From:
To: Environment Assessment Web Account; @shiftcreativemarketing.com; @juniperlaw.ca; @eastlink.ca;
Subject: Review of Northern Pulp NS EA Registration Documents
Date: March 8, 2019 3:07:57 PM
Attachments: NPEA_EATechnicalReview_2019.03.08.pdf

Good afternoon ,

On behalf of the Gulf Nova Scotia Fleet Planning Board, and their Fishermen's Working Group for the Northern Pulp Environmental Assessment, it is our pleasure to provide you with the attached technical review of the Northern Pulp Nova Scotia Environmental Assessment Registration Documents for the Replacement Effluent Treatment Facility.

If possible, please provide confirmation of receipt of the attached report.

Regards,

, B.Sc.
Aquatic Ecologist

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Northern Pulp Nova Scotia Environmental Assessment Registration Document Replacement Effluent Treatment Facility

Technical Review of the EA Registration Document

March 8, 2019

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March 8, 2019.

On behalf of the Gulf Nova Scotia Fleet Planning Board, and their Fishermen's Working Group for the Northern Pulp Environmental Assessment, it is our pleasure to provide you with the results of our technical review of the "Northern Pulp Nova Scotia Environmental Assessment Registration Document - Replacement Effluent Treatment Facility," dated January 31, 2019. In our professional opinion, the Project cannot be approved as currently registered. Given the numerous issues, data gaps and information gaps we have identified in the technical review, we recommend that the Minister, as per Section 13 of the Environmental Assessment Regulations made under Section 49 of the Environment Act, determine either that

- the registration information is insufficient to allow the Minister to make a decision and additional information is required (Section 13(1) (a)), or

- a review of the information indicates that there may be adverse effects or significant environmental effects caused by the undertaking and an environmental-assessment report is required (Section 13(1) (d)).

Please do not hesitate to get in touch with us if you have any questions or concerns with the enclosed report.

With best regards,

Project Director
Risk Assessment Specialist, Shared Value Solutions Ltd.

Contents

Executive Summary

The Northern Pulp Nova Scotia (NPNS) proposed Replacement Effluent Treatment Facility (ETF) ("the Project") is regulated under the Government of Nova Scotia's Environmental Assessment Branch and is currently being considered a Class 1 assessment under the Province of Nova Scotia's environmental assessment (EA) process. The proposed ETF for the NPNS pulp mill is an AnoxKaldnes BAS™ process that will be designed to treat maximum wastewater flow of 85 MLD (62 MLD avg) and is based on a combination of traditional activated sludge treatment (AST) process with moving bed bioreactors (MBBR) for wastewater treatment. Following the public review period of the Class 1 EA Registration Documents for the proposed ETF, the Government of Nova Scotia's Minister of the Environment must decide if additional project information or reporting is required, or if the undertaking is approved or rejected.

As part of the public review period, Shared Value Solutions Ltd. (SVS), on behalf of the Gulf Nova Scotia Fleet Planning Board, and their Fishermen's Working Group for the Northern Pulp Environmental Assessment, completed a technical review of the Environmental Assessment (EA) Registration Documents provided by NPNS. The review focused on the technical aspects of the proposed Project design, as well as the validity and comprehensiveness of the environmental effects assessment within the EA. The review yielded a number of issues and concerns related to potential environmental impacts. Where applicable, recommendations for each identified issue or concern, based on the professional opinion of SVS, are provided to the Minister herein.

From a plant design perspective, overall, the new proposed plant design appears to offer a more modern, high rate treatment option than the current wastewater facility design based on aerated stabilization basin (ASB) technology primarily using natural basins and poorly designed "release" (i.e., discharge) into the Northumberland Strait. The proposed design appears to offer increased capability to control operations and optimize treatment performance within a modern wastewater treatment plant than the current infrastructure. Waste solids management and closed loop design for clarifier sludge could be an added benefit of the proposed design. However, several issues and concerns were identified related to the ETF design that must be addressed including whether the EFT will be able to meet more stringent discharge regulations being considered in proposed revision to the *Pulp and Paper Effluent Regulations* (target publication date of 2021).

With respect to effluent modelling, the information provided is considered to be lacking or inadequate. A major limitation of the modelling work (Stantec 2017, 2018) has been the use of water quality data that are old, from different years, from different locations, and from Pictou Harbour instead of Caribou Harbour and the CH-B location. In addition, water-column stratification (ambient density) was not considered in the modelling and the non-tidal counter-clock flow gyre existing around Pictou Island (approximately 6 km from CH-B) was not included/combined with the southeast-northwest direction flow pattern. These limitations must be re-evaluated and included in the modelling, as the MIKE 21 and CORMIX predictions on effluent dispersal and effluent build-up are incorrect.

With respect to the potential for adverse environmental effects to occur as a result of the Project, there were numerous issues and concerns identified related to a lack of detailed assessment on the potential impacts to marine life. More specifically, NPNS has attempted to assess impacts using outdated literature, and without conducting any current field or lab assessments to understand both the short-term and long-term impacts of the proposed Project. Further, NPNS is not clear on what the actual effluent will be comprised of when it is released to the Northumberland Strait, nor does it fully consider the cumulative impacts of the known effluent over time. Without knowing the composition of the effluent (i.e., chemical concentrations), and with the lack of relevant existing environmental conditions data, it is unclear how NPNS can make any informed or accurate predictions on the potential adverse environmental impacts of the proposed Project on the marine environment.

Similarly, a human health risk assessment (HHRA) was not completed as part of the EA Registration Document submission. Rather, NPNS completed a Human Health Evaluation (HHE). A quantitative assessment of potential exposures to project-associated chemicals of potential concern (COPC), and resulting human health risks (if any), was not completed. This is, in part, due to the project-specific effluent chemistry not being fully known (result of the chemical process engineering design work not being complete). As such, the chemical composition of the effluent, including chemical concentrations, has not been fully characterized and potential risks to human health have not been quantified.

Based on a review of the socio-economic baseline information provided and effects assessment conducted of the local assessment area's social and economic environment, it is evident that information has been omitted that prevents an accurate analysis of the potential risks the Project will have on the region's economic and socio-economic wellbeing. Dismissals of adverse effects on fish and fish habitat are informed by a reported lack of, or outdated, data and are therefore misleading in assumptions. This, in turn creates a very low level of confidence in the predicted lack of effects on socio-economic related values and interests held by the region's stakeholders, public, First Nations and the fishing and fish processing sectors.

Overall, the EA does not acknowledge or address the magnitude of potential adverse socio-economic effects on the region's commercial fisheries and the thousands of (Indigenous and non-Indigenous) citizens who are dependent on a resilient fishery. Nor does it adequately consider or address the potential for adverse effects to the marine environment and human health. As such, in our professional opinion, the Project cannot be approved as currently registered. Given the numerous issues, data gaps and information gaps identified in the EA, and summarized below, we recommend that the Minister, as per Section 13 of the Environmental Assessment Regulations made under Section 49 of the Environment Act, determine either that

- the registration information is insufficient to allow the Minister to make a decision and additional information is required (Section 13(1) (a)), or
- a review of the information indicates that there may be adverse effects or significant environmental effects caused by the undertaking and an environmental-assessment report is required (Section 13(1) (d)).

Summary of Issues and Recommendations

The following is a summary list of issues and recommendations, as identified in the technical review that follows the Executive Summary. Numbering has been kept consistent between the summary list and main technical review for ease of reference.

Addendum Receiving Water Study:

- **2.1:** NPNS must provide modelling results for the proposed CH-A effluent discharge location.
- **2.2/2.7:** NPNS must provide a study on sea floor ice scouring at, and near, the proposed outfalls CH-A and CH-B and make recommendations on the best location for an effluent outfall diffuser.
- **2.3:** NPNS must provide field verification of the water column stratification, and these measurements, taken at the CH-A and CH-B locations, and other areas, should be part of a water quality survey.
- **2.4:** Provide a water quality study for the CH-A and CH-B locations and other related areas, including Caribou Harbour and the surroundings of Pictou Island, using numerous sampling stations. As part of this study, one or two reference areas should be considered with several sampling stations.
- **2.5:** Provide an explanation as to how to reconcile the input of MIKE 21 July data for use in CORMIX simulations for August–September, and possible implications of this on the study results.
- **2.6:** A rationale for not completing an industry-standard characterization of the effluent plume at CH-A or CH-B must be presented.

Effluent Treatment Facility Design

- **3.1:** Environment and Climate Change Canada has proposed updates to the Pulp and Paper Effluent Regulations (PPER), to account for changes in the pulp and paper industry, as well as to address findings from EEM studies indicating that the PPER do not adequately protect fish, fish habitat, and the environment (ECCC, 2017). NPNS must address whether or not the effluent from the project will meet the requirements of the proposed updates to the PPER.
- **3.2:** More information should be provided on the data collected in the lab trials conducted in Fall 2018 on the NPNS effluent and site visits to the two Kraft mills in Sweden using BAS™ technology in terms of specific water quality data (BOD, TSS, P, N & COD) and relevant regulations (current and proposed).

- **3.3:** Consideration of the non-biodegradable organic fraction within the effluent should be given, with more specific information on components in effluent that contribute to non-biodegradable fraction of COD, and any other efforts that could be considered in the pulp mill process design to lower COD in the mill effluent prior to biological wastewater treatment.

- **3.4:** More information needs to be provided on metal concentrations in the current ASB effluent (Point C) and metal concentrations expected to be found in the effluent of the proposed ETF.

- **3.5:** More detail should be supplied on (1) what "key performance indicators" will be monitored on daily basis, and (2) what monitoring/testing will be conducted on the influent into the ETF; specifically, what water quality and/or operational parameters will be part of this monitoring/testing framework.

- **3.6:** Historical impacts of the Boat Harbour Treatment Facility are of major concern. NPNS must clearly outline how the proposed effluent treatment facility will be designed and operated in a way that will mitigate the potential for similar environmental impacts to occur.

