, including Mi'kmaw Economic Benefits Office of Nova Scotia, in procurement opportunities; 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 pro-actively attract the required overseas specialists. Attracting foreign specialists to fill gaps in the workforce and to act as advisors in the development of training curricula and programs and as instructors in OSW education and training programs is an option that the Committee feels 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, keeping jobs within the province and supporting the future growth of the industry.

Developing a strategy to address critical labour gaps is not 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, NS's current International Community of Healthcare Workers Engagement Program 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.

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 Plus) issues as part of their regulatory submissions. As emphasized in the work conducted on the topic for the Committee (Fusco *et al.*, 2024), GBA Plus 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 Plus problems fragmented, but there is no single source responsible for its collection.

There is a considerable literature on GBA Plus 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 Plus (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 and proposed action plans for the required regulatory submissions. These data should be publicly accessible.

10.3 Theme 3: Project Development

Section 6 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	Establishment of a 25 km coastal buffer zone
T3-2	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

T3-1 Establishment of a 25 km coastal buffer zone

The nearshore/coastal area of NS 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. As noted in section 1, provincial "internal" waters are excluded from the RA Study Area as these areas are within the exclusive jurisdiction of the province.

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 and migratory routes 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 6.3. 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.

T3-2 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 and other engagement opportunities. 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 summarizes the constraints and considerations influencing the Committee's selection process since the issuance of the Interim Report. Eight PDAs were identified, separated into two categories: 'Tier 1' areas located at Sydney Bight, French Bank, Middle Bank, Sable Bank and Emerald Bank and are recommended for priority WEA consideration; and 'Tier 2' areas 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 coexistence 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 identified criteria and their weighting can change over time. For example, in the early stages of the industry where there are questions related to supply chain capacity and availability of skilled labour (see 21FSP, 2024 and Module 2 of the provincial OSW Roadmap), these can be prioritized. When it becomes apparent which communities may experience adverse cultural or social impacts, Community Benefits Agreements can be prioritized. Module 2 of the Provincial OSW Roadmap notes the utility of "... mechanisms like local benefit plans, community funds, as well as local content requirements."[62]

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 report (2024) 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 NS'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 NS'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:

[62] Provincial OSW Roadmap, Module 2, s.12, p.20.

i. allowing for any initial smaller-scale (step-stone) project targeted for the domestic grid to be nested within a larger overall development framework;
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 and/or Community Benefits Agreements 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 oil and gas 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 operators' 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 and Minas Basin 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.

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 economic loss caused by OSW activities including temporary or permanent loss of access to fishing grounds. The subject has been reviewed in section 2.6 including a discussion of how it is being managed in other jurisdictions. In summary, key points are:

- There is no legal obligation to compensate for economic loss resulting from exclusion or displacement caused by OSW activities in most OSW jurisdictions, including the UK, Germany and the US. This is also the situation in Canada, although s. 98.7 (c) of the Accord Act requires consideration of fishing activities during the submerged land license process.
- In the absence of a legal obligation, various means have been employed by governments and regulators to encourage and enable some form of "voluntary" compensation payable by the development proponents. In some cases, compensation 'Guidelines' have been developed and compensation proposals based on the Guidelines have been solicited from developers in various ways including as part of a bid licensing process. Accepted proposals have become included as conditions to operating authorizations effectively creating an obligation on the developer to pay.
- There are *major* differences in the approaches taken in the various industry Guidelines with reference to fundamental questions that include the types of loss to compensate who is eligible to claim, the "proof" or documentation required to support a claim, and the duration for which any compensation should be paid.

- In Germany, 5% of lease revenues are allocated to protect marine biodiversity and another 5% to support sustainable fishing;[63] BOEM's Guideline[64] encourages payment of direct losses sustained by commercial and recreational fishing interests during the construction phase based on the gross value of lost income, and for a further 5 year "adjustment" period on a declining basis during the operations phase with possibility for extension of that timeframe;[65] the UK FLOWW Best Practice Guidance[66] contemplates "settlements" for "disruption or displacement" of fishing activities resulting from offshore renewable energy installations" where "disruption settlement" is defined as "monetary payment for demonstrable loss of fishery access or economic disadvantage caused *directly* to active fishing vessels by disturbance or displacement" (emphasis added), but also provides for separate Fisheries Community Funds to be established by the developer "to be used for the general betterment of the members of a fisheries community". Extending compensation to community interests in the form of Community Benefits Agreements to recognize indirect or cultural impacts occasioned by OSW projects is a fairly widespread practice that may be separate and apart from fisheries compensation Guidelines (see recommendation T3-3 where 'Community Benefits Agreements' are identified as a possible criterion to be employed in a call for bids).

There are clear and obvious challenges in any attempt to comprehensively address the topic of non-legally required fisheries compensation, as evidenced by the duration of time it has taken for some jurisdictions to develop Guidelines, the conflicting approaches adopted, and perhaps the ongoing criticism levelled at existing approaches. In some of the submissions received on the Draft Report, the Committee was encouraged to go beyond its articulation of the principles on which a compensation framework is to based and to effectively (and unilaterally) write a 'Guideline', i.e., something that would better define compensable losses including clarity around the eligibility of indirect losses, speak more precisely on categories of potential claimants and elaborate on the burden of proof required to support a claim.

