APPENDIX O

Fish Habitat Characterization, Mitigation and
Fisheries Act Compliance Overview (Wood 2020)

FINAL

Bay du Nord Development Project
Fish Habitat Characterization, Mitigation and Fisheries Act Compliance Overview

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1.0 INTRODUCTION

This document summarizes the Bay du Nord Development Project as it relates to Fish and Fish Habitat and outlines efforts to date on assessing the fish and fish habitat within the Project footprints (habitat characterization) as well as preliminary considerations on compensation strategies should a *Fisheries Act* Application for Authorization (and offsetting plan) be required.

This report should be viewed as a complementary document to the following documents that provide more detailed characterization, effects/risk assessment for fish and fish habitat:

- Bay du Nord Development Project Environmental Impact Statement (Equinor 2020a)
- Several Coral and Sponge Survey Reports (AFW 2017 a,b, Wood, 2019, 2020, Equinor 2020b)

1.1 Regulatory Context

DFO's Policy for Applying Measures to Offset Adverse Effects on Fish and Fish Habitat Under the *Fisheries Act*' (DFO 2019) states the following:

> *Works, undertakings or activities resulting in the death of fish or the harmful alteration, disruption or destruction of fish habitat are prohibited under the Fisheries Act unless otherwise authorized. Before approving works, undertakings or activities that will result in the death of fish and/or the harmful alteration, disruption or destruction of fish habitat, Fisheries and Oceans Canada (the Department), must consider if there are alternatives that avoid adverse effects on fish and fish habitat. If the adverse effects on fish and fish habitat are unavoidable, the Department must consider if there are measures to mitigate that would reduce or minimize those adverse effects. Finally, if there are any residual effects, then the Department must consider measures to offset or counterbalance the death of fish and the harmful alteration, disruption or destruction of fish habitat.*

This project is currently undergoing an environmental assessment pursuant to the *Canadian Environmental Assessment Act* (CEAA 2012) (Equinor 2020a). The environmental impact statement (EIS) describes the residual effects on fish and fish habitat when project mitigations have been considered. Per the requirements of the Department of Fisheries and Oceans (DFO), pursuant to the provisions of the Fisheries Act, 2019, Equinor Canada will submit a "Request for Review Application" once Project design is finalized. This Request will be submitted prior to the commencement of offshore construction associated with the Project. If, based on Request for Review Application and other supporting documentation, DFO determines that the Project constitutes "harmful alteration, disruption or destruction of fish habitat" as defined by the *Fisheries Act* (2019) and a *Fisheries Act* Authorization is required, a *Fisheries Act* Application for Authorization including a detailed Offsetting Plan will be developed.

1.2 Overview

This document is organized into the following sections:

- Project Description with an emphasis on seafloor footprints (Section 2)
- Existing Habitat Characterization (Section 3)
- Habitat Compensation Strategies (Section 4)
- Monitoring and Consultations (Section 5)

2.0 PROJECT DESCRIPTION

As discussed in detail in Chapter 2 of the EIS (Equinor 2020a), the Project includes the production of oil and gas from the Bay du Nord field (which includes Bay du Nord, Bay de Verde and Bay de Verde East) and the Baccalieu field (collectively the Core BdN Development). The Core BdN Development activities include offshore construction and installation of subsea infrastructure, hook-up and commissioning (HUC), production and maintenance operations, drilling and eventual decommissioning, as well as associated supporting surveys, field work, and supply and servicing activities. There are no land-based activities associated with this Project. In addition to the Core BdN Development, the Project Description also includes Project Area Tiebacks. The location of the proposed Project is illustrated in Figure 2-1. The Project scope includes the following detailed components and activities:

Core Bay du Nord Development:

- Offshore construction, installation and HUC
  - Installation of subsea infrastructure
- Production and maintenance operations
- Drilling activities
- Supply and servicing
  - Offshore supply vessels (OSV)
  - Standby vessels (SBV)
  - Helicopter support
  - Crude oil shipping (including movement, hook-up / disconnect and offloading of crude oil to shuttle tankers within the Project safety zone)
- Supporting surveys
  - Geohazard / wellsite and seabed surveys
  - Geophysical surveys (2D/3D/4D seismic surveys; vertical seismic profiling (VSP))
  - Geotechnical / geological surveys
  - Environmental surveys
  - Remotely-operated vehicle (ROV) / autonomous underwater vehicle (AUV) / video surveys
- Decommissioning