Effluent Modelling

- **3.7:** Summary information should be provided in the main EA text on both the Preliminary Receiving Water Study and the Addendum Receiving Water Study. How Mike 21 and Cormix models were used should be clearly stated.

- **3.8:** NPNS must provide a water quality study for the CH-A and CH-B locations and other related areas, including Caribou Harbour and the surroundings of Pictou Island, based on numerous sampling stations. As part of this study, one or two reference areas should be considered with several sampling stations.

- **3.9:** Provide a brief description in Section 8.11.5 of what the Follow-up and Monitoring Program entails.

Marine Fish and Aquatic Habitat

- **3.10**: In the interest of assessing the impacts to fish with the highest level of scrutiny and precaution, in our professional opinion, it is recommended that the Proponent should approach the EA with an analysis that goes beyond the provision of Serious Harm to a shift in focus on avoiding harmful alteration, disruption or destruction (HADD) of fish and fish habitat. This approach is being contemplated in the proposed *Fisheries Act* amendments under Bill C-68. Given the high level of concern from fisheries groups regarding harmful alteration, disruption or destruction of fish and fish habitat of the Northumberland Strait, and the potential adverse effects of the Project, Northern Pulp must assess the proposed activities and design of the Project in the context of HADD avoidance. This approach enhances the measures described within the EA.

- **3.11:** NPNS needs to provide more detail on spill response and safeguards against potential accidents or malfunctions along the terrestrial portion of the pipeline. Without this information, it is unclear how the Minister can make an informed decision regarding whether adverse effects or significant environmental effects may be caused by the undertaking and whether these effects can be mitigated.

- **3.12:** In our professional opinion, a comprehensive multi-year baseline study on all marine species present within the Northumberland Strait must be completed in order to understand potential adverse impacts that may result from project activities. Robust studies are required to better understand each species, and the potential impacts the project could have on each. This type of baseline study is the foundation of an EA, especially one focused on a project that has the potential to cause serious environmental impacts. The Minister needs to decide "w*hether environmental baseline information is sufficient for predicting adverse effects or environmental effects related to the undertaking" (Nova Scotia Environment, 2018).* We see no evidence of such baseline information in the EA.

- **3.13:** In our professional opinion, a more detailed environmental assessment that considers all potential fisheries in the Northumberland Strait needs to be completed to adequately assess project impacts. The EA should consider every species fished commercially in the area and should look at sensitivities of all of those fish to changes in water quality and negative health effects of contaminants

- **3.14:** The Environmental Management Plan and the Environmental Protection Plan must be completed and circulated for review and consultation with stakeholders prior to the project being approved. The Project should not be approved until all stakeholders have been consulted on all environmental protection measures within the Environmental Management Plan.

- **3.15:** The proponent must provide more detail on what is meant by moving the alignment to the centre of the road, and on which watercourses, in particular, they intend to carry this out.

- **3.16:** In our professional opinion, geotechnical assessments must be completed and reviewed by project stakeholders. This information is required before the Minister can make an informed decision on all potential impacts of the project. In addition, the Environmental Protection Plan must address prevention and emergency response related to horizontal directional drilling.

- **3.17a:** The EA must provide more details on mitigating benthic disturbance and subsequent TSS mobilization during pipe construction in the Northumberland Strait.

- **3.17b:** The EA should examine the possibility of horizontal directional drilling (HDD) to facilitate the placement of the pipe into the Northumberland straight. HDD could reduce the risks of in-water works that could significantly impact fish and benthic communities.

- **3.18a:** The EA must outline species-specific limits of tolerance with respect to the above parameters described as well as upper and lower limits for chemicals specific to mill effluent. A robust assessment of how changes to the marine environment, and the discharge of effluent contaminants, impact species inhabiting the area must be completed in order to understand impacts of the proposed project.

- **3.18b**: The proposed changes to the PPER must be considered when addressing the species-specific effects including a quantitative evaluation of the impact of the proposed changes on the assumptions and conclusions of the EA.

- **3.19:** In our professional opinion, a project of this magnitude warrants comprehensive field work investigations to be completed. NPNS should conduct a comprehensive baseline assessment to characterize current conditions of the marine environment within the project assessment area, including sediment and water quality.

- **3.20**: The proponent should collect and analyze current water quality data, from the proposed outfall location, in order for the EA to adequately assess impacts to the water quality from the project, and to adequately plan for preventing or mitigating those potential impacts**.**

- **3.21:** Northern Pulp must collect current and relevant data on sediment characterization at the proposed outfall location.

- **3.22:** Proper research needs to be completed to understand possible effects of the effluent on herring spawn, including sub-lethal effects. A rebuilding plan for herring is currently being developed to ensure the regrowth of the stock, and therefore any potential impacts to herring spawn must be fully considered in the EA.

- **3.23:** Research must to be completed to understand possible sub-lethal effects of the effluent on mackerel eggs. Currently, the stock is in the critical zone (DFO, 2017) and a rebuilding plan is being developed to ensure the regrowth of the stock. The EA must clearly assess how potential impacts from the project could affect stock regrowth.

- **3.24:** Atlantic sturgeon must be considered in the assessment, and potential impacts to the species identified.

- **3.25:** As stated in Appendix R of Northern Pulp's EA Registration documents, it is recommended that more research be completed on the effect of the effluent on lobster in each life stage. It is important to highlight that the recommendation given in Appendix R regarding more research on the effect of effluent on lobster must be followed through and completed.

- **3.26:** Detailed field assessment on the sea scallops that inhabit the area near the proposed outfall location must be completed prior to the release of the proposed effluent to ensure there

will be no negative effects on the sea scallops. Otherwise, it is unclear how the Minister will be able to determine if adverse effects or significant environmental effects are likely to occur.

- **3.27:** Detailed field and lab work must be carried out as part of a comprehensive EA that assesses and quantifies sublethal, chronic and cumulative effects on lobster larvae. The level of stakeholder concern regarding lobsters warrants the need for increased scientific understandings and fulsome assessment of impacts, in order for the Minister to make an informed decision regarding potential impacts of the project to lobster.

- **3.28:** Individual species cannot be pinpointed to specific locations within the Northumberland Strait. They do have traditional habitat and areas they are commonly found, but individuals are not restricted to these areas only. The ability, and likelihood, of each species to move throughout the Northumberland Strait must be considered and accounted for in a robust environmental assessment.

- **3.29:** The Northumberland Strait must be also assessed as an interwoven and interdependent ecosystem, not only on an individual species by species basis. NPNS must consider these ecosystem impacts in a more comprehensive and robust environmental assessment. Otherwise, it is unclear how the Minister will be provided with sufficient information to make an informed decision about the likelihood of adverse impacts.

- **3.30:** Despite the PPER regulations, given the high level of concern expressed by the public and harvesters, a biological monitoring program should be implemented prior to final commissioning of the proposed treatment plant and effluent outfall. The collection of this baseline information will significantly strengthen the interpretive power of the biological monitoring program as a whole. This baseline information will allow the biological monitoring program data to be analysed in a BACI (Before-After-Control-Impact) framework so that potential effluent related effects can be considered both spatially (i.e., exposure vs. reference) and temporally (i.e., pre-discharge vs post-discharge).

- **3.31:** Again, despite the PPER regulations, in our professional opinion, and due to the high level of concern expressed by the public and harvesters, the biological monitoring program should be implemented and remain continuous as soon as effluent is released to the Strait. Considering the level of concern from stakeholders in the region and coupled with the uncertainty of the effluent composition and the limited collection of existing environmental condition data, it is imperative that NPNS implement a robust continual biological monitoring program prior to effluent discharge and that continues through operations.

- **3.32a:** The EA must consider both lethal and sublethal effects of the Project and must go beyond the provision of “serious harm” to incorporate how effects, other than direct mortality, could negatively impact the fisheries of the Strait.

- **3.32b:** In addition, analysis and monitoring of lethal and sublethal effects should be carried out independently of one another on locally important species such as lobster, crab, herring and Atlantic salmon.

Marine Mammals

- **3.33**: An ERA is required that considers ecological receptors, including marine mammals such as North Atlantic Right Whales, who may be exposed to chemicals of potential concern from the proposed project.
- **3.34**: The assessment of project effects on the marine mammals, sea turtles, and marine birds VEC (Section 8.13) is considered to be incomplete and underscores the need for NPNS to conduct field studies for this project, especially given growing uncertainty regarding the distribution of North Atlantic Right Whales in their summer foraging range.
- **3.35a:** NPNS must provide more detailed information on visual surveying methods and consider completing these in combination with other marine mammal monitoring methods such as the deployment of passive acoustic monitors or aerial (helicopter or drone) surveys.
- **3.35b:** NPNS must provide more information on Marine Mammals Observer (MMO) monitoring requirements, including information on reporting intervals, accessibility of reports to stakeholders, and whether reporting will trigger any adaptive management measures.
- **3.35c**: NPNS should consider requiring marine mammal monitoring during all project activities that require vessel travel.
- **3.36a:** More detailed and definitive information on the vessel traffic (including vessel type, size, route, speed, schedules) that will be required to complete Project activities must be provided and considered in the EA, given potential impacts to marine mammals.
- **3.36b:** NPNS should ensure that observers are present on all Project vessels to identify the presence and location of marine mammals and to ensure appropriate mitigation measures outlined in EA Section 8.13.3.2 are adequately triggered and implemented.

Cumulative Effects

- **3.37:** The EA must assess cumulative effects of the proposed project on the marine environment, in light of current stressors that have already been identified, including increases in surface water temperature and salinity, as well as decreases in oxygen saturation.
- **3.38:** Discussion is required around the interactions between potential impacts from the new ETF discharges from the outfall, and ferry discharges within the harbour and Strait, and in turn the implications for ecological and human health risks, from a cumulative effects assessment standpoint.