The Committee understands the uncertainty created by the pending arrival of the OSW industry and the unknowns that this presents to fishers and the communities in which they live. It is hoped that the recommendations will elevate the conversation and engage the parties that must be involved if some form of consensus is to be achieved on a made in NS approach to OSW fisheries compensation; the relative importance of NS's thriving fishing industry and the communities that it supports compared to

[63] Bonsu *et al.,* 2024. Co-location of fisheries and offshore wind farms: Current practices and enabling conditions in the North Sea. https://www.sciencedirect.com/science/article/pii/S0308597X23004748
[64] BOEM, 2022. Guidelines for Mitigating Impacts to Commercial and Recreational Fisheries on the Outer Continental Shelf Pursuant to 30 CFR Part 585. https://www.boem.gov/sites/default/files/documents/renewable-energy/DRAFT%20Fisheries%20Mitigation%20Guidance%2006232022_0.pdf
[65] Note that where claims have the potential to exceed the duration or capacity of an established fund, there are calls for the establishment of additional "resilience" funds raising questions on the source of funding. https://offshorewindpower.org/fisheries-mitigation-project; Special Offshore Wind Initiative, 2023
[66] FLOWW, 2015. Best Practice Guidance for Offshore Renewables Developments: Recommendations for Fisheries Disruption Settlements and Community Funds. https://www.thecrownestate.co.uk/media/1776/floww-best-practice-guidance-disruption-settlements-and-community-funds.pdf

other jurisdictions have been noted throughout the Report. The fundamental Committee recommendation is the adoption of the principle of compensation for economic loss grounded in, though not necessarily limited to, direct losses to fishers through exclusion and loss of access. The adoption of the recommendation would be an important step in what the Committee hopes will lead to a mutually acceptable understanding between government, OSW proponents and the fishing industry reflected in a Nova Scotia OSW Fisheries Compensation Guideline.

Theme	Recommendations
T4-1	Adoption of the principle of compensating for economic loss
T4-2	Development of a more comprehensive baseline characterization of the fishery
T4-3	Adoption of coexistence as a key objective
T4-4	Development of a Compensation Guideline by the Working Group
T4-5	Establish an industry wide funding model based on equitable distribution of liability among OSW leaseholders
T4-6	Establish participation funding to support fishers in implementing these recommendations

T4-1 Adoption of the principle of compensating for economic loss

The principle of providing compensation for economic loss associated with OSW development in the absence of a legal obligation is increasingly acknowledged and supported in OSW jurisdictions, and it is a principle which the Committee endorses.

T4-2 Development of a more comprehensive baseline characterization of the fishery

Following the identification of any WEA leading to a call for bids, the Working Group that has been established pursuant to the Interim Report Recommendation T3 (Working Group), or its successor, be tasked with completing a comprehensive description of the WEA's fishing activity by gear type and species to augment existing data gaps and provide a more precise baseline understanding.

T4-3 Adoption of coexistence as a key objective

Co-location 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. 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 of general application, such as the required setbacks from monopiles, while others will be project specific informed by project design such as turbine spacing and the nature of transit corridors that may accommodate some types of bottom trawl fishery. The following sub-sections form part of this recommendation and are designed to support its implementation:[67]

[67] Fisheries Mitigation Project. https://offshorewindpower.org/fisheries-mitigation-project

a) Fishers 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 best practices and project specific operating procedures (see (d) below).
b) In keeping with Recommendation T1-7, NS should attempt to become active participants in one or more of the research initiatives taking place or proposed, e.g., the State of Maine's proposed floating turbine demonstration project[68] and Scotland's Salamander OSW Project. The Committee believes that having local academic, regulatory and fishing industry representation integrated into these projects can inform the development of both operating and compensation guidelines.
c) Fishers 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.[69] 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) The Committee sees coexistence as primarily a safety issue and the responsibility of the CNSOER to develop Best Practice advice[70] and project specific operating procedures once field layout is determined. Weather criteria are obvious and important considerations, as is emergency response. The experience gained through (a), (b) and (c) will be relevant.
e) 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. Any incremental cost to fishers should be accounted for in recommendation T4-4.

T4-4. Development of a Compensation Guideline by the Working Group

The Committee recommends that the Working Group be tasked with the development of an industry wide Compensation Guideline governing compensation for economic loss associated with OSW as endorsed in Recommendation T4-1.

Feedback received during the public comment period suggested that this recommendation should be deferred and that the focus for this early stage of the industry be limited to gaining a better understanding of coexistence issues and opportunities. T4-2 and T4-3 support the necessary coexistence work, and the Committee believes that a Compensation Guideline should receive the same level of priority for several reasons. If the experience from other jurisdictions repeats itself in NS, the development of a Compensation Guideline will take time. It is also important for OSW developers to

[68] State of Maine's Floating OSW Research Array. https://www.maine.gov/energy/initiatives/offshorewind/researcharray
[69] 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.
[70] See for reference the discussion in BOEM's 'Guidelines for Mitigating Impacts to Commercial and Recreational Fisheries' (2022), section C Safety Measures.

gain a better understanding of their financial exposure as soon as practicable, and for the fishing industry, and potentially impacted communities, to understand without significant delay how their well-documented concerns are going to be addressed in practice. By virtue of recommendation 3 in the Committee's Interim Report, the work should already be underway. Similarly, s.98(7) of the new Accord Acts requires that due consideration be given to the OSW effects on fishing activities "during the submerged land tenure issuance process", which in the Committee's understanding is expected to commence sometime in 2025 following the issuance of this Report.

To perhaps state the obvious, gaining a reasonable level of consensus on an approach and ultimately a Compensation Guideline will require best efforts and perhaps some level of compromise from all participants. As noted in T4-5, the development of a Compensation Guideline and the funding mechanism may demand a staged approach and will be informed by the understanding gained through the parallel work being undertaken in recommendations T4-2 and T4-3. There is a large body of relevant existing work based on the experience in other jurisdictions to guide the discussion, much of which has been referenced in this Report.