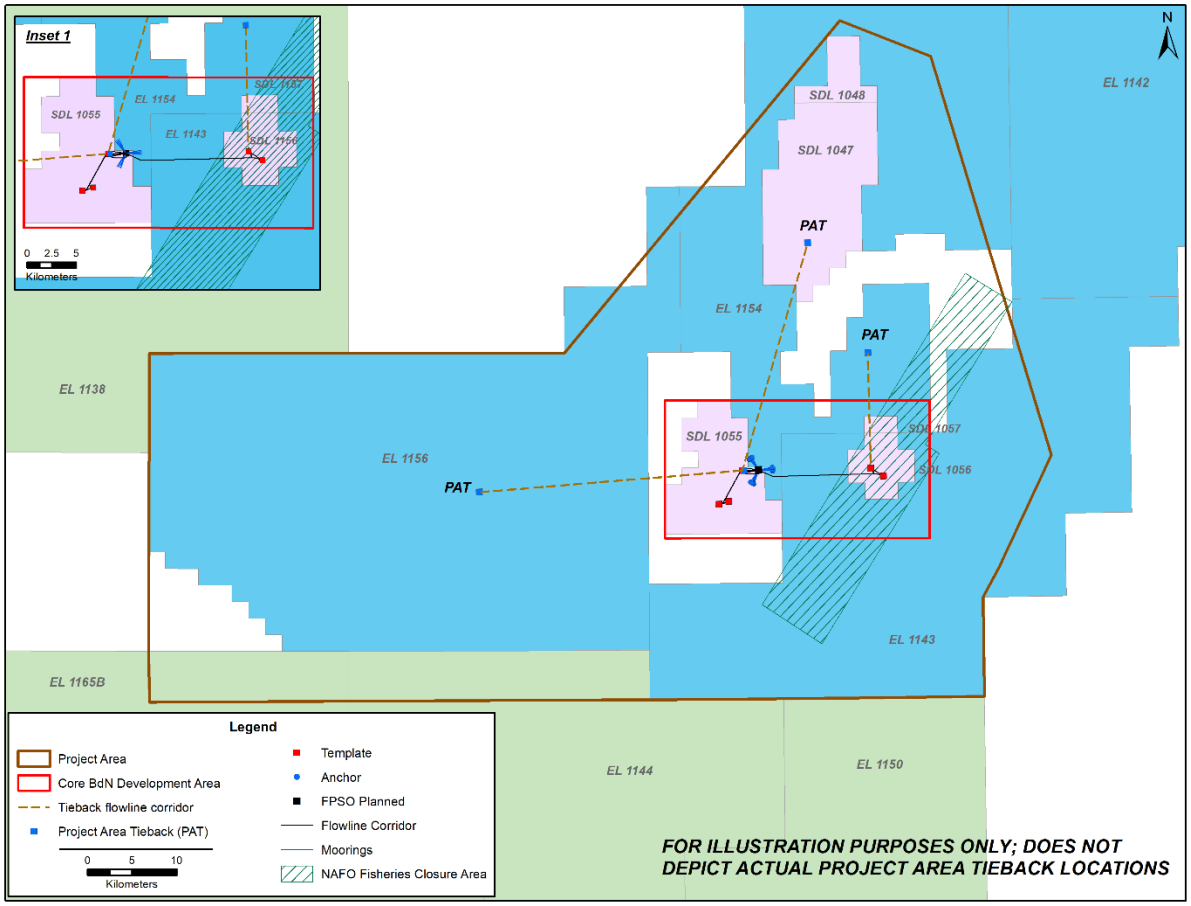

Figure 2-1. Proposed Conceptual Project Layout including Examples of Project Area Tiebacks

2.1 Project Footprint

Chapter 2, specifically Section 2.5.3.2, of the EIS (Equinor 2020a) provides a detailed overview of subsea infrastructure. Summary details are presented here. The proposed development concept is comprised of subsea installations tied back to a floating, production, storage, offloading (FPSO) platform for crude production and offloading to shuttle tankers. Subsea infrastructure will likely consist of the following:

- Well templates with wellhead and wet trees (production, water and gas injection)
- Production and water injection manifolds
- Flowlines (gas injection, production, water injection)
- FPSO / turret moorings
- Riser bases
- Umbilicals

The seafloor layout is illustrated in Figure 2-2 showing the general flowlines (green, red, and blue), FPSO moorings, and drill templates (yellow). In addition, Figure 2-2 shows a schematic of a drilling template. Further details including preliminary dimensions of these various project components are listed in Table 2-1. Flowline corridors are anticipated to be approximately 40 m wide. Overall, it is estimated that subsea infrastructure will occupy approximately 7 km^2 area of the seabed.

Well templates will include all infrastructure and equipment necessary for the safe and efficient operation and control of the subsea wells and transportation of production and injection fluids (subsea system). Due to the water depth in the Core BdN Development Area, there is no plan to use excavated drill centres for iceberg protection, such as those that are used in the shallower Jeanne d'Arc Basin area, to house the subsea well equipment.

Well templates, riser bases, and moorings will be permanently positioned on the seafloor likely via suction pile driving. The suction pile driving concept consists of a large diameter cylinder sealed at the top end and the open end is driven into the seabed by extracting water from the cylinder internals. As the cylinder is driven into the seabed, water, along with disturbed sediment is extracted and deposited on the seabed adjacent cylinder.

The flowline corridors will include a production flowline, a water injection flowline, gas injection flowline and umbilicals. Flowlines, umbilicals, and cables will likely be laid directly on seafloor or laid via trenching. The need for protection of the subsea infrastructure (well templates and flowlines / umbilicals / cables) from dropped objects or other interference will be assessed. Protection measures, if required, for flowlines and/or the fibre optic cable may include rock placement, concrete mattresses, and/or trenching.

As described in the EIS (Chapter 2, Equinor 2020a), components are itemized as Core BdN development and Project Area Tiebacks.