Human Health

- **3.39:** A robust and comprehensive assessment of potential health risks (i.e., through the completion of a Human Health Risk Assessment) is required in order to determine if adverse health effects from the project are likely.
- **3.40:** An adaptive management plan should be provided to address discrepancies between project assumptions and predictions, and what is found to occur in the environment once the project begins. This plan should include an assessment of changes to predicted risks to human health, should the project assumptions not hold true.
- **3.41:** The assessment of potential risks to human health associated with the project requires a fulsome understanding of both the exposure concentrations of Contaminants of Potential Concern (COPC) in the marine environment, and the exposure pathways identified as being of concern to human health (i.e., the consumption of fish and shellfish).
- **3.42:** A more robust assessment of baseline conditions (such as water quality, sediment quality, land use patterns, fish consumption rates and other relevant environmental attributes) must be completed prior to project approval, to understand potential risks to human health related to the project.
- **3.43:** NPNS must confirm that the pilot study will be completed to evaluate the potential impacts to air quality due to the combustion of hog fuel and sludge in the power boiler and must outline adaptive management strategies should the results of the air monitoring and pilot study not align with the assumptions and predictions of the current assessment.
- **3.44:** If 2018 air monitoring data are available from Stantec (2019), they should be included in the assessment.
- **3.45:** Details are required regarding adaptive management measures, to address the potential for actual air emissions to be greater than predicted emissions (based on modelling exercises).In addition, further discussion in the EA is needed regarding what is meant by an artifact of model inputs related to modelled exceedances of H_2S (Section 9.2.4.1).
- **3.46:** The potential risks to human health associated with cumulative impacts of the project and current stressors must be considered in the assessment.

Socio-Economics

- **3.47:** Provide information on the pipeline's lifecycle length and anticipated activities for its decommissioning (i.e., expansion, upgrades, replacement etc.)
- **3.48:** NPNS must include VEC, and more importantly, a robust and consistent effects assessment on indicators related on the acknowledged VEC "health of communities" to capture missing elements of health and wellbeing, including the protection of a resilient fishery and associated economies including harvesting and processing plants; employment, analysis of economic risks and/or benefits at community, regional and provincial level; description for, and management plans for anticipated workforce at both construction and operation phases.

- **3.49a:** Apply an actual ecosystem and integrated approach for the effects assessment that considers VEC interdependencies and an economic risk analysis to other economic sectors in the region – fisheries in particular.
- **3.49b:** Provide a detailed description of the region's economic reliance on commercial fisheries, including individual harvester economic baselines and dependencies as they relate to fishing.
- **3.49c:** Provide analysis of the Project's construction and operation phase effect mechanisms and interactions with harvesters' ability to fish (in terms of access); as well as potential risks to fishing economy due to risks to species' habitat, spawning area integrity and health.
- **3.49d:** Describe how individuals within the lobster fishery (and other fisheries) will be compensated or accommodated for losses as a result of the Project's construction and/or operations activities. An explicit acknowledgement of the adverse economic impacts (and in turn social impacts on regional and community wellbeing and health) for fishers when even just a few days of fishing are interrupted is critical for a balanced effects assessment.
- **3.50:** NPNS must provide a balanced and accurate description of the existing regional socio-economic context, including regional health and wellbeing dependencies on the fish harvesting and fish processing sectors. Using complete baseline information, an economic effects assessment is required that carries forward information referred to within the baseline section including: project effect mechanisms and interactions with existing fisheries economic sector, at a granular level i.e., net losses anticipated due to forecasted days of interruptions due to construction and operations); human health effect mechanisms and interactions with economic risks related to fish processing plant operation requirements and interactions with effluent discharges; project workforce requirements; wages and salaries, and supply chain procurement needs during both construction and operations.
- **3.51:** Provide more baseline information describing the specific aspects of the tourism sector within the LAA that have inter-connections with water – either from recreational usage or from drinking and/or other water uses. These details would be relevant within an eco-system approach to the socio-economic impact assessment**.**
- **3.52:** NPNS must provide information and analysis of the following:

    - Discussion and analysis of risks and in turn, potential adverse social impacts to individuals and families who rely on uninterrupted or undisturbed access to the fisheries; including mitigations for avoiding this adverse impact.

    - Identification of positive socio-economic effects from employment during the 21-month construction period as well as operations and maintenance. It is acknowledged that the project description states that no additional jobs would be created during operations as existing personnel would be retrained for the new facility. Both phases of the Project need to be discussed in terms of what economic benefits would occur (even if no change during operations) within the socio-

economic effects assessment. This allows the impact evaluation to demonstrate both the potential negative as well as the potential positive socio-economic impacts that would be predicted as a result of the Project's various activities, including employment generation and associated indirect and induced impacts during the 21 months' construction.

- A description of human and ecological health pathways, project interactions and effect mechanisms within the socio-economic effects assessment including a human health risk assessment (i.e., drinking water within the LAA's wells; recreational water usage; Indigenous community members' land uses, water and wild foods consumption).

- A discussion and demonstrated planning for health and safety considerations of the surrounding communities as related to construction, should there be a temporary, non-resident workforce hired for construction. Include whether the construction workforce will be housed in surrounding local communities and/or within temporary workcamps. How many workers are anticipated to be hired for the construction phase?

- **3.53a:** NPNS must provide discussion and analysis of potential effects to the health and integrity of the region's commercial fisheries based on results of more comprehensive effluent modelling, data upgrades and effects analysis as per the results of this EA's technical review of these inter-dependent VECs.
- **3.53b**: NPNS must provide discussion and analysis of tourism impacts and human health risks related to Indigenous land and resources, and non-Indigenous lands and resources (i.e., drinking water and marine based recreation).
- **3.53c:** NPNS must provide discussion and analysis of potential impacts of pipeline operations and maintenance (specifically integrity digs) on land and resource use for both Indigenous and non-Indigenous citizens.
- **3.54:** NPNS must provide more fulsome consideration, description and commitment for specific mitigation, management and monitoring measure to address both the ecological and social factors related to the Project's activities at construction and operations as listed in previous comments.
- **3.55**: NPNS must provide a balanced and accurate description of the existing regional socio-economic context, included regional health and wellbeing dependencies on the fish harvesting and fish processing sectors. Using complete baseline information, an economic effects assessment is required that carries forward information referred to within the baseline section including: project effect mechanisms and interactions with existing fisheries economic sector, at a granular level (i.e., net losses anticipated due to forecasted days of interruptions due to construction and operations); human health effect mechanisms and interactions with economic

risks related to fish processing plant operation requirements and interactions with effluent discharges; project workforce requirements; wages and salaries, and supply chain procurement needs during both construction and operations.

1.0 Introduction

Shared Value Solutions Ltd. (SVS) was retained by the Gulf Nova Scotia Fleet Planning Board, and their Fishermen's Working Group for the Northern Pulp Environmental Assessment, to conduct a technical review of the Northern Pulp Nova Scotia (NPNS) Environmental Assessment (EA) Registration Document for the Replacement Effluent Treatment Facility (the Project). The purpose of this report is to provide a critical technical review of the EA report prepared by Dillon Consulting Ltd. (Dillon, 2019), which is intended to subsequently inform the Minster's decision regarding project approval. The report aims to outline scientific data gaps and deficiencies in the EA that may result in adverse effects or significant environmental effects, or a lack of sufficient information to determine whether such effects might occur, should the Project proceed.

The review was conducted by:

- . – Risk Assessment Specialist and Project Director (SVS)
- – Aquatic Ecologist and Project Manager (SVS)
- Managing Partner (SVS)
- . – Environmental Scientist and Project Coordinator (SVS)
- – Wildlife Biologist (SVS)
- – Senior Community Development Specialist (SVS)
- Senior Aquatic Scientist (Lebeau and Associates Inc.)
- Wastewater Treatment Specialist

1.1 Review Objectives

The objective of this review is to outline data gaps and deficiencies in the EA. This has been completed using best science and professional judgement. It must be noted, as set out in Section 34(1) of the *Environment Act*, that the Minister must demonstrate that all of the following pieces of information were considered in formulating her decision*:*

- *The location of the proposed undertaking and the nature and sensitivity of the surrounding area;*
- *The size, scope and complexity of the proposed undertaking;*
- *Concerns expressed by the public and aboriginal people about the adverse effects or the environmental effects of the proposed undertaking;*

- *Steps taken by the proponent to address environmental concerns expressed by the public and aboriginal people;*
- *Whether environmental baseline information submitted under subclause 9(1A)(b)(x) [of the Environmental Assessment Regulations, which states "Environmental baseline information"] for the undertaking is sufficient for predicting adverse effects or environmental effects related to the undertaking;*
- *Potential and known adverse effects or environmental effects of the proposed undertaking, including identifying any effects on species at risk, species of conservation concern and their habitat;*
- *Project schedules where applicable;*
- *Planned or existing land use in the area of the undertaking;*
- *Other undertakings in the area;*
- *Whether compliance with licences, certificates, permits, approvals or other documents of authorization required by law will mitigate the environmental effects;*
- *Such other information as the Minister may require*

As such, we expect that the Minister will consider all technical review comments contained within this review during the decision-making process, and address concerns accordingly.

1.2 Project Description

The Northern Pulp bleached kraft mill is located at Abercrombie Point adjacent to Pictou Harbour in Pictou County, Nova Scotia and has been operating, under various ownerships, since 1967. The mill produces bleached kraft market pulp at a rate of 280,000 to 300,000 air-dry tonnes per year (ADt/y). Currently, the mill's effluent is treated at a wastewater treatment plant located in the western portion of Boat Harbour, 3.5 km east of the mills across the East River. The current treatment plant consists of constructed sedimentation basins and a natural basin prepared with baffle curtains. Prior to the effluent being released into the Northumberland Strait via a weir in Boat Harbour, it passes through a large, natural final polishing/ stabilization basin. The *Boat Harbour Act,* which was enacted in May 2015, calls for the use of the current Boat Harbour effluent facility to cease as of January 31, 2020. As a result, a new wastewater plant and effluent discharge will be required prior to the 2020 deadline.