T4-5. Establish an industry wide funding model based on equitable distribution of liability among OSW leaseholders

The Committee recommends that the OSW industry, directly or indirectly, fund the compensation model. Funding can be accessed in several ways including:

- the developer voluntarily and directly entering into an agreement with fishers and/or impacted community interests;
- the developer responding to a compensation requirement specified in a call for bid process which becomes a condition of regulatory approvals; or
- an industry wide compensation fund generated through set-asides from government lease revenues or production royalties to respond to claims in accordance with a Compensation Guideline.

In the Draft Report the Committee articulated a preference for the latter as promoting consistency, transparency and potentially a more equitable distribution of the compensation burden. It was noted however, that this system would be best suited to a mature industry where multiple projects were generating revenue for government through which the compensation fund could be created and maintained. While the Committee's preference has not changed, it is suggested that this funding model be adopted in principle, to be implemented once the industry has established a foothold in NS with operating wind farms producing government revenue. In the meantime, and as the NSFAEE points out, NS is currently without a Compensation Guideline and is unlikely to have one in place in advance of the anticipated 2025 call for bids. This needs to be addressed. One reasonable option would require the developer to act on any approved Compensation Guideline when available and prior to any regulatory approval being granted to construct a windfarm. An alternative would be to specify compensation

requirements as part of the bid criteria that would become conditions associated with regulatory approvals.

Whether the compensation funding results through a call for bids process or through a lease or tariff set aside, the Committee endorses the concept of a 3rd party fund administrator to hold the funds and administer the claims process. The administration process adopted by the New England states may offer an instructive precedent.[71]

T4-6. Establish participation funding to support fishers in implementing the recommendations

The critical success factor in developing the tools, frameworks, operating practices and guidelines that will define a coexistence model and associated compensation framework is that it involves all the parties and likely 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, government support will be required and costs potentially recovered from successful bidders. In other cases, such as the fisheries input into detailed field design, 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 variations 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.

[71] For a discussion on the rationale in support of a centralized claims administration process, see: Request for Information (RFI): Framework for Establishing a Regional Fisheries Compensation Fund Administrator for Potential Impacts to the Fishing Community from Offshore Wind Energy Development, 2023. https://offshorewindpower.org/wp-content/uploads/2022/12/FisheriesCompensationFund_RFI_FINAL.pdf, and https://www.carbontrust.com/news-and-insights/news/the-carbon-trust-and-browngreer-selected-to-lead-the-design-and-development-of-offshore-wind-fisheries-compensation-fund-on-east-coast-of-us

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, government agencies, developers, 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. There is a need to establish a cumulative effects assessment framework for multiple projects within the same potential OSW development area.

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 federal 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 management and regulatory processes to update historic information where necessary, in order to enhance understanding of ecosystem processes and human activities on the Scotian Shelf

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 oil and gas 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. The Committee has been advised that formally reserving a seat for a Mi'kmaq person may require a change to the relevant legislation, and that this would take some time. In the interim, the Committee recommends that best efforts be made to implement this recommendation.

T6-3 Recommend that project specific federal 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 federal impact assessments. This exemption previously occurred as part of the Regulations Respecting Excluded Physical Activities (Newfoundland and Labrador Offshore Exploratory Wells).[72] The Committee believes that OSW development projects should not be exempted from the federal impact assessment process.

The Committee supports Paragraphs 44 and 45 of the Physical Activities Regulations that specifies the following activities as designated projects under the *Impact Assessment Act*:

- Paragraph 44: construction, operation, decommissioning and abandonment in an offshore area or in boundary water of a new wind power generating facility that has 10 or more wind turbines; and,
- Paragraph 45: the expansion in an offshore area or in boundary water of an existing wind power generating facility, if the expansion would result in an increase in production capacity of 50% or more and a total number of wind turbines of 10 or more.

It is recommended that OSW development projects remain in the *Physical Activities Regulations*, at least until key data gaps are addressed and impacts of OSW within the RA Study Area are better understood.

It is hoped that future federal impact assessment for OSW projects 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.

The Committee notes that under subsection 9(1) of the IAA the Minister has discretion to designate a project that is not identified in the *Physical Activities Regulations.*

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 (DFO, 2016). 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, which then sends the data to DFO. The system has been used primarily for regulatory compliance monitoring

[72] Regulations Respecting Excluded Physical Activities (Newfoundland and Labrador Offshore Exploratory Wells) - Canada.ca

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, 2016).

Not all commercial fishing vessels, e.g. lobster and groundfish vessels less than 45 feet, are required to participate in this program as the evaluation of each fishery and its corresponding monitoring requirements is made on a case-by-case basis.

The 1974 Safety of Life at Sea Convention[73] 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.[74]

Each of these systems has limitations and advantages, i.e., reporting frequency, cost of installation and use (Iacarella *et al*., 2020). While acknowledging that there are costs associated to the implementation of this recommendation, 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.

[73] 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

[74] 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

T6-5 DFO to review management and regulatory processes to update historic information where necessary, in order to enhance understanding of ecosystem processes and human activities on the Scotian Shelf

In response to an ever-changing marine environment resulting from global climate change, other activities occurring within the marine environment and a potential new offshore wind industry, considerable efforts are needed among various stakeholders to improve the understanding of potential physical and ecological changes in our waters. The Committee acknowledges that DFO has played a major leadership role in monitoring and understanding the marine environment and has been making good progress with marine spatial planning initiatives in recent years. However, the Committee is of the opinion that a more comprehensive and collaborative approach is needed to successfully plan for future changes, including those associated with a new OSW industry. This will require effective cooperation between DFO and other departments and knowledge holders.