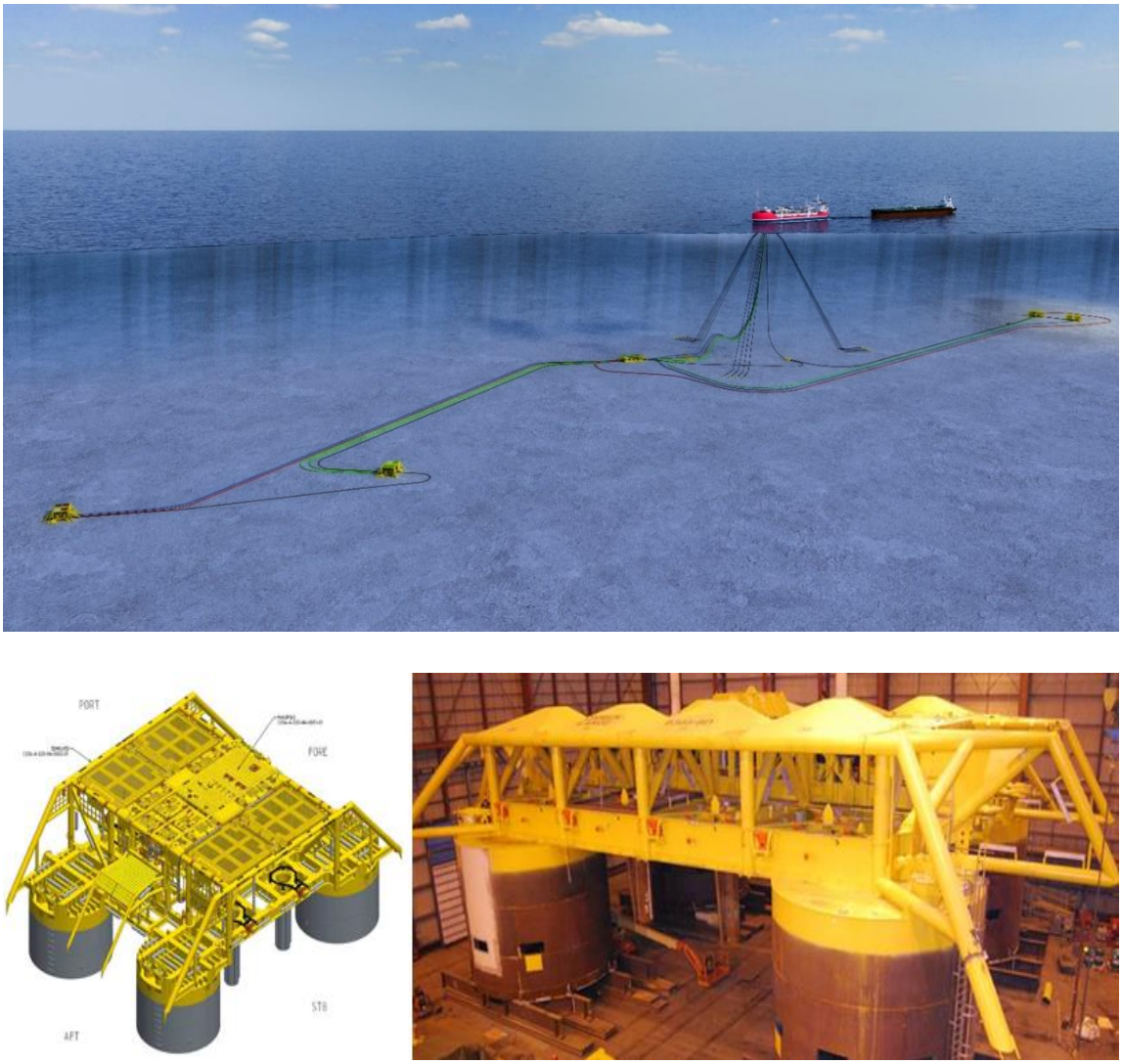

Figure 2-2 Illustration of a Typical Subsea Development - Representative of the Core BdN Development (upper panel) and subsea well template (lower panels)

Table 2-1. Planned Subsea Infrastructure for the BDN Project; actual values will likely be refined once Project design is completed

Name	Description	Dimensions	Core BdN	Project Area Tiebacks
Subsea Well Templates, (combination of 4-slot, 6-slot and 8-slot templates and/or individual satellite wells)	includes all infrastructure and equipment necessary for the safe and efficient operation and control of the subsea wells and transportation of production and injection fluids (subsea system).	A 4-slot template is approximately 24 m (Length) x 21 m (Width) x 17 m. 8-slot template is 48 m (Length) x 21 m (Width) x 17 m (Height).	3 to 10, includes individual satellite wells	1 to 5
Flowlines	production flowline, water injection flowline, gas injection flowline, umbilicals, and cables connected to the riser base.	Each flowline/umbilical will need a corridor of approximately 10 m between each flowline for a total corridor width of approximately 30 - 40 m. Subsea protection measures may be required along flowline corridor Flowline corridors from well templates to riser base	- Length of flowline corridors to be determined - Dimension/ type of subsea protection measures to be determined To be determined	To be determined
FPSO Anchors	suction anchors to secure FPSO positioning	To be determined	12	Not applicable
Riser base	Connects flowlines /umbilicals from well templates to FPSO	To be determined	1-4	Not applicable

2.2 'Enhancing' Marine Subsea Infrastructure

Portions of the submarine infrastructure material, including protection measures, could serve to enhance the benthic habitat in terms of increasing hard substrate abundance and distribution.

The need for protection of the subsea infrastructure (well templates and flowlines / umbilicals / cables) from dropped objects or other interference is being assessed. Protection measures, if required, for flowlines and/or the fibre optic cable may include the following options:

- Rock placement
- Concrete mattresses
- Trenching

Any rock material used in stitch rock placement for protection would diversify the mix of finer substrates in the area, which would likely increase local fish/benthic species diversity. The rock material would act as an artificial reef and improve the overall productive capacity of an area of homogeneous substrate because it offers food and protection, therefore a potential increase in survival for several marine species.

Any rock material used in flowline stitching will have to meet engineering specifications particular to the intended function, but those details are yet to be determined. The number of rock stitches across the flowline is also currently under study, so overall aerial extent, arrangement, and quantity are not yet known. It is also envisioned that if engineering constraints allow, consideration will be given to maximizing biological functionality.

Provided the rock material and the design of the stitching placement is acceptable to DFO, rock stitching of the flowline could mitigate possible habitat losses due to infrastructure placement and subsea disturbance.

Details regarding protection of sea infrastructure will be assessed during final Project design stages. Information, including substrate types, berm dimensions, and lengths, will be incorporated into the *Fisheries Act* Request for Review documentation.

3.0 EXISTING HABITAT

The existing fish habitat in the Project Area in general and proposed Project footprint has been well documented in the EIS (Equinor 2020a); specifically, Chapter 6. In addition, several component studies have been executed using AUVs and ROVs to further characterize the benthic habitat (bullet listed below). Therefore, this report should be viewed as a complementary summary to the following documents that provide a more detailed characterization, effects/risk assessment for fish and fish habitat:

- *Statoil Seabed Survey Video* – Cupids A-33 Survey (AFW 2017a)
- *Preliminary results of the Statoil Seabed Survey Video – Baccalieu Survey* (AFW 2017b)
- *Bay du Nord Development Project Environmental Impact Statement* (Equinor 2020a)
- *Bay du Nord 2018 Seabed Survey Coral and Sponge Survey Report* (Equinor 2020b)
- *EL 1156 Seabed Survey Report* (Wood 2020a)
- *Exploration Licence 1156 Coral and Sponge Characterization.* (Wood 2019)

3.1 General/ Regional

Marine ecosystems comprise biological and physical elements that interact to form complex and variable patterns across a seascape. The physical elements of fish habitats in shallower shelf areas and continental slopes to deep abyssal areas affect the presence, abundance and distribution of marine organisms, resulting in assemblages of species associated with particular habitats. Biological ecosystem elements span primary producers such as phytoplankton to consumers such as zooplankton, invertebrates and fish that have important roles in supporting regional biodiversity and marine productivity.