The proposed effluent treatment facility, as described in the Project EA report, will use a biological activated sludge process that combines Moving Bed Biofilm Reactor (MBBR) technology with conventional activated sludge. After the effluent has undergone treatment, it will travel along a 15.5 km long effluent transmission pipeline which follows the Highway 106 right-of-way for 11.4 km, then enters

the water adjacent to the Northumberland Ferries marine terminal and continues for 4.1 km. The effluent pipeline will be buried and weighted down using concrete collars. The effluent transmission pipeline will continue through Caribou Harbor to the Northumberland Strait, where it eventually terminates at an engineered marine outfall northeast of the Northumberland Ferries marine terminal (Figure 1). It is proposed that the effluent pipeline will end at a 50 m long diffuser with three outlets spaced 25 m apart. The proposed outfall will be capable of discharging up to 85,000 m^3 of treated effluent per day, with a peak discharge velocity of 4.6 m/s from each port. The Proponent predicts that the proposed outfall design will result in an approximate dilution ration of 144:1.

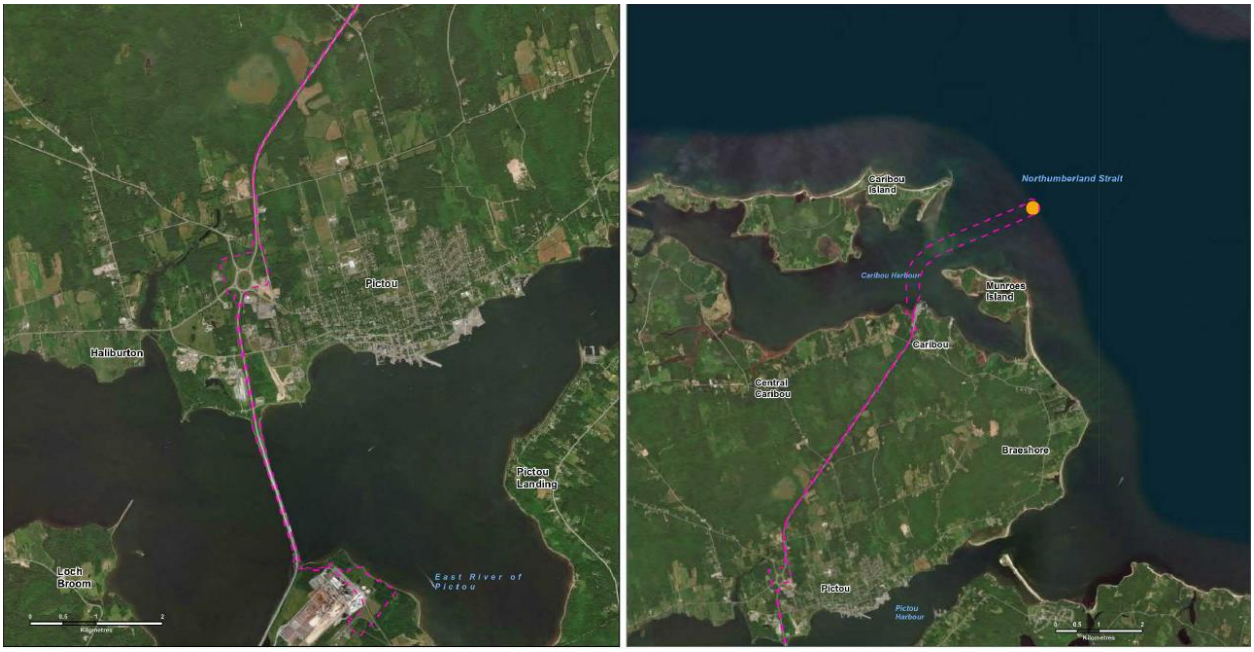

Figure 1. Proposed Project Route and Outfall Location (Based on Figure 1.1-2 of Dillon Consulting, 2019)

Should the Project receive all necessary approvals through the EA review process, it is anticipated that construction will occur for approximately 21 months, commencing after all applicable permits and approvals have been obtained. The Proponent is anticipating construction to start in the second quarter of 2019 but has noted that this will be weather dependent. The operation and maintenance phase of the proposed Project will start immediately after the construction phase, assumed to begin in the fourth quarter of 2020, and is anticipated to continue for several decades.

1.3 Regulatory Context

The NPNS proposed Replacement Effluent Treatment Facility ("the Project") is regulated under the Government of Nova Scotia's Environmental Assessment Branch and is being assessed through a Class 1 Environmental Assessment by the province.

The Government of Nova Scotia defines environmental assessment as the following:

> *"Environmental Assessment (EA) is a decision-making tool used to promote sustainable development by evaluating the potential environmental effects of major developments before they proceed. This is accomplished by involving the public along with various government departments and agencies during the environmental assessment.*
>
> *Environmental assessment also promotes better project planning by identifying and addressing environmental effects at the earliest stages of project development and can save proponents time and money" (Nova Scotia Environment, 2018).*

Projects classified as Class 1 undertakings are deemed to be smaller in scale and the level of concern to the public is considered unknown or uncertain (Nova Scotia Environment, 2018). This uncertainty means that the initial submission made by the proponent in Class 1 EA undertakings is subject to a public review period. Following the public review period, the Nova Scotia Minister of Environment will decide if a more comprehensive review and/ or public hearing process is required (Nova Scotia Environment, 2018).

In addition, following the review period, the Environmental Assessment Branch of Nova Scotia Environment will review all information received during the review. Based on the information received, the branch will proceed to provide the Minister with a report summarizing the issues received. The report will also include a recommendation for the Minister's decision (Nova Scotia Environment, 2018). The Minister has one of five options for a decision, as set out in section 13(1) of the Environmental Assessment Regulations made under Section 49 of the *Environment Act:*

(a) The registration information is insufficient to allow the Minister to make a decision and additional information is required;

(b) A review of the information indicates that there are no adverse effects or significant environmental effects which may be caused by the undertaking or that such effects are mitigable and the undertaking is approved subject to specified terms and conditions and any other approvals required by statute or regulation;

(c) A review of the information indicates that the adverse effects or significant environmental effects which may be caused by the undertaking are limited and that a focus report is required;

(d) A review of the information indicates that there may be adverse effects or significant environmental effects caused by the undertaking and an environmental-assessment report is required; or

(e) A review of the information indicates that there is a likelihood that the undertaking will cause adverse effects or significant environmental effects which are unacceptable and the undertaking is rejected.

In order to reach this decision, the Minister must demonstrate the all of the following pieces of information were considered in formulating her decision as set out in Section 34(1) of the *Environment Act:*

- *The location of the proposed undertaking and the nature and sensitivity of the surrounding area;*
- *The size, scope and complexity of the proposed undertaking;*
- *Concerns expressed by the public and aboriginal people about the adverse effects or the environmental effects of the proposed undertaking;*
- *Steps taken by the proponent to address environmental concerns expressed by the public and aboriginal people;*
- *Whether environmental baseline information submitted under subclause 9(1A)(b)(x) [of the Environmental Assessment Regulations, which states "Environmental baseline information"] for the undertaking is sufficient for predicting adverse effects or environmental effects related to the undertaking;*
- *Potential and known adverse effects or environmental effects of the proposed undertaking, including identifying any effects on species at risk, species of conservation concern and their habitat;*
- *Project schedules where applicable;*
- *Planned or existing land use in the area of the undertaking;*
- *Other undertakings in the area;*
- *Whether compliance with licences, certificates, permits, approvals or other documents of authorization required by law will mitigate the environmental effects;*
- *Such other information as the Minister may require*

The following figure outlines all of the steps within a Class 1 Environmental Assessment.

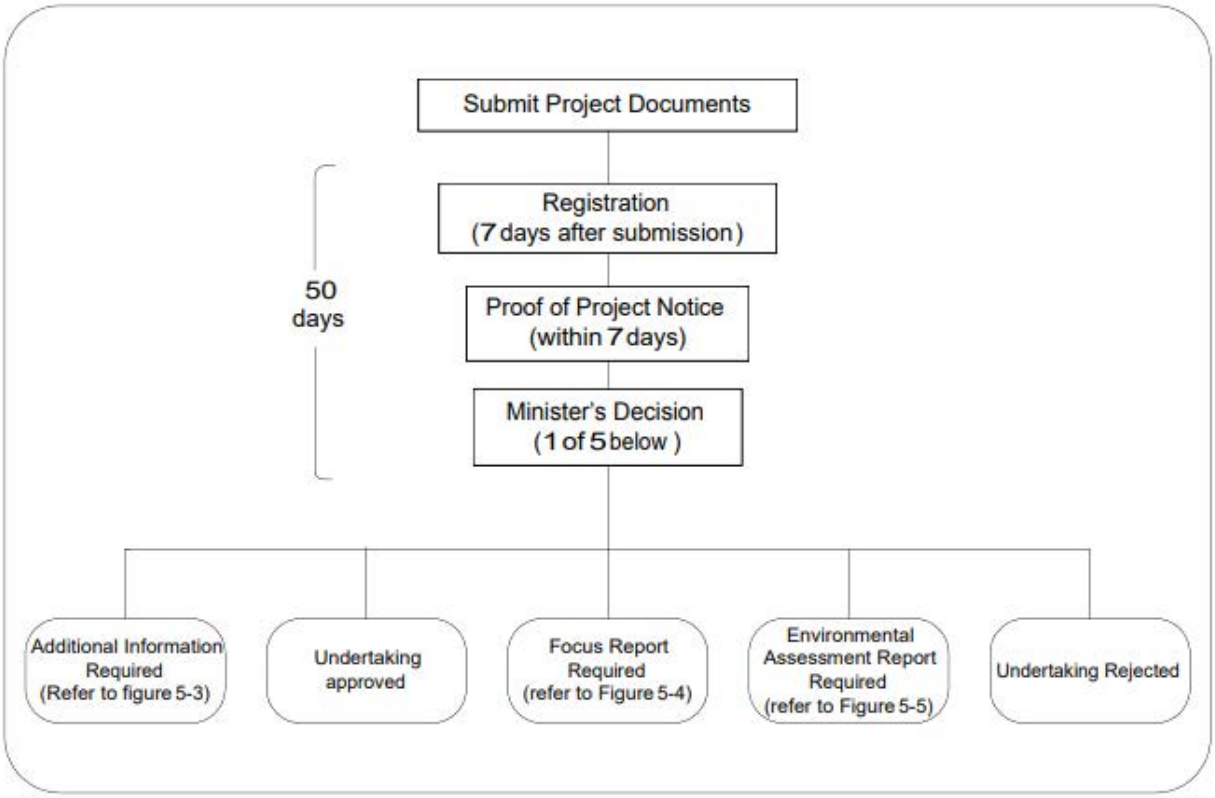

Figure 2. Class 1 Environmental Assessment Process Diagram (Source: Nova Scotia Environment, 2018)

In the context of a Class 1 EA in Nova Scotia, the most rigorous outcome possible is the completion of an environmental assessment report for the Project. The process steps for the completion of an EA report are identified in Figure 3 below.