The Committee recommends that the mandate for this work be broadened both intradepartmentally and interdepartmentally across government. For example, we would recommend intradepartmental collaboration within DFO be facilitated to ensure the relevant levels of expertise are available and supported, and that past information be reviewed to assess if that information remains valid. In addition, more complete interdepartmental collaboration is necessary to enhance collaboration and deal with the cognate or overlapping mandates of other departments involving the marine environment. We recommend that collaboration with other government departments be facilitated within a forum that works together towards this common goal. Departments that come to mind include NRCan, ECCC, Parks Canada, DND and Transport Canada.

10.7 Theme 7: Education and Training

Table 10.7. Recommendations: Education and Training

Theme	Recommendations
T7-1	Nova Scotia Department of Education and Early Childhood Development and the Department of Advanced 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 Labour, Skills and Immigration and Department of Advanced 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 Nova Scotia Department of Education and Early Childhood Development and Department of Advanced Education to work with schools, colleges and universities to develop educational and training programs related to OSW and other renewables

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 primary to grade 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 within NSCC which it understands was designed to assist in province-wide program planning to meet the workforce development needs for renewables, including OSW. More broadly, NS universities and colleges should explore potential opportunities for co-op programs and international collaboration. Engagement of the Mi'kmaq of NS in the OSW sector would be enhanced through the development of scholarships, bursaries and apprenticeships targeted at Mi'kmaw communities.

The Committee recommends that in consultation with NZA, COVE, Ulnooweg Education Center, CMM and Mi'kmaw Kina'matnewey, the Province of NS develop and implement a renewables education program (including an OSW/green hydrogen module) in primary to grade 12 schools. The program should be supported by a communications strategy explaining career opportunities and pathways.

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 providing long-term employment and training opportunities in equity-deserving communities and in NS'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 NS could be the catalyst for launching a similar workforce development coalition in NS.

T7-2 Nova Scotia Department of Labour, Skills and Immigration and Department of Advanced Education to develop curriculum for new upskilling, retraining and micro-credential programs for current marine workforce to transition into new roles in support of OSW development

Nova Scotians have long been employed at sea, e.g., in the fishery, in the navy and in the oil and gas 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 recommends 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, prepare such programs and to

develop an outreach program to attract participants. Development of new upskilling, retraining and micro-credential programs for current marine workforce should be made available to communities through local training facilities or offered virtually to enable students to be trained in this industry while residing in their home communities. Upskilling opportunities could include transferable training programs in health, computer science, and others that benefit rural NS communities alongside the development of the OSW industry.

Additionally, the Committee recommends that governments explore and support the establishment of a supplier development program for OSW that focuses on strengthening the capabilities and performance of suppliers by providing targeted support, training, and collaboration. Key components may include capacity building for local suppliers, technical assistance to meet stringent industry standards, and facilitating access to funding or financing options for innovation and scaling. The program could also emphasize improving supply chain resilience through better logistics, quality control, and risk management practices. Collaboration with research institutions, universities, and industry experts to drive technological advancements and sustainability improvements would be crucial. Additionally, fostering long-term relationships between OSW developers and suppliers, alongside promoting knowledge sharing and best practices, could ensure that the entire supply chain is better equipped to meet the growing demands of the OSW industry, while driving local economic growth and job creation.

11.0 Concluding Thoughts

The goals of this RA were: to identify PDAs; to identify and analyze the potential environmental, health, social and economic effects and benefits associated with OSW development activities in the RA Study Area; to make recommendations for mitigation and monitoring; and to inform and improve future planning, licensing and impact assessment processes for a new OSW industry in Atlantic Canada. The intent was to inform activities in a way that helps protect the environment and health, social and economic conditions while also creating opportunities for sustainable economic development.

The Committee's Report has been submitted to the federal and provincial Ministers. It is up to their discretion how to respond. In terms of the next steps in the OSW regulatory process, the Committee expects the following:

- Proclamation of the recently adopted amendments to the Accord Acts (refer to section 1 and section 2) which will formally establish the CNSOER as the energy regulator for OSW.
- Government identification and release of "Wind Energy Areas" (WEAs) for public comment.
- Following finalization of WEAs, a Call for Bids process on specific parcels within one or some of these areas. The provincial government has indicated a desire for this to happen in 2025 - its stated objective is to have 5 GW of licenses awarded by 2030.
- Following acceptance of a project bid and issuing of a Submerged Land Licence through the Call for Bids, a project level federal Impact Assessment (for any project with 10 or more turbines) to address project specific environmental, health, social and economic impacts.
- Prior to commencing, any project related activities would also require the review and authorization of the Canada-Nova Scotia Offshore Energy Regulator.

As previously noted (section 1), provincial "internal waters" were not within the scope of this RA because they are under the exclusive jurisdiction of the province.

The feedback received on the draft Final Report included concerns that PDAs had expanded in size. This does not mean that development will take place throughout each PDA. The provincial goal of 5 GW could, as an example, potentially fit within the Sydney Bight PDA. It is also expected that large areas within each PDA may be unsuitable for development based on geotechnical constraints or because of conflicts with other ocean users. Identifying areas allows for the necessary micro-siting of projects.

The Regional Assessment of Offshore Wind Development in Nova Scotia represents a critical step in attempting to position the province's energy goals within a broader environmental and socio-economic framework. This must be understood in terms of what the Committee has characterized as the greatest impact producing factor of our time, namely climate change. The analysis that has been undertaken considers the immense OSW development potential that exists in the RA Study Area while emphasizing the importance of adhering to principles of adaptive management and the precautionary approach while integrating Indigenous knowledge through Two-Eyed Seeing and consideration of Netukulimk

to strengthen the impact assessment and foster trust and collaboration with First Nations. It is hoped that this assessment provides a robust framework for informed decision-making.

The hallmarks of the approach adopted by the Committee were transparency, inclusive engagement and active listening. It is suggested that this approach, in addition to the written text of the Committee's Report, should be adopted and applied as NS continues to advance its consideration of OSW development. Achieving the potentially transformative economic potential of OSW development and desired climate change mitigation will require a coordinated effort between all levels of government supported by the social license earned through community participation and success.