The Project Area primarily includes the northern part of the Flemish Pass, and portions of the slope regions of the Grand Bank and Flemish Cap. Water depths within the Project Area range from 340 m to 1,200 m with habitats transitioning from relatively shallow slope areas (i.e., mesopelagic zone: 200 to 1,000 m) to deeper bathypelagic zone areas (1,000 m to over 2,000 m).

These habitats are used by fishes and invertebrates of commercial, cultural, and/or ecological value, and support regionally important areas of biodiversity and marine productivity. The abundance and distribution of these fish and invertebrate species are dependent on their linkages with other species across fish habitats and interactions with the physical parameters of the marine environment.

More details and data about the project area in general and an assessment on the environment at it relates specifically to fish and fish habitat in available in Chapter 6.1 (Marine Fish and Fish Habitat – Existing Environment) and Chapter 9 (Effects Assessment on Marine Fish and Fish habitat) of the EIS (Equinor 2020a).

3.2 Habitat Types within Current Project Footprint

Surveys to assess the benthic fish and fish habitat in and around the Project seafloor footprint have been undertaken. Wood was contracted by Equinor to conduct seabed surveys in the BdN Development Area in 2018 primarily within Exploration Licence (EL) 1143, 1154, 1156 (formerly designated EL 1126) and Significant Discovery Licence (SDL) 1055 in the Flemish Pass (Equinor 2020b). The objective of the BdN 2018 Seabed Survey was to characterize coral and sponge presence, density, and distribution in support of potential exploration and/or development activities and project design activities in Flemish Pass.

The seabed was surveyed via an Inspection Class remotely operated vehicle (ROV) and the Fugro EchoSurveyor VI autonomous underwater vehicle (AUV). Surveys were conducted from the *Maersk Detector*. The surveys for the BdN Development Project Area were conducted between September 2nd - September 30th, 2018. ROV surveys were completed at four proposed drill template locations between September 2nd and September 22nd with AUV visual surveys of the proposed FPSO moorings, flowline, and drill template locations within the fisheries closure area conducted between September 29th and September 30th. MBES/SSS data was collected using the AUV, and visual surveys were completed using the AUV and ROV. The area was first surveyed with the AUV to collect MBES / SSS information for informing visual surveys at each drilling template.

The areas that were surveyed in relation to the current Core BdN Project footprints are illustrated in Figure 3-1. The coral and sponge seabed survey spanned an area of 4,862 km^2, collecting approximately 70 hours of ROV video covering 22,312 m of seafloor and 54,000 m of AUV imagery. In addition to documenting macrofauna and seafloor substrate, the reports documented trawl marks, hard targets within 1.5 km of each drill centre based on multi-beam echo-sounder data (MBES), predicted and estimated species presence and abundance on hard targets and photographed low and high densities of coral and sponge functional groups.

Interpretation reports for these surveys have been completed. (see bulleted list above). These reports represent the benthic habitat characterisation component of the *Fisheries Act* process and will be used in assessing the existing habitat in the *Fisheries Act* Request for Review and potential habitat quantification if a *Fisheries Act* Authorization is required.