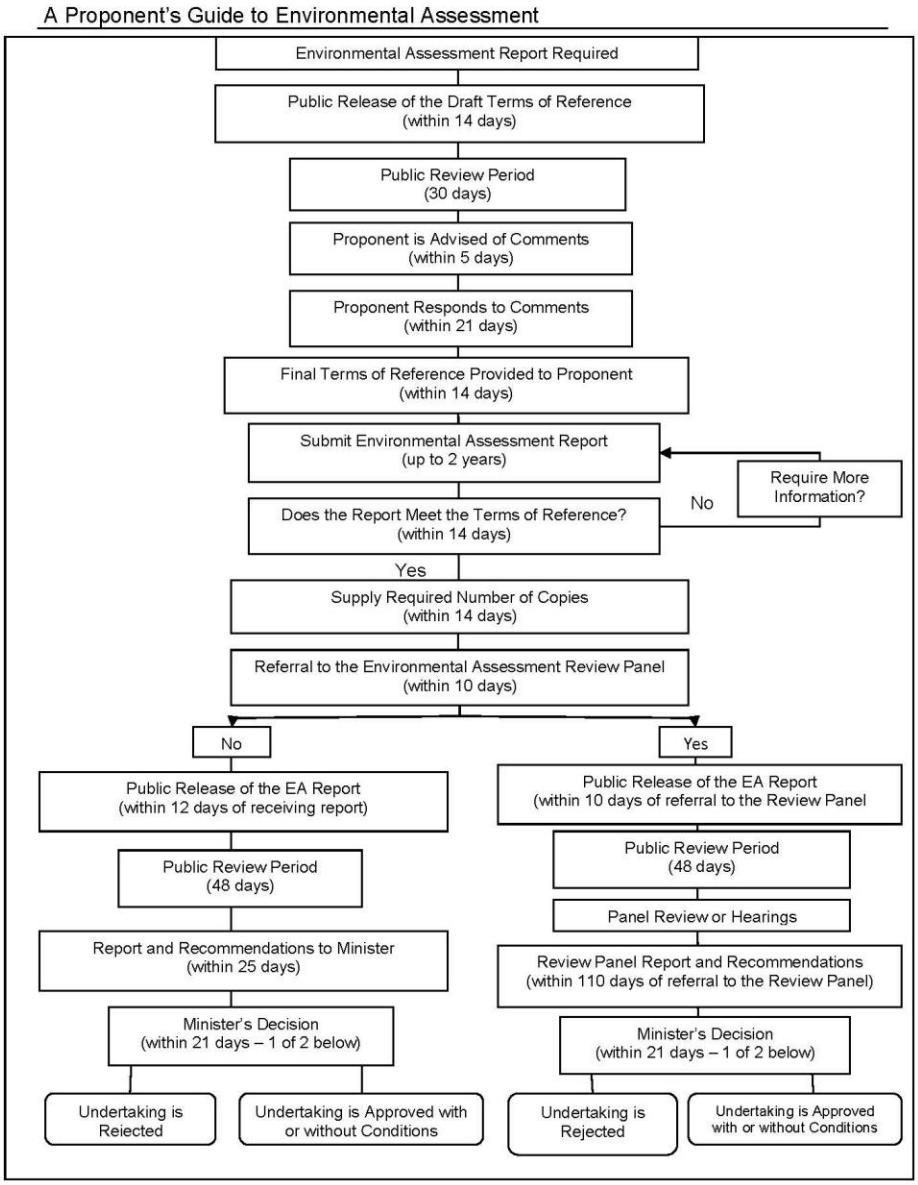

Figure 3. Class 1 EA - Environmental Assessment Report Required (Source: Nova Scotia Environment, 2017)

2.0 Summary of Technical Review of the Receiving Water Study

In preparation for, and to inform, the technical review of the EA Registration Documents, a review of Addendum Receiving Water Study for Northern Pulp Effluent Treatment Plant Replacement Project – Additional Outfall Location CH-B, Caribou Point, Nova Scotia dated December 19, 2018, was completed by Dr. Bernard Lebeau. A summary of the identified issues and concerns from the ARWS is provided below (Section 2.1).

Background

The *Preliminary Receiving Water Study for Northern Pulp Effluent Treatment Plant Replacement in Pictou Harbour* dated August 11, 2017, had identified the discharge location Alt-D as the preferred option, however further studies have provided evidence for seabed ice scour at a water depth of 11 m. This new information deemed the preferred location Alt-D not technically feasible for the outfall. Consequently, Stantec conducted additional modelling and prepared the 'Addendum Receiving Water Study' (ARWS) to investigate other potential outfall locations. The computational domain and boundaries for far-field modelling used in the ARWS are shown in the following figure.

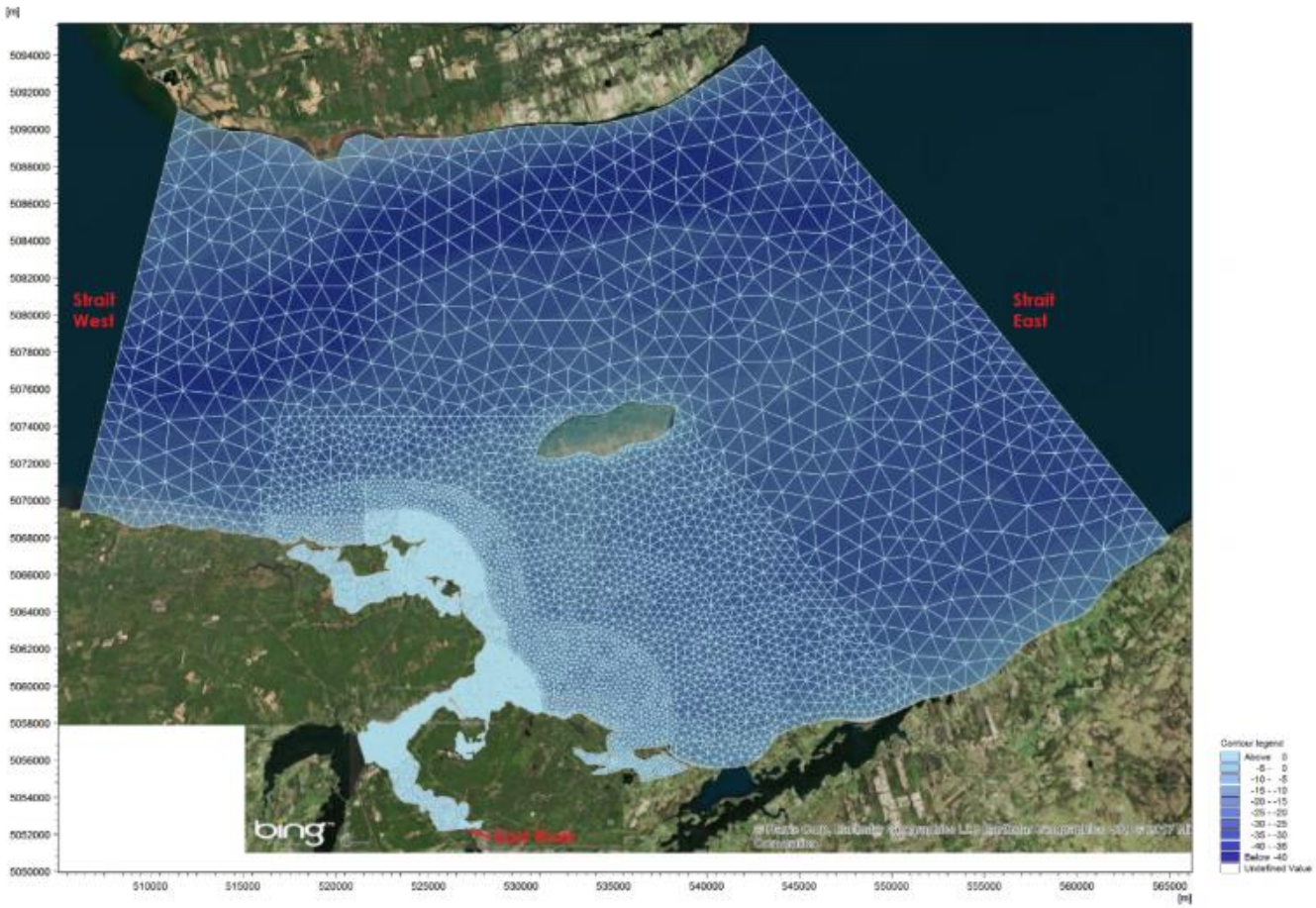

Figure 4. Computational Domain Boundaries for Far-Field Modelling (Source: Stantec, 2018)

The far-field modelling conducted for the ARWS identified two alternate discharge outlet locations, CH-A and CH-B off Caribou Point (see figure below). The two alternate discharge outlet locations are 540 m apart, and in 25 m (CH-A) and 20 m (CH-B) water depths. Further analysis determined that CH-B was the preferred location of the two alternate options, with a preferred diffuser design of three ports, each with a 0.3 m opening, horizontal angle of 0˚, and a vertical angle of 20˚. Outfall CH-B was further analyzed in the near-field modelling portion of the ARWS as the preferred outfall location.