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.
Accord Acts	The Accord Acts refer to the *Canada-Newfoundland and Labrador Accord Implementation Act* and the *Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act*. These acts were the legal basis for managing oil and gas activity in the offshore areas of Canada. The amended acts are the result of agreements between the federal and provincial governments to develop renewable resources, including offshore wind, in the jointly managed waters of the Atlantic offshore area.
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.
Aerofauna	Aerofauna is the term for animals that live in the aerosphere, which is the area of the atmosphere where birds, bats, and flying insects can be found.
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 HVDC and from HVDC 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 (mollusks) or mobile species (crustaceans 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.

Term	Definition
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.
Canada Marine Planning Atlas	The Atlas is a key component of marine spatial planning in Canada. It is an interactive mapping tool for decision-makers and other end users to access information about ecological processes, bioregion features and human activities in Canada's marine spatial planning areas.
Carbon Payback Period	An estimate of how long it will take a renewable energy project to offset the greenhouse gases emitted during construction (the “carbon cost”) and 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.
Coexistence	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.

Term	Definition
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.
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.
Endangered (COSEWIC)	Species facing imminent extirpation or extinction.
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)	An approach 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.
Exclusion Zone	A designated zone around an offshore wind farm that ensures safety and control over operations near the wind farm.
Feathering	Feathering is a curtailment measure that involves adjusting the turbine blade angle so that they no longer produce force that spins the rotor.
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.
Fixed foundation turbine	A wind turbine that is permanently attached to the seabed.
Floating foundation turbine	A wind turbine that is mounted on a floating structure, or floating offshore wind platform (FOWP), instead of being placed on a fixed foundation on the seabed.

Term	Definition
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.
Full Time Equivalents (FTE)	An FTE is equal to the number of hours a full-time employee works for an organization. The concept is used to count "hours worked" rather than the number of employees to budget, forecast, staff and calculate wages. For example, if an organization considers 40 hours per week as full-time and there are four employees who work 10 hours each per week, the hours for those four employees add up together to make 1 FTE.
Gender-based Analysis Plus (GBA Plus)	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 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.
High Voltage Direct Current (HVDC)	Power supplied from a battery source is HVDC. HVDC is primarily used for transmitting electricity over long distances. Electricity can be changed from AC to HVDC and from HVDC to AC, which allows flexibility for transport and use.

Term	Definition
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.
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 Navigation Zone	A defined area of water where vessels navigate, with regulations in place to control traffic and access.
Marine Protected Area (MPA)	Areas created by government under a variety of legislation, e.g., *Oceans Act, Canada Wildlife Act, Canada National Marine Conservation Act* etc.. MPAs are 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. Similar to protected areas on land, MPAs conserve the natural environment for the long term, protecting not just one single species, but the ecosystem as a whole.
Marine Refuge	Area-based fisheries closures under the federal *Fisheries Act* to protect marine ecosystems and species and to contribute to other ecosystem-based conservation measure criteria and the conservation of biodiversity over the long-term. Marine refuges protect only single species and do not usually prohibit activities such as oil and gas or mineral extraction.

Term	Definition
Marine Renewables Canada (MRC)	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.
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 (MOU)	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.
Mi'kma'ki	The ancestral and unceded territory of the Mi'kmaq.
Mitigation Zone	An area that is monitored before and during the conduct of a work, undertaking, or activity (WUA) to ensure that marine animals are not present. The mitigation zone boundaries vary depending on the WUA, project location, species and other considerations.
Morphologically	Of, relating to, or concerned with form or structure.
MOTUS	The Motus Wildlife Tracking System is an international collaborative research network that uses cooperative automated radio telemetry to track small flying organisms (birds, bats and insects).
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.
Net-Zero Accelerator	An initiative that incentivizes Canadian companies to decarbonize their operations and contribute to meeting Canada's 2030 and 2050 climate goals.

Term	Definition
Net Zero Atlantic (NZA)	NZA is a team of scientists, engineers and program managers who's mission is to lead applied research and contribute to projects that enable the transition of Atlantic Canada's energy system to a carbon-neutral future through collaboration with academia, governments, private sector, Indigenous Peoples and other non-government organizations.
Offshore Renewable Energy Installation (OREI)	A facility that captures ocean-based resources like wind, waves, tides, or thermal energy and converts them into electricity.
Paleontological	A science dealing with the life of past geologic periods as known from fossil remains.
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.
Pelagic VMS	Areas within pelagic longline maps aggregating speed-filtered vessel monitoring system (VMS) track lines as vessel minutes per km^2 on a base-10 log scale using specific temporal data.
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	Lobster fishing area off Cape Breton
Registry (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.
Safety Zone	Safety zones are intended to safeguard the safety of other users of the marine environment and the offshore renewable energy installation itself during the construction, maintenance and decommissioning phases of the installation.
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.

Term	Definition
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.
Special Concern (COSEWIC)	Species which may become threatened or endangered because of a combination of biological characteristics and identified threats.
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.
Threatened (COSEWIC)	Species which are likely to become endangered if nothing is done to reverse the factors leading to their extirpation or extinction.
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/	The geographical area that is visible from one or more viewing points.

Term	Definition
Viewshed	
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 population)	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.