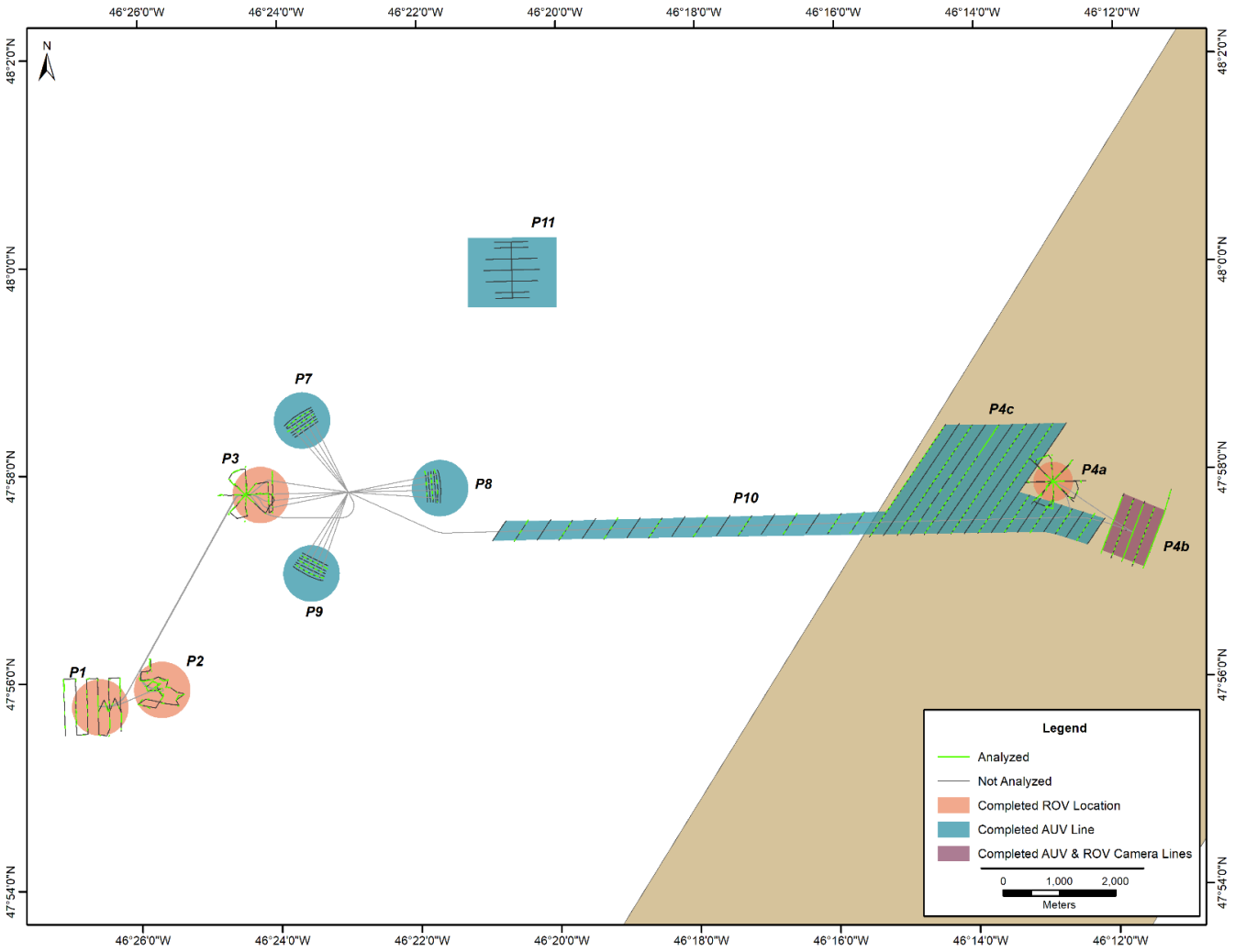

Figure 3-1: ROV/AUV surveys of the Core BdN Project Footprints and Surrounding Areas

3.3 Assessing Substrate Preferences

Equinor has spent considerable effort further defining the associations between substrates (namely boulders greater than 0.2 m) and the corals and sponges that colonize them.

Using multibeam echosounder (MBES) / side-scan sonar (SSS) data, hard targets over 0.2 m were identified throughout the Bay du Nord (BdN) area. As part of Equinor's commitments for the BdN EIS, hard targets within a 1.5 km radius from the center of each drilling template were enumerated and estimates of corals and sponges on these hard targets were estimated. Corals and sponges are typically associated with either hard (medium class or above) or soft (fine or organic class) substrate. While these associations are not universal within the functional groups analyzed, broad preference for either hard or soft substrate can be determined using available literature (e.g., Edinger et al. 2011, Fuller 2011, Beazley et al. 2018, Miles 2018) and observations from ROV and AUV. Soft corals, leaf/vase shaped sponges, round with projection sponges, thin-walled complex sponges, and other (typically encrusting) sponges were all predominantly found living on hard substrates, while sea pens were found living in fine substrate. Densities for each of these functional groups was statistically compared to the largest grain size categories in which they were observed. The goal of this analysis was to test whether these functional groups were found associated with their expected substrate within the BdN area. A randomly selected sub-sample of hard substrate 20 cm or larger had all corals and sponges present counted. An estimate of expected presence of corals and sponges on hard targets not surveyed by ROV was then created within the 1.5 km area around each drill centre.

A total of 179 hard targets across all well sites, flowlines, and anchor points were analyzed (79 from ROV video and 100 from AUV imagery). Overall, corals (mainly soft corals) were present on 98 percent of the hard targets. Of the four coral functional groups (soft corals, branching corals, black corals, hard corals) that can form attachments to hard substrates (Edinger et al. 2011, Miles 2018), only soft corals and black corals were observed. Sponges (mainly solid / massive) were present on 50 percent of hard targets analyzed. Four sponge morphological groups that can inhabit hard substrates (solid / massive, thin-walled complex, round with projections, and leaf / vase shaped) were observed during the analysis (Fuller 2011, Beazley et al. 2018).

4.0 FISHERIES ACT PROCESS

Equinor will submit a *Fisheries Act*, 2019 Request for Review application for the Project once Project design is finalized. Preliminary analysis of existing survey data suggests that corals and sponges are not uncommon in the area and that hard substrates are colonized by a wide array of soft and black corals. If, based on review and consideration of activities, disturbance, and mitigations described within a Request for Review application and other supporting documentation, Fisheries and Oceans Canada determines that the Project constitutes "harmful alteration, disruption or destruction of fish habitat" as defined by the *Fisheries Act* (2019) and a *Fisheries Act* Authorization is required, a *Fisheries Act* Application for Authorization including a detailed Offsetting Plan will be developed in accordance with DFO guidance.

While mitigations proposed for the BdN Development Project may be sufficient to protect fish and fish habitat, the options outlined below are based on DFO's guidance "Policy for Applying Measures to Offset Adverse Effects on Fish and Fish Habitat Under the *Fisheries Act*" (hereafter the Policy) (DFO 2019).

The information below is a list of preliminary information and strategies should a *Fisheries Act* Authorization be required. If an Authorization is required, the options will be further refined based on discussions with Fisheries and Oceans Canada (DFO) and relevant stakeholders. It is also possible that alternative approaches not listed could be integrated into any Final Authorization application (via an Offsetting Plan), if one is required. The options listed below are based on what is available and feasible specific for the type of habitat within the Project Area.

4.1 Hierarchy of Measures

Fish habitat components, their function and attributes, and the fish populations that rely on them (e.g., aquatic ecosystems) are dynamic and complex. It is more difficult, costly and uncertain to restore, enhance, or create, aquatic ecosystems than it is to avoid adverse effects. For this reason, DFO emphasizes measures to avoid and mitigate as the preferred steps in the hierarchy of measures, followed by measures to offset as a means of last resort in the Policy for Applying Measures to Offset Adverse Effects on Fish and Fish Habitat Under the Fisheries Act, December 2019.

The Policy's hierarchies are listed below along with a summary of how they have been considered with this Project. The three levels include:

- Measures to Avoid
- Measures to Mitigate
- Measures to Offset

Note that the BdN Development Project EIS (Equinor 2020a) has further details on the project, avoidance measures, mitigations, and effects assessment for Fish and Fish Habitat (Chapter 6). This information is not reproduced here but rather synthesized to bring forward key avoidance strategies, mitigations, and possible offsetting strategies related to DFO's 'hierarchy of measures.'

4.1.1 Measures to Avoid

'Measures to Avoid' for the conservation and protection of fish habitat is the first and most important step in the hierarchy of measures and therefore have been the major focus of this project to date. There have been a number of measures put in place to avoid and minimize the effects on Fish and Fish Habitat.