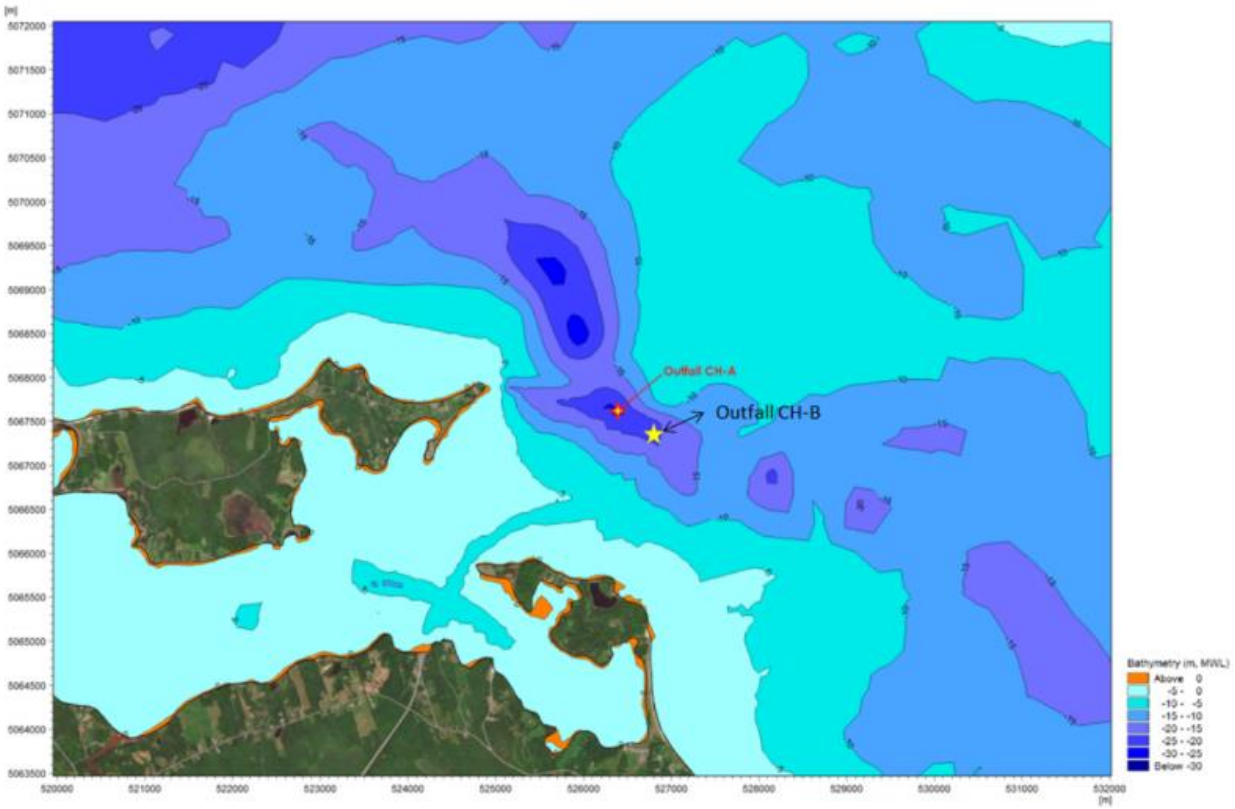

Figure 5. Outfall Locations for CH-A and CH-B

2.1.2 Far-Field Modelling

A two-dimensional (2D) model was used to simulate far-field effluent dispersion at two alternative potential discharge locations (CH-A and CH-B). The MIKE 21 model was used in the assessment.

Issue 2.1: There are no results from the dispersion modelling presented for the effluent discharge at the CH-A outfall location; results from only the CH-B outfall location were presented (Section 2.2, Page 5). How can the reader conclude that the "Dispersion modelling results from effluent discharges from CH-A and CH-B outfall locations indicate that the CH-B discharge provides relatively higher dilution and less potential effluent impact on Caribou Harbour water" without seeing results from the dispersion modelling from the CH-A location? Furthermore, the CH-A location is in 25 m depth, while CH-B location is in 20 m depth. There is ice scouring evidence on the sea floor to suggest that the CH-B location may not be deep enough and that the CH-A may be found to be a more appropriate location. It is of note that divers have reported ice scouring as deep as 20 m (MacCarthy and Egilsson, 2019).

> **Recommendation 2.1:** NPNS must provide modelling results for the proposed CH-A effluent discharge location.

Issue 2.2: "Outfall depth is often a bigger driver than exact position of the outfall" (Page 6). In our professional opinion, the most important driver in this type of study is "ice scouring" (See Section 1.3

Engineering Consideration). If ice scouring exists at or around the CH-B location, that location will not be suitable at the outset.

> **Recommendation 2.2:** NPNS must provide a study on sea floor ice scouring at, and near, the proposed outfalls CH-A and CH-B and make recommendations on the best location for an effluent outfall diffuser.

Issue 2.3: The following comment applies to the PRWS as well as the ARWS. For modelling purposes with both Mike21 and CORMIX, it is important to determine whether a stratification is present in the water column. With stratification of the water column (pycnocline), the effluent plume stops rising and becomes "trapped" at an intermediate depth, therefore reducing dilution. In this case, the effluent plume is expected to be building up and be (much) larger than expected. Therefore, field data must be provided to determine whether stratification exists at or near the effluent outfall. This stratification of the water column is particularly important in estuarine environments, such as the proposed outfall location. The water of the Northumberland Strait is primarily derived from the surface layer of the Gulf of St. Lawrence (AMEC 2007), which means it has more freshwater than ocean water, but also has the deep saline flow from the Gulf Stream that enters through the Cabot Strait. The data available for Pictou Harbour indicates that a stratification of the water column occurs there and yet this phenomenon was not addressed by Stantec (2017). It seems that stratification may be potentially occurring over the entire Strait. Again, field verification of the water column stratification is required at the CH-B location for modelling purposes; otherwise the modelling results presented in the ARWS cannot be assumed to be representative of the future effluent plume.

> **Recommendation 2.3:** NPNS must provide field verification of the water column stratification and these measurements, taken at the CH-A and CH-B locations, and other areas should be part of a water quality survey.

2.1.3 Near-field Modelling

Near-field monitoring was completed to analyse effluent dispersion for the CH-B location, the proposed discharge location which was determined as a result of the far-field modelling results. The Cornell Mixing Zone Expert System (CORMIX, Version 11.0), a three-dimensional model, was used to analyze and assess near-field mixing. Issues and data gaps related to Section 3.0 of the ARWS are as follows:

Issue 2.4: "No historical water quality data are available for Northumberland Strait around the CH-B location. Data from neighboring Pictou Road (Stantec 2017) located about 6 km southeast were used" (Page 16, 2nd paragraph). In this statement, no additional descriptions of the Pictou Road data are provided. The PRWS (Stantec 2017) described the Pictou Road data as background water quality measurements from various studies (data that are between 10 to 29 years old), that were not even within range between sampling years and/or relative locations. The background water quality data needed for the CH-B location must be from that specific area, rather than from other locations, or from an assemblage of other locations, as is the case for the Pictou Road data. It is difficult to base this important study on poor background water quality data that cannot be reconciled in the first place. The background data used are certainly of historical importance, but should not be considered in the

modelling work for establishing background values for water quality parameters and effluent discharge objectives (EDO) to meet applicable water quality standards or environmental quality objectives (EQO) at the mixing zone boundary. Both winter and summer data should have been collected, and the water column at CH-B should have been measured as well to confirm a non-stratification, rather than being simply assumed as non-stratified. The characterization of water quality in the mixing zone (Section 3.2, pages 20 to 26) is only a temporary presentation of cursory information since the available background water quality data are poor. A water quality study for the specific area of the proposed CH-B effluent outfall location is required.

> **Recommendation 2.4:** Provide a water quality study for the CH-A and CH-B locations and other related areas, including Caribou Harbour and the surroundings of Pictou Island based on numerous sampling stations. As part of this study, one or two reference areas should be considered with several sampling stations.

Issue 2.5: The Mike 21 model was run for a full month from July 1 to 31, 2016. To run CORMIX, the "Hydrodynamic information at the CH-B outfall location were obtained from Mike 21" (Page 16, last paragraph). However, as provided in the PRWS (Stantec 2017), "The CORMIX simulations were conducted for "August-September" only." How do we reconcile the input of Mike 21 July data for use in CORMIX simulations for August–September, as assumed (information is unclear and not found in the ARWS)?

> **Recommendation 2.5:** Provide an explanation as to how we reconcile the input of MIKE 21 July data for use in CORMIX simulations for August–September.

Issue 2.6: Within the Environmental Effects Monitoring (EEM) Program, CORMIX model simulations are typically conducted for both winter and summer conditions, using the ambient characteristics at the study locations, etc. With the objective of gaining a more complete understanding of the dynamic processes that occur at the discharge and to obtain accurate estimates of the dilution potential that can be applied to effluent concentrations, the CORMIX model is (most often) used for simulations with varied discharges and ambient conditions. It is unclear if the work by Stantec (2017, 2018) was designed for effluent outfall siting purposes. A rationale for the delay in complete characterisation of the effluent plume at CH-A or CH-B performed under the EEM program, must be presented.