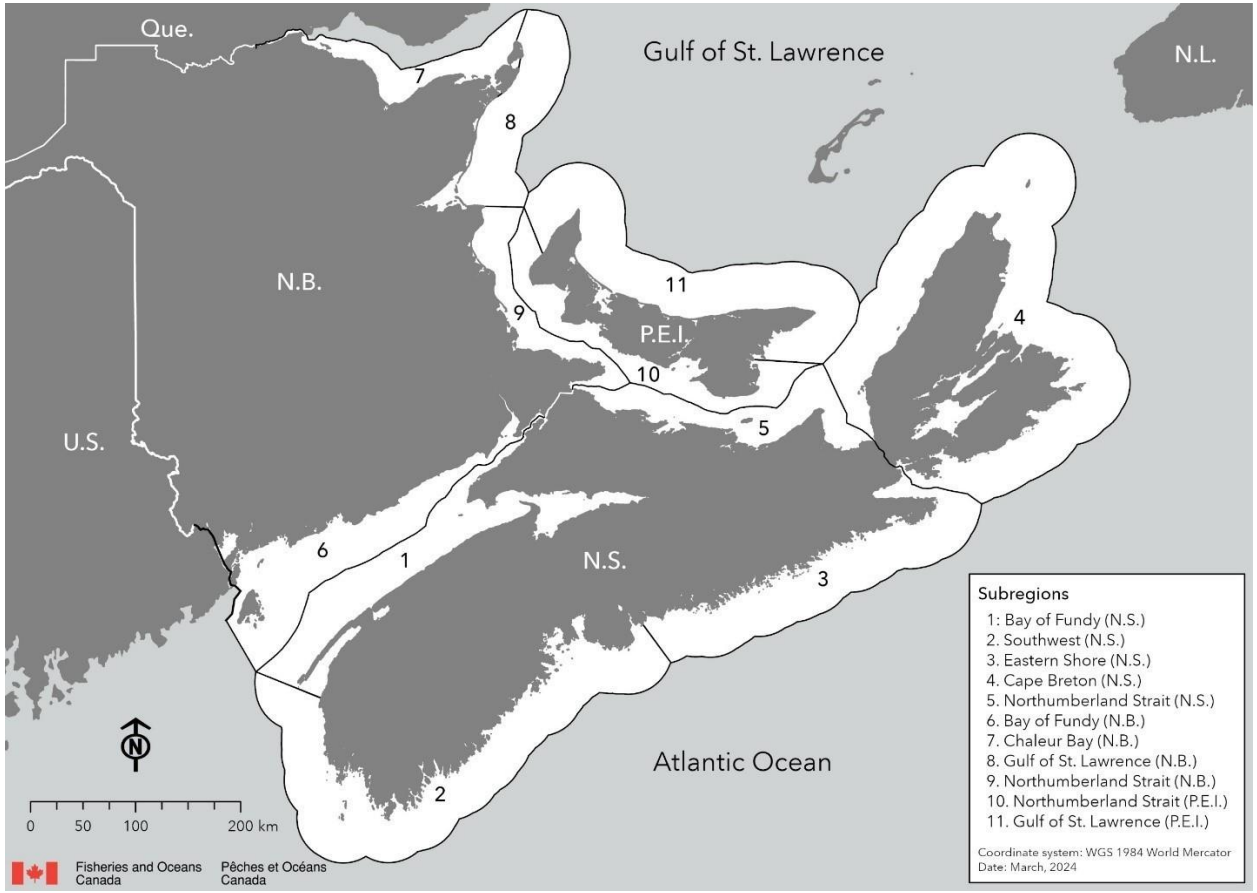
Note: Adapted from “Middle Scotian Shelf and Slope Strategic Environmental Assessment”, Stantec, 2022.
Sources: Beguér-Pon *et al.*, 2015; Bowlby *et al.*, 2022, Campana *et al.*, 2003; COSEWIC, 2006a, 2006b, 2008a, 2009a, 2009b, 2010a, 2010b, 2010c, 2010d, 2011a, 2012a, 2012b, 2012c, 2012d; DFO 2011a, 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[1]	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.* • 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. Anns 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 found only 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. Aerofauna of Special Status Potentially Occurring in the RA Study Area

Taxon	Species – Common Name	SARA Status (Canada, 2023)	COSEWIC Status (Canada, 2023)
Arthropods	Monarch	Endangered	Endangered
Birds	Bank swallow	Threatened	Threatened
Birds	Barn swallow	Threatened (under consideration for status change)	Special Concern
Birds	Barrow's goldeneye (Eastern population)	Special Concern	Special Concern
Birds	Bicknell's thrush	Threatened	Threatened
Birds	Bobolink	Threatened (under consideration for status change)	Special Concern
Birds	Buff-breasted sandpiper	Special Concern	Special Concern
Birds	Canada warbler	Threatened (under consideration for status change)	Special Concern
Birds	Chimney swift	Threatened	Threatened
Birds	Common nighthawk	Special Concern	Special Concern
Birds	Eastern whip-poor-will	Threatened (under consideration for status change)	Special Concern
Birds	Eastern wood-peewee	Special Concern	Special Concern
Birds	Gray-cheeked thrush (*minimus* subspecies)	(under consideration for addition)	Threatened
Birds	Harlequin duck (Eastern population)	Special Concern	Special Concern
Birds	Horned grebe (Magdalen Islands population	Endangered	Non-active
Birds	Hudsonian godwit	(under consideration for addition)	Threatened
Birds	Ivory gull	Endangered	Endangered
Birds	Leach's storm-petrel	(under consideration for addition)	Threatened
Birds	Lesser yellowlegs	(under consideration for addition)	Threatened