Coral Guidance

Equinor has committed to following the C-NLOPB guidance for drilling activities where cold-water corals may be present. The condition prohibits drilling activity within 100 m of a "coral colony", defined either as

- a *Lophelia pertusa* reef complex; or
- Five or more large corals (>30 cm in height or width) within a 100 m^2 area.
- Well templates will not be placed over a *Lophelia pertusa* complex

Discharge locations for water-based cuttings, when cuttings transport system is used, will be determined based on the above CNLOPB requirements for avoiding a "coral colony".

While not a mitigation, upon completion of final subsea layout design, the area occupied by the final layout design will be compared against the layout used in the 2018 survey. Based on the final design, if there are areas where subsea infrastructure will be installed on the seafloor that were not captured by the 2018 survey, these areas will be surveyed to collect coral, sponge and/or sea pens data. The survey methodology and plan will be provided to DFO in advance of survey commencement date for review and acceptance.

4.1.2 Measures to Mitigate

Mitigations have been identified in the EIS to minimize or reduce potential disturbances of fish and fish habitat (Section 9.1.5.2 of the EIS) and are listed in Table 4-1. These are in addition to mitigations put in place and described in detail in Chapter 2 of the EIS (Equinor 2020a), including the following.

Minimizing Effects from Anchors

Equinor has choses to minimize the effects on the seafloor footprint for the Project by the use of Suction Anchors which unlike the conventional anchor type, are not dragged on the seafloor.

Infrastructure Protection

Infrastructure protection is detailed in Section 4.1.3. These components, could be used for offsetting measures should they be required.

Table 4-1 List of Mitigations (reproduced from Section 9.1.5.2 of EIS (Equinor 2020a)).

A. With regards to subsea layout, well templates will not be placed over Lophelia pertusa corals
B. Discharge locations for water-based cuttings, when cuttings transport system is used, will be determined based on the C-NLOPB requirements to avoid Lophelia pertusa complexes and / or assemblages of 5 or more corals in 100 m2 with heights greater than 30 cm within 100 m of the discharge location.
C. Where Project activities may affect fish habitat, and it is determined through DFO's "Request for Review" process pursuant to the *Fisheries Act* that a *Fisheries Act* Authorization is required, a habitat offsetting program will be developed in conjunction with DFO and in consultation with Indigenous Groups and stakeholders as a mitigation measure for the net loss of fish habitat resulting from the Project.
D. Ballast water and hull fouling will be managed in consideration of applicable Canadian and international requirements to reduce the potential spread of invasive species.
E. In consideration of the Offshore Waste Treatment Guidelines (OWTG) (NEB et al. 2010) and regulatory discharge limits, for discharges associated with the Project, the use of best treatment practices that are commercially available and economically feasible will be implemented.
F. The selection and screening of chemicals to be discharged, will be undertaken in consideration of the Offshore Chemical Selection Guidelines for Drilling and Production Activities on Frontier Lands (OCSG) (NEB et al. 2009) and Equinor Canada's chemical selection and screening processes.
G. Marine discharges (e.g., bilge water) will be treated in accordance with MARPOL and Canadian requirements prior to discharge.
H. Sewage and food waste will be treated in consideration of the OWTG and in accordance with Canadian and international regulatory requirements (e.g., IMO).
I. Appropriate procedures will be implemented for the handling, storage, transportation, and onshore disposal of solid and hazardous waste.
J. Use of anti-fouling paint on hull of FPSO
K. In consideration of the Geophysical, Geological, Environmental and Geotechnical Program Guidelines (C-NLOPB 2018), mitigation measures applied during the Project's geophysical surveys where air source arrays are used will be consistent with those outlined in the Statement of Canadian Practice with respect to the Mitigation of Seismic Sound in the Marine Environment (SOCP) (DFO 2007).
L. Lighting on the FPSO will be reduced to the extent that worker safety and safe operations, per regulatory requirements, are not compromised. Lighting reduction options will be evaluated during detail design, and economically and technically feasible options which do not compromise worker safety and safe operations will be implemented. This may include, but not limited to shading, avoiding use of unnecessary lighting, and directional lighting (i.e., towards the deck and not out to sea). Equinor Canada will engage with ECCC on the results of the lighting engineering study(s) undertaken in the front-end engineering and design phase before proceeding to detailed design.

The selection of technical and economic feasible lighting options will be undertaken at detail design, in which Equinor Canada will again engage with ECCC on the selection of lighting options.

M. Low pressure flare gas (e.g., produced water degassing, cargo tank blanket gas) will be recovered, therefore no continuous flaring, which reduces air emissions and light emissions.
N. A decommissioning plan will be submitted to the C-NLOPB for review and acceptance. The plan will be developed in consideration of regulatory requirements in place at the time of decommissioning, engagement with Indigenous groups, commercial fisheries and other stakeholders and likely effects on the environment.
O. Use of explosives will not be employed for removal of wellheads.
P. At the time of decommissioning a well, the well will be inspected in accordance with applicable regulatory requirements
Q. At the time of decommissioning, all surface facilities (e.g., FPSO, turret, anchor lines) will be removed.

4.1.3 Summary of Potential Methods to Offset

Considerable efforts have been made to minimize residual effects of the Project on fish and fish habitat. However, if measures to offset are required, some preliminary considerations include the use of enhanced marine infrastructure and complementary measures related to fish and/or fish habitat research It is also important to note that the dominant habitat type in the region is fine grained sediments (sand and mud); replacement of fine-grained sediments is not a feasible option for an offsetting plan (i.e.. adding additional muds to a fine, silty bottom) so other options are discussed here.

Infrastructure Protection

As detailed above in Section 2.3 of this report, the need for protection of the subsea infrastructure (well templates and flowlines / umbilicals / cables) from dropped objects or other interference will be assessed and may utilize rock placement and concrete mattresses. These engineered structures would mitigate any loss of substrate and/or production caused by placement of subsea infrastructure.

Any rock material used for stitch rock dumping would diversify the mix of finer substrates in the area, which would likely increase local species diversity. Rock material could act as an artificial reef and improve the overall productive capacity of an area of homogeneous substrate because it offers food and protection, therefore a potential increase in survival for several species. Provided the rock material and the design of the stitching placement is acceptable to DFO, additional rock stitching near the flowline could be incorporated into an offsetting plan to further offset disrupted habitat if required. The details on quantity and distribution required to provide adequate offsets would be developed upon receipt of a HADD determination through the Request for Review process.