> **Recommendation 2.6:** A rationale for not completing an industry-standard characterisation of the effluent plume at CH-A or CH-B must be presented.

2.1.4 Engineering Considerations

A preliminary description of engineering considerations, and the installation methodology, that could be undertaken as part of the construction of the CH-B outfall option is not provided in the ARWS. This aspect had been provided in the PRWS (Stantec 2017), with a follow up provided briefly in the *Introduction* section of the ARWS.

Issue 2.7: In the PRWS produced by Stantec (2017), marine geophysical and geotechnical notes for Alt-D, located outside Pictou Road in Northumberland Strait, were provided. It was noted that little was

known of the marine sediments that would be encountered along the proposed outfall pipe alignment. In the ARWS Section 1.0 (Page 1), it is reported that subsequent marine geophysical and geotechnical field investigations of the Alt-D location show evidence for seabed ice scour, indicating that this location, with a water depth of 11 m, was not suitable for an effluent outfall. In the ARWS, there are no indications as to whether there is adequate knowledge of the marine geophysical and geotechnical aspects for the new "preferred" CH-B location which is in a water depth of 20 m. The deeper location "might help avoid issues of ice scour" (Page 1, 2nd paragraph). Real data are needed on how far offshore and how deep ice scouring is occurring on the seabed of the Northumberland Strait. Observations by divers have indicated that seabed ice scouring is occurring at 20 m depth (MacCarthy and Egilsson 2019). Therefore, is the proposed depth of 20 m suitable and deep enough to avoid ice scouring? Is the CH-A location at 25 m depth more appropriate? Bottom ice scouring is a most important issue in deciding the location and depth of the future effluent outfall in the Strait. A marine geophysical and geotechnical assessment of the CH-B location may yield similar results as the Alt-D location, and thus the ARWS may not be of use. Consequently, we do not know whether CH-B is an appropriate location for an effluent outfall.

> **Recommendation 2.7:** Provide a study on sea floor ice scouring at and near the proposed outfalls CH-A and CH-B. Make recommendations on the best location for an effluent outfall diffuser.

2.1.5 Summary

In summary, the MIKE 21 and CORMIX modelling work contained in the PRWS and ARWS requires new water quality data with field verifications of water column non-stratification in winter and summer, as well the inclusion of the non-tidal ocean flow that is a counter-clock gyre around Pictou Island. As such, only limited confidence can be given to the modelling results by either MIKE 21 or CORMIX in the PRWS and ARWS. Furthermore, since seabed ice scouring is occurring at a 20 m depth as per diver observations, and yearly maintenance of an effluent diffusor would preferably be kept to a minimum, a focus on the CH-A location may be more appropriate as the preferred option. Future modelling work should present information for both locations, CH-A and CH-B.

3.0 Northern Pulp EA Review Findings

3.1 Effluent Treatment Facility Design

3.1.1 Summary of EA Content

The proposed Effluent Treatment Facility (ETF) for the NPNS pulp mill is an AnoxKaldnes BAS™ process that will be purchased from Veolia Water Technologies. The proposed ETF facility will be designed to treat maximum wastewater flow of 85 MLD (62 MLD avg). The BAS™ technology is based on combination of traditional activated sludge treatment (AST) process with moving bed bioreactors (MBBR) for wastewater treatment. The use of AST is common in Canada and the United States for the

treatment of Kraft pulp mill wastewater. The integration of MBBR with AST for Kraft pulp mill wastewater treatment is not currently employed in North American Kraft pulp mills. However, there are many installations of the BAS™ technology world-wide in the pulping sector, and including, specifically, softwood Kraft pulp mill wastewater systems.

Overall, within the EA, it is indicated that the proposed plant design offers a more modern, high rate treatment option than the current wastewater facility design based on aerated stabilization basin (ASB) technology primarily using natural basins and poorly designed "release" (i.e., discharge) into the Northumberland Strait. The proposed design appears to offers increased capability to control operations and optimize treatment performance within a modern wastewater treatment plant than the current infrastructure. Waste solids management and closed loop design for clarifier sludge is an added benefit of the proposed design.

A 35,000 m^3 capacity spill basin is proposed which would be able to provide 10 to 13–hour storage of mill effluent at full production rates. This basin would be designed with a high-density polyethylene (HDPE) impermeable barrier liner.

3.1.2 Evaluation & Recommendations

Issue 3.1: The purpose of the *Pulp and Paper Effluent Regulations* (PPER) is to manage threats from all pulp and paper mills in Canada to fish, fish habitat, and human health originating from fish consumption (ECCC, 2017). The PPER prohibit the deposition of effluents that are acutely lethal to fish, set limits on suspended solids (SS) and biochemical oxygen demand (BOD), and require pulp and paper mills to carry out environmental effects monitoring (EEM) studies. Environment and Climate Change Canada has proposed updates to the PPER, which came into effect in 1992, to reflect upcoming changes to the pulp and paper industry and to address findings from EEM studies that indicate the PPER do not adequately protect fish, fish habitat, and the environment.

Despite the fact that effluent quality from pulp and paper mills has improved substantially and the level of compliance with PPER has been high, pulp and paper mill effluent has been shown to pose a risk to fish, fish habitat, and the environment. For example, 99.9 percent of BOD and SS samples from the 77 mills directly depositing effluent to water bodies were compliant with the PPER in 2015. However, EEM studies demonstrated that effluent from 70% of pulp and paper mills are impacting fish and/or fish habitat, and 55% of these effluent deposits pose a higher risk to the environment (ECCC, 2017). To address these findings, the proposed updates to the PPER include:

- Reductions to BOD and SS discharge limits;
- Setting limits for phosphorous and nitrogen discharge to reduce nutrient enrichment;
- Setting effluent temperature limits to protect fish-bearing waters;
- Setting discharge limits for chemical oxygen demand (COD); and

- Setting pH range limits (ECCC, 2017).

The PPER are also being updated because the pulp and paper industry is diversifying to include bio-products (e.g. bio-fuels, bio-chemicals, and nanomaterials derived from wood) and the PPER only apply to traditional pulp and paper products. Stand-alone bio-product facilities would instead be subject to the *Fisheries Act*, which could create regulatory uncertainty in the industry (ECCC, 2017). Proposed updates to the PPER to manage bio-product impacts to the environment include setting limits for new deleterious substances (e.g. nitrogen and phosphorus) and lowering BOD and SS limits (ECCC, 2017).

> **Recommendation 3.1:** Environment and Climate Change Canada has proposed updates to the PPER, to account for changes in the pulp and paper industry, as well as to address findings from EEM studies indicating that the PPER do not adequately protect fish, fish habitat, and the environment (ECCC, 2017). NPNC must address whether or not the effluent from the Project will meet the requirements of the proposed updates to the PPER.

Issue 3.2: It is unclear in the EA document if the proposed ETF plant design using BAS™ technology will be able to meet more stringent discharge regulations being considered in proposed revisions to the *Pulp and Paper Effluent Regulations* which have a target publication date of 2021. Changes being considered in the revised PPER include reductions to current BOD and SS discharge limits in addition to setting allowable discharge limits for phosphorus, nitrogen and chemical oxygen demand (COD) that are not within the current PPER regulation.

The EA outlined that visits to two pulp mills in Sweden that operate Veola BAS™ wastewater treatment plants *"confirmed that the proposed Veolia BAS™ treatment system will provide the required treatment needs for NPNS to meet current and anticipated future regulations." (Section 4.2.1, p.29).* No further information was provided in terms of effluent quality at these mills, or regulatory requirements for discharge water quality at these locations.

In Section 5.2.2, p.40, it is stated *"The ETF is designed to treat the NPNS effluent to meet the Pulp and Paper Effluent Regulations before entering the transmission pipeline and exiting NPNS property."* No reference is made here to potentially more stringent water quality objectives that will have to be met under a revised PPER in 2021.

> **Recommendation 3.2:** More information should be provided on the data collected in the lab trails conducted in Fall 2018 on the NPNS effluent and site visits to the two Kraft mills in Sweden using BAS™ technology in terms of specific water quality data (BOD, TSS, P, N & COD) and relevant regulations (current and proposed).

Issue 3.3: The proposed ETF with BAS™ technology is outlined in the EA to be able to "*provide a more reliable facility by protecting the AS system from upset conditions, reduce nutrient consumption, and allow for low effluent total phosphorus (TP) and total nitrogen (TN), and improve the AS effluent sludge settling characteristics*." (Section 5.2.2.1, p.40). There is no consideration given within the treatment technology assessment and selection related to the non-biodegradable organic fraction within the pulp mill effluent that would be tied to COD discharge limits that may be proposed in modernized PPER.

Recommendation 3.3: Consideration of the non-biodegradable organic fraction within the effluent should be given, with more specific information on components in effluent that contribute to non-biodegradable fraction of COD, and any other efforts that could be considered in the pulp mill process design to lower COD in the mill effluent prior to biological wastewater treatment.

Issue 3.4: There is no information provided in the EA regarding expectant metal concentrations in the AST effluent. There is metal data provided in Appendix M4 on samples collected in December 2018 and analysis done by Maxxam Laboratories. However, each water quality test report is tied to a sample ID placed by analytical lab; there is no information provided on where these samples were taken.

Recommendation 3.4: More information needs to be provided on metal concentrations in the current ASB effluent (Point C) and metal concentrations expected to be found in the effluent of the proposed ETF.

Issue 3.5: Within the section on Accidents, Malfunctions and Unplanned Events (Section 10), mitigation strategies are proposed that would prevent accidental release of off-specification effluent to the receiving environment. Focus of mitigation would be on identification of potential deviation from standard quality of the mill effluent into the ETF. Daily monitoring of key performance indicators of the ETF is also highlighted to provide response and management to changes of the influent to the ETF.

Recommendation 3.5: More detail should be supplied on (1) what "key performance indicators" will be monitored on daily basis, and (2) what monitoring/testing will be conducted on the influent into the ETF; specifically, what water quality and/or operational parameters will be part of this monitoring/testing framework.