Birds	Olive-sided flycatcher	Special Concern	Special Concern
Birds	Piping plover (*melodus* subspecies)	Endangered	Endangered
Birds	Red crossbill (*percna* subspecies)	Threatened	Threatened
Birds	Red knot (*rufa* subspecies)	Endangered	Endangered
Birds	Red-necked phalarope	Special Concern	Special Concern
Birds	Roseate tern	Endangered	Endangered
Birds	Rusty blackbird	Special Concern	Special Concern
Birds	Savannah sparrow (*princeps* subspecies)	Special Concern	Special Concern
Birds	Short-eared owl	Special Concern (under consideration for status change)	Threatened
Birds	Wood thrush	Threatened	Threatened
Mammals	Eastern red bat	(under consideration for addition)	Endangered
Mammals	Hoary bat	(under consideration for addition)	Endangered
Mammals	Little brown bat	Endangered	Endangered
Mammals	Northern Myotis	Endangered	Endangered
Mammals	Silver-haired bat	(under consideration for addition)	Endangered
Mammals	Tricoloured bat	Endangered	Endangered
Sources: ECCC, 2024; Stantec, 2022			

Appendix 4.7. 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 4.7A. 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	• Area has a unique and diverse filter feeding benthic community, e.g., corals, anemones, hydrozoans, area of high fish biomass and species richness, and is Important habitat for white hake (COSEWIC-Threatened), spiny dogfish (COSEWIC-Special Concern), redfish (COSEWIC-Threatened), cusk (COSEWIC-Endangered) and seabirds.
Canadian portion of Georges Bank	• Area of high primary productivity and important spawning and nursery habitats for groundfish, e.g., Atlantic cod, haddock, cusk, Atlantic herring, yellowtail flounder, white skate, and pollock, and foraging habitat for Bluefin tuna, 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	• Area has high densities of large and sensitive gorgonian corals in the region, high primary productivity, high levels of mixing result in the aggregation of large pelagic fish during certain periods of the year, important cusk (COSEWIC-Endangered), redfish larvae, and seabird habitat. Cetaceans may also be in higher abundances in this area.
Browns Bank	• Area of high primary productivity, unique and sensitive benthic community (Rock Garden), important for American lobster, Atlantic cod (COSEWIC-Endangered), haddock, herring, Atlantic wolfish (COSEWIC-Special Concern), winter skate (COSEWIC-Special Concern),as well as scallop. • Area of high fish and invertebrate species diversity and biomass, high larval fish genus richness and important seabird habitat. Area includes partial gyre that encourages physical retention.
Roseway Basin	• Area includes Critical Habitat (SARA) for endangered North Atlantic right whale (SARA-Endangered) and important habitat for other whale species such as blue whales (SARA-Endangered) and fin whales (SARA-Special Concern), and supports high copepod biomass important for groundfish, e.g., redfish nursery (COSEWIC-Threatened), smooth skate (COSEWIC-Special Concern), American plaice (COSEWIC-Threatened), Atlantic cod (COSEWIC-Endangered), Atlantic wolfish (COSEWIC-Special Concern), cusk (COSEWIC-Endangered). • Area of high fish biomass, high fish and invertebrate species diversity, important seabird habitat, moraine feature and pockmarks (possible chemosynthetic communities).
Emerald Basin and the Scotian Gulf	• Area has unique concentrations of Hexactinellid sponge, i.e., Russian hat sponges/*Vazella pourtalesi,* unique temperature and salinity regime, high zooplankton biomass in basin (overwintering area for copepods and euphausiid), important for groundfish, e.g. silver hake, white hake (COSEWIC-Threatened), tuna, swordfish, high

	fish and invertebrate biomass and fish species diversity important for Northern sandlance and shortfin squid, pockmarks in basin (possible chemosynthetic communities), probable feeding area for cetaceans including certain at risk species, e.g., blue whale, important seabird habitat, very low natural disturbance. Possible nursery for immature porbeagles and is a known overwintering and mating area for basking shark (COSEWIC-Special concern).
Emerald-Western-Sable Island Bank Complex	• Area of important habitat for groundfish, e.g. haddock, Atlantic cod (COSEWIC-Endangered) spawning area, winter skate (COSEWIC-Threatened), silver hake, yellowtail flounder as well as Atlantic herring, mackerel, pollock, scallop and invertebrate species. • Additionally, this complex supports Atlantic herring spawning, mackerel and pollock habitat, scallop abundance, and high larval fish abundance and diversity, including commercial and non-commercial invertebrates, high diversity of zooplankton species, important seabird habitat and the Western Gully area is of potential significance to cetaceans. Compared to other parts of the Scotian Shelf, this area provides high fish and invertebrate diversity, richness and abundance in all seasons.
Sable Island Shoals	• Area has unique coastal habitat in the offshore as well as the world's largest breeding colony of grey seals and small population of harbour sealsit is a nursery area with high concentrations of juvenile fish such as haddock, silver hake, Atlantic cod (COSEWIC-Endangered), yellowtail flounder. • Globally Important Bird Area, supports significant breeding populations of terns (common, arctic, and roseate) (SARA-Endangered) and gulls (great black and herring) as well as seabird habitat for plunge diving piscivores, shallow diving piscivores, shallow pursuit generalists.
Eastern Scotian Shelf Canyons	• Area has unique submarine canyon ecosystems (The Gully is largest off eastern North America), which are Critical Habitat (SARA) for Endangered Northern bottlenose whales (SARA-Endangered) and is important habitat for other cetaceans, e.g., blue whale, Sowerby's beaked whale (SARA-Special Concern). • Area has 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 (COSEWIC-Endangered), Atlantic halibut, redfish (COSEWIC-Threatened), smooth skate (COSEWIC-Special Concern), white hake (COSEWIC-Threatened), and seabird habitat.
Middle Bank	• Area is important habitat for groundfish, e.g., Atlantic cod (COSEWIC-Endangered) spawning and nursery area, high larval fish genus richness, high invertebrate species diversity, high small fish species richness, high invertebrate biomass, abundant scallop, American plaice (COSEWIC-Threatened), redfish (COSEWIC-Threatened), silver hake, yellowtail flounder, and witch flounder larvae, and important seabird habitat. Fin whales (SARA-Special concern) and minke whales have been observed in this area due to high primary productivity and seasonal phytoplankton blooms.
Canso Bank and Canso Basin	• Area has high fish species diversity, high larval fish genus richness, high invertebrate species diversity and biomass including commercial species, e.g., northern shrimp, striped pink shrimp, snow crab, toad crab, and several other invertebrates.