Complementary Measures (Research and Development)

Equinor Canada, through its participation in such research groups as Petroleum Research Newfoundland and Labrador (PR-NL), Canada Ocean Supercluster, or through its own initiatives will undertake research and development opportunities towards a portion of any offset (up to 10%). Research topics will be considered through engagement with Indigenous groups and key stakeholders and the regulatory agencies.

Alternative Offsetting Options

Offsetting plans are typically based on providing for the replacement of impacted habitat with similar habitat, preferably within the same aquatic system. Marine ecosystems are highly complex and provide many challenges for compensation in offshore Newfoundland and Labrador (Warren and Roberge 2017). Therefore, some potential nearshore options that could also make a meaningful impact to fish and fish habitat and the marine environment in general. For example, an offsetting plan in an area with known concerns related to fish and fish habitat but not within the same aquatic system (i.e. nearshore offsetting for an offshore project). Some of those options could include:

Contributing to the seagrass restoration projects that are ongoing in Placentia Bay

Aquatic invasive species (AIS) can threaten aquatic ecosystems, occupy habitats or out-compete native species, introduce new diseases and alter ecosystem processes (Bax et al. 2001). One possible offsetting option is to further contribute to the ongoing effort to reduce the potential effects of the invasive green crab (*Carcinus maenas*) to eelgrass and eelgrass communities; a species that was first observed in Placentia Bay in 2007 in and has been observed feeding on various fish species in eelgrass habitats (Rossong, 2016). Studies have shown fewer benthic species in mud, sand, and eelgrass sites heavily populated by green crab (Rossong, 2016). Efforts to reduce the green crab population and restore eelgrass beds in Placentia Bay are ongoing by researchers at Marine Institute's Centre for Fisheries Ecosystem Research and funded by the federal government's Coastal Restoration Fund. Several sites have been targeted for restoration of eelgrass beds and rock reef placement including North Harbour, Placentia Sound, Northeast Arm, St. Joseph's, and Baine Harbour. [1] Plans could be made to contribute financially or with other resources to those ongoing efforts.

Creating artificial reefs in nearshore coastal environments similar to what has been done for other offshore oil and gas projects in the past

There are also other methods for habitat offsetting such as creating artificial reefs in coastal environments that have been shown to be successful in Newfoundland in the past in relation to offshore oil and gas projects (Warren and Roberge 2017). Two types of artificial marine reefs have been utilized in Newfoundland and Labrador: scallop shell reefs and multi-species rock reefs. These reefs were developed to offset offshore project area oil and gas footprints on the Grand Banks (Warren and Roberge 2017). Using similar rationale for this Project in the Bay du Nord area, those options could also be explored in further detail if an offsetting plan is required.

[1] https://gazette.mun.ca/research/coastal-restoration/

Recovery of 'ghost' fishing gear to the benefit of the fish and fish habitat as well as local fishers'.

> Another alternate offsetting option is the recovery of 'ghost' nets and abandoned fishing gear. Abandoned, lost, or otherwise discarded fishing gear ('ghost' gear) is a major threat to marine fish (Lively and Good 2019). Ghost fishing occurs when both targeted and non-targeted species become trapped and die due to starvation, predation, cannibalism, disease, or poor water quality (Lively and Good, 2019). Methods have been developed to survey and source ghost gear using high-resolution sonar (Sullivan et al. 2019) and subsequently recover these abandoned fishing gear and prevent further unnecessary losses of fish. Some of these rehabilitation projects have shown to be have several benefits not only to the overall ecosystem but also to the fisheries stakeholders including direct pay, reused gear, and future harvest (Mitchel et al. 2019). This type of undertaking would require extensive consultation with the fishing industry, science (DFO), policy, authorities, NGOs and citizens as the marine litter problem requires expertise from various sectors (Bergman et al. 2015).

Concluding Remarks

The listed strategies provided above are to demonstrate options that may or may not be considered for an offsetting plan, should it be required under the Fisheries Act. Equinor will prepare a *Fisheries Act* Request for Review and consult DFO regarding further requirements under the noted legislation. In addition, measures proposed in a Fisheries Act Authorization application and Offsetting Plan will be subject to consultation with Indigenous Groups and Project stakeholders.

5.0 MONITORING AND CONSULTATIONS

5.1 Monitoring and Consultations

Should an offsetting plan be required, a compensation monitoring program will be developed in consultation with DFO and will be specific to the Offsetting Plan. Equinor will strive to incorporate the 'surveys of convenience' (i.e., 'As-Built' and standard maintenance/inspection surveys of subsea infrastructure using standard offshore equipment such as ROVs and/or AUVs) as a major component of the monitoring regime.

5.2 Consultations

Engagement is a key component of Equinor Canada's approach to the planning and implementation of its oil and gas projects and other business activities. A number of engagement initiatives have been undertaken in relation to the Project, with further engagement in progress or being planned. This includes discussions with relevant government departments and agencies, Indigenous groups and stakeholder organizations.

Chapter 3 of the EIS (Equinor 2020a) describes previous and ongoing engagement initiatives related to the Project. To continue in the vein of open communications on the Project, Equinor is committed to meeting with and/or providing information to stakeholders at the appropriate time to discuss any offsetting plans, should it be required for the Project.

6.0 SUMMARY

This document summarizes the Bay du Nord Development Project as it related to Fish and Fish Habitat, outline efforts to date on assessing the fish and fish habitat within the Project Footprints (habitat characterization) as well as preliminary concepts on Compensation Strategies should a *Fisheries Act* Application for Authorization (and offsetting plan) be required.

Measures to avoid, for the conservation and protection of fish habitat, is the first and most important step in the hierarchy of measures (DFO 2019) and has been a focus of this project to date.

Upon completion of final Project design, a *Fisheries Act*, 2019 Request for Review Application for the Project will be submitted to DFO. Analysis of existing survey data suggests that corals and sponges are not uncommon in the area and that hard substrates are colonized by a wide array of soft and black corals. If, based on review and consideration of activities, disturbance, and mitigations described within a Request for Review application and other supporting documentation, Fisheries and Oceans Canada determines that the Project constitutes "harmful alteration, disruption or destruction of fish habitat" as defined by the *Fisheries Act* (2019) and a *Fisheries Act* Authorization is required, a *Fisheries Act* Application for Authorization including a detailed Offsetting Plan will be developed.

7.0 CLOSURE

This report of the has been prepared for the exclusive use of Equinor. The project was conducted using standard practices by qualified Wood staff and in accordance with verbal and written requests from the client.

Yours sincerely,

Wood Environment & Infrastructure Solutions,
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8.0 REFERENCES

Amec Foster Wheeler. 2017a. Preliminary results of the Statoil Seabed Survey Video – Baccalieu Survey. Report prepared for Statoil Canada Ltd. Project No. TF1654118.

Amec Foster Wheeler. 2017b. Statoil Seabed Survey Video – Cupids A-33 Survey. Report prepared for Statoil Canada Ltd. Project No. TF1654118.

Barrett, N., Seiler, J., Anderson, T., Williams, S., Nichol, S., Hill, N. 2010. Autonomous Underwater Vehicle (AUV) for mapping marine biodiversity in coastal and shelf waters: Implications for Marine Management. OCEANS' 10 IEEE, Sydney, 2010.

Bax, N., J.T. Carlton, A. Matthews-Amos, R.L. Haedrich, F.G. Howarth, J.E. Purcell, A. Reiser, and A. Gray. 2001. The control of biological invasions in the world's oceans. Conservation Biology, 15: 1234-1246.

Beazley, L. I., E. L. Kenchington, F. J. Murillo, and M. Sacau. 2013. Deep-sea sponge grounds enhance diversity and abundance of epibenthic megafauna in the Northwest Atlantic. ICES Journal of Marine Science 70:1471–1490.

Bergmann, M., Gutow, L. and Klages, M. eds., 2015. Marine anthropogenic litter. Springer.

Clarke, M. E., Whitmire, C., Fruh, E., Anderson, J., Taylor, J., Rooney, J., Ferguson, S., Singh, H. 2010. Developing the SeaBED AUV as a tool for conducting routine surveys of fish and their habitat in the Pacific.IEEE/OES Autonomous Underwater Vehicles, Monterey, CA, 2010.

DFO 2019. Policy for Applying Measures to Offset Adverse Effects on Fish and Fish Habitat Under the *Fisheries Act*. 24 pp. December 2019.

DNV (Det Norske Veritas). 2013. Monitoring of Drilling Activities in Areas with Presence of Cold Water Corals. Page 31. Norsk Olje Og Gass.

Edinger, E. N., O. A. Sherwood, D. J. W. Piper, V. E. Wareham, K. D. Baker, K. D. Gilkinson, and D. B. Scott. 2011. Geological features supporting deep-sea coral habitat in Atlantic Canada. Continental Shelf Research 31:S69–S84.

Equinor Canada Limited (Equinor). 2020a. Bay du Nord Development Project Environmental Impact Statement.

Equinor Canada Limited. (Equinor). 2020b. Bay du Nord 2018 Seabed Survey Coral and Sponge Survey Report. Document No. RE-PM539-00030. Draft

Fuller, S. 2011. Diversity of Marine Sponges in the Northwest Atlantic. Graduate Studies Online Theses, Dalhousie University.

Lewis, R., Bose, N., Lewis, S., King, P., Walker, D., Devillers, R., Ridgley, N., Husain, T., Munroe, J., Vardy, A. 2016. MERLIN - A decade of large AUV experience at Memorial University of Newfoundland. IEEE/OES Autonomous Underwater Vehicles (AUV), Tokyo, 2016, pp. 222-229.

Lively, J.A. and Good, T.P., 2019. Ghost Fishing. In World Seas: an Environmental Evaluation (pp. 183-196). Academic Press.

Ludvigsen, M. and Sorensen, A. J. 2016. Towards integrated autonomous underwater operations for ocean mapping and monitoring. Annual Reviews in Control. 42:145-157.

Miles, L. 2018. Cold-water coral distributions and surficial geology on the Flemish Cap, Northwest Newfoundland. Memorial University of Newfoundland, St John's, NL.

Mitchell, J., 2019. The Effects of Ghost Fishing on Crab and Fish Populations.

NEB, CNSOPB, and C-NLOPB. 2010. Offshore Waste Treatment Guidelines. Issued 15 December 2010. Available online at: https://www.neb-one.gc.ca/bts/ctrg/gnthr/ 2010ffshrwstgd/ 2010ffshrwstgd-eng.pdf

Rossong, M. A. 2016. Impacts of newly established non-indigenous green crab (Carcinus maenas) on native fauna in Placentia Bay, Newfoundland. Doctoral Thesis. 225 pp.

Stelfox, M., Hudgins, J. and Sweet, M., 2016. A review of ghost gear entanglement amongst marine mammals, reptiles and elasmobranchs. *Marine pollution bulletin*, *111*(1-2), pp.6-17.

Sullivan, M., Evert, S., Straub, P., Reding, M., Robinson, N., Zimmermann, E. and Ambrose, D., 2019. Identification, recovery, and impact of ghost fishing gear in the Mullica River-Great Bay Estuary (New Jersey, USA): Stakeholder-driven restoration for smaller-scale systems. Marine pollution bulletin, 138, pp.37-48.

Warren, T.N., and Roberge, M.M. 2017. Methods to determine the efficacy of utilizing artificial scallop and rock reefs as fish habitat compensation in inshore Newfoundland. DFO Can. Sci. Advis. Sec. Res. Doc. 2017/047. v + 17 p.

Wood. 2019. Exploration Licence 1156 Coral and Sponge Characterization. Report prepared for Equinor Canada Ltd. Project No. TA1872108.14000. 108 pp.

Wood. 2020. EL 1156 Seabed Survey Report. St John's, NL. Report prepared for Equinor Canada Ltd. Project No. TA1972109.3000. 124 pp.