Issue 3.6: Historical effluent impacts from the Boat Harbour Treatment Facility, have been described in the Environmental Effects Monitoring (EEM) Cycle 7 Interpretive Report (Ecometrix, 2016). It is understood that the new treatment facility process differs from that of the Boat Harbour Facility. However, it is unclear if NPNS has assessed the potential (if any) for similar ecological impacts to occur from the proposed treatment facility.

Recommendation 3.6: Historical impacts of the Boat Harbour Treatment Facility are of major concern. NPNS must clearly outline how the proposed effluent treatment facility will be designed and operated in a way that will mitigate the potential for similar environmental impacts to occur.

3.2 Effluent Modelling

3.2.1 Summary of EA Content

The EA document does not convey a description of the effluent modelling methodologies or studies through the main text. The effluent modelling work is referred to in the text in very few sections and for the most part often referred to as Appendix E. This Summary of EA Content section provides the limited EA content main text related to the effluent modelling. The effluent modelling studies for Northern Pulp

Effluent Treatment Facility Replacement Project (i.e., Preliminary Receiving Water Study [Stantec 2017] and the Addendum Receiving Water Study [Stantec 2018]) were reprinted as Appendix E3 and Appendix E1 respectively in the whole EA document.

What is known from the effluent modelling work in the entire main text is mostly contained in the Executive Summary. "Water quality has been assessed through modelling of the treated effluent discharge. Through the analysis it has been determined that under 'worst case' conditions water quality at the end of the mixing zone for the three-port diffuser will reach ambient conditions within less than 2 m from the diffuser in terms of total nitrogen, total phosphorous, TSS, DO, pH, and salinity. Colour will return to baseline conditions within 5 m of the diffuser. Temperature will be within 0.1 °C of background at the end of the 100-m mixing zone." The same text is reprinted in Response to Key Issues identified Section 6.7, Table 6.7-1, 9th page.

The Effluent Quality section (5.2.2.9) briefly mentions that a maximum rate of 85,000 m^3/day was used in the analysis of effluent plume dispersion, representing a worst-case scenario. The annual average flow is predicted to be 63,600 m^3/day. Table 5.2-1 provides the anticipated daily maximum effluent quality and is reprinted from Appendix E3. (The same table is repeated as Table 5.6-1).

Also, the Outfall and Diffuser section (5.2.4) briefly mentions that the "diffuser pipe will be 50 m long, with three outlets ('port') spaced 25 m apart. Each port will be 0.3 m diameter connected to a 1.0 m tall riser pipe with an elastometric duckbill check valve opening at the end. The outfall will be capable of conveying discharge up to 85,000 m^3." (Note: m^3 is in fact m^3/day). It is reported that "The spacing and sizing of ports for the diffuser will achieve an approximate 144:1 dilution ratio". It does not say that the 144:1 dilution ratio is at a 100 m distance from the diffuser (important modelling constrain and CCME requirement). Overall, there was no mention that the above engineering/marine sciences, in regard to the outfall diffuser, was calculated from the effluent modelling studies presented in Appendix E.

The Valued Environmental Component (VEC); Harbour Physical Environment, Water Quality and Sediment Quality section (7.2) is presented in Table 7.4-1, which is of interest to regulatory agencies, the public, stakeholders and First Nations. Also, it is noted that no field work was conducted in this study and that all the information used for this VEC (and the effluent modelling work) was derived from the available literature and other studies. Therefore, all the information is from different perspectives, locations, years, seasons, months, etc.

In the Harbour Physical Environment, Water Quality and Sediment Quality section (8.11), potential effects are provided with an overview of existing environmental conditions in the Northumberland Strait and Caribou Harbour (the location of the effluent outfall), as well as Pictou Harbour. The latter location is used for its existing studies on water quality "in the absence of water quality data for Caribou Harbour" (section 8.11.1). Effluent modelling results are presented in the Characterization of Residual Effects section (8.11.3.3), under Operation and Maintenance (Page 350). The text in this section is repeated from the Executive Summary paragraph mentioned above. It concludes that "Any effects due to the discharge of treated effluent would be localized at the diffuser as the three-port diffuser and the high currents present in Northumberland Strait will aid in dispersion of treated effluent. Thus, significant

residual effects to water quality or sediment quality … are not likely." While these conclusions are based on the CORMIX modelling for near- and far-fields, it is not mentioned other than referring to Appendix E. The same applies for the Mike 21 far-field modelling results, which are the cumulative effects after a one-month simulation period of effluent discharge from the outfall location CH-B off Caribou Point. However, "results indicate that there are few traces of relatively high diluted effluent after a period of 30 days." The last paragraph reads "The modelling of the plume dispersion used very conservative assumptions, including maximum daily effluent flow rate for 30 days, summer conditions with lower wind speeds, waves and warmer ambient temperatures that are not favourable for plume mixing, and no decay of effluent quality, which represent an exaggerated condition where normally some decay is expected to occur."

Under the Follow-up and Monitoring section (8.11.5), it is noted that NPNS will conduct an EEM program for future effluent outfall in Caribou Harbour and is referenced to Appendix G only.

In brief, the above paragraphs are the extent of the EA main text content regarding effluent modelling, with annotations.

3.2.2 Evaluation & Recommendations

Issue 3.7: Appendices E1, E3, G and H, which relate to effluent modelling are lacking integration with the EA main document. The content of the EA main document is difficult to accept because of the absence of this important information. Additionally, reference to this information are few to none. This is apparent from the Summary of EA Content provided above.

> **Recommendation 3.7:** Summary information should be provided in the main EA text on both the Preliminary Receiving Water Study and the Addendum Receiving Water Study. This information should be tied directly with the information provided in the main EA text. How Mike 21 and Cormix models were used should be clearly stated in the main EA text.

Issue 3.8: There is a lack of field work, particularly in obtaining new water quality data and a field verification of water column non-stratification in winter and summer, as input to customize the hydrodynamic models (Mike 21 and CORMIX) for the CH-B location of the future effluent outfall. It is understood that the modelling aspect was performed with considerable professional judgment. However, the use of the water quality information available from Pictou Harbour (taken from several sources published in different years and from different locations), as a proxy to the Caribou Harbour data, brings considerable doubt to the validity of the studies and main EA text (e.g.,Table 5.2-1 or 5.6-1). To have a so-called "conservative approach" is important, nonetheless a reliable and convincing data set on water quality for the study is essential.

> **Recommendation 3.8:** NPNS must rovide a water quality study for the CH-A and CH-B locations and other related areas, including Caribou Harbour and the surroundings of Pictou Island based on numerous sampling stations. As part of this study, one or two reference areas should be considered with several sampling stations.

Issue 3.9: In view of the issues above (Issues 1 and 2), there is no mention in the EA main text that future field work and data collection will be performed to verify the hydrodynamic modelling results of the effluent mixing and dispersion. Under the Follow-up and Monitoring section (8.11.5), it is only noted that NPNS will conduct an EEM program at the effluent outfall diffuser, with reference to Appendix G. Once again, the main text does not convey a brief description of what the follow-up and monitoring entails. It entails a full EEM characterization of effluent plume which will be performed using the CORMIX model during summer and winter conditions, flood and ebb currents and slack tides, with field confirmation using Rhodamine WT. It is of great interest to regulatory agencies, the public, stakeholders and Indigenous Communities to be aware of the up-coming work. In addition, NPNS states that biological monitoring will be performed to include water and sediment quality sampling, as well as benthic invertebrate community and fish population sampling to assess conditions and health over time.

> **Recommendation 3.9:** Provide a brief description in Section 8.11.5 of what the Follow-up and Monitoring Program entails.

3.3 Marine Fish and Aquatic Habitat

3.3.1 Summary of EA Content

The EA describes marine fish and fish habitat in the context of consideration of the ecological value provided to marine ecosystems, the socio-economic importance of fisheries resources and potential interactions with the Project and project activities on marine fish populations. Marine fish are protected under the federal *Fisheries Act*, which includes provisions to protect the productivity of, and prevent "serious harm" to, commercial, recreational, and Aboriginal (CRA) fisheries.

Marine fish, and their habitat, are closely linked to the surrounding physical environment, as well as water and sediment quality, all of which could be impacted by the proposed Project. The main fisheries of importance, as described in the EA, include lobster, sea scallop, herring and rock crab, among other lesser species fished. The Northumberland Strait is a known migration corridor for many species (Rondeau et al. 2016). Commercially important species known to occur in the marine local assessment area (LAA) include rock crab, lobster, sea scallop, herring, mackerel, and tuna.

American Lobster, *Homarus americanus,* is caught throughout the central and eastern portions of the Northumberland Strait. Lobster habitat overlaps with both the proposed route of the effluent pipeline and the location of the marine outfall. American Lobster stock status reports provided by DFO (2013) in the southern Gulf of St. Lawrence show that the Northumberland Strait is a secluded system based on larval recruitment compared to the rest of the southern Gulf of St. Lawrence. With respect to lobster larval transport, eggs that are released are reliant on the current within the Northumberland Strait for transport and have a period between 3- 12 weeks in which the larvae's destination is a result of the direction of the current (Chasse and Miller, 2010). Lobster larvae are retained in the Northumberland Strait for up to 120 days, with some individuals actually settling west of where they were released rather than east. These locations indicate specific circumstances where there are east-to-west currents, some of which have been known to last days to weeks in duration (Hanson and Comeau 2017). The complexity

of larval transport within the Strait highlights the relationship that exists between the provinces in relation to the lobster fishery.

Herring is caught along the shoreline of New Brunswick and Nova Scotia in the Northumberland Strait,

including the Pictou area. There is overlap with herring fishing and the location of the marine outfall. Concern has also been raised about the effects of the marine effluent pipeline on herring spawning from the commercial fishing industry (PEI Standing Committee