	• Area of high primary productivity and is important habitat for groundfish, e.g., American plaice (COSEWIC-Threatened)as well as important seabird habitat. • The bank component of this EBSA has not been subjected to the same level of fishing intensity as other banks in the bioregion.
Misaine Bank	• Area of high fish and invertebrate species diversity and biomass, and is important for commercial invertebrates, e.g., northern shrimp, striped pink shrimp, green sea urchin, several crab species and others, and is important habitat for thorny skate (COSEWIC-Special Concern) and American plaice (COSEWIC-Threatened), as well as northern sandlance, and is an Atlantic cod (COSEWIC-Endangered) spawning area, and provides important seabird habitat, e.g., pursuit diving piscivores. • The bank component of this EBSA has not been subjected to the same level of fishing intensity as other banks in the bioregion.
Eastern Shoal	• Area is unique coastal and marine habitat and significant concentrations of kelp beds and eelgrass important for fish species, e.g., juvenile Atlantic cod (COSEWIC - Endangered), winter skate (COSEWIC-Threatened), American plaice (COSEWIC-Threatened), thorny skate (COSEWIC-Special Concern), and northern sandlance. • Area of high larval fish genus richness, e.g., yellowtail flounder, silver hake, witch flounder, and redfish and is an important seabird habitat.
Stone Fence	• Area is unique and sensitive benthic community, e.g., *Lophelia pertusa* reef.
Laurentian Channel	• Area of high zooplankton biomass and is important overwintering area for Atlantic cod (COSEWIC-Endangered), redfish (COSEWIC-Endangered), white hake (COSEWIC-Threatened), Dover sole, turbot, Greenland shark, plaice, witch flounder and thorny skate (COSEWIC-Special Concern). • Important aggregation area for krill and zooplankton, with high fish species richness and is an important migration corridor for many fish and cetacean species. • Area is an important foraging are for leatherback sea turtles (SARA-Endangered) and mating area for porbeagle shark (COSEWIC-Endangered). • Important habitat for sensitive benthic communities, e.g., sea pen fields, corals and sponges.
St. Anns Bank	• Area of high primary productivity, high larval fish genus richness, and provides important habitat for groundfish, e.g., Atlantic cod (COSEWIC-Endangered), Atlantic wolffish, herring, including high fish and invertebrate species diversity, high small fish species richness. • Area is located on a migratory route for many fish and cetaceans species,is an important foraging area for leatherback sea turtles (SARA-Endangered), and may include porbeagle shark mating area • Area has sensitive benthic communities, e.g., sea pen fields, and provides important habitat for high densities of seabirds, e.g., plunge diving piscivores.

Laurentian Channel Slope, including Fan Cold Seep Communities	• Area has steep topography along shelf break enhancing vertical mixing and results in high primary productivity, high zooplankton biomass. • Area is an important migratory route for cetaceans and large pelagic fishes, e.g., sharks, swordfish and tuna, and for leatherback sea turtle (SARA-Endangered) as important prey for these turtles, e.g., jellyfish and salps, concentrate along the slope. • Habitat for Sowerby's beaked whale (COSEWIC-Special Concern) and seabirds. • Area of high finfish and squid diversity as well as high invertebrate and fish species richness. • Overwintering area for shelf fishes, e.g., halibut and mackerel, and invertebrates, e.g., American lobster. • Important habitat for many invertebrates, e.g., red crab, northern shortfin squid, northern stone crab, American lobster and sea stars. • Important habitat for many demersal fish species, cusk (COSEWIC-Endangered), redfish (COSEWIC-Threatened), white hake (COSEWIC-Threatened), thorny skate (COSEWIC-Special Concern), Atlantic halibut, longfin hake and Atlantic Argentine. • Area has multiple submarine canyons on edges of the shelf along the Scotian Slope. • Area has a high density and diversity of coldwater coral species.
Scotian Slope	• Area of 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
*Note: Browns Bank, Western/Emerald Bank, Sable Island Bank Complex, and Middle Bank have, or have had in the recent past, sufficient productivity for sizeable fisheries and annual science surveys (DFO, 2024). 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, 2023g; 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 4.7B. 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, within the RA Study Area
	T1-7	Open discussions with third parties 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 Nova Scotia Offshore Wind Roadmap
	T2-4	Initiate socio-economic studies for key communities
	T2-5	Engage the Nova Scotia Department of Education and Early Childhood Development, and the Department of Labour, Skills 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 Plus research specific to the OSW industry
Project development	T3-1	Establishment of a 25 km coastal buffer zone
	T3-2	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
Coexistence and compensation	T4-1	Adoption of the principle of compensating for economic loss
	T4-2	Development of a more comprehensive baseline characterization of the fishery

	T4-3	Adoption of coexistence as a key objective
	T4-4	Development of a compensation guideline by the Working Group
	T4-5	Establish an industry wide funding model based on equitable distribution of liability among OSW leaseholders
	T4-6	Establish participation funding to support fishers in implementing these recommendations
Cumulative effects	T5-1	Recognize 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 federal 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 management and regulatory processes to update historic information where necessary, in order to enhance understanding of ecosystem processes and human activities on the Scotian Shelf
Education and training	T7-1	Nova Scotia Department of Education and Early Childhood Development and the Department of Advanced 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 Labour, Skills and Immigration and Department of Advanced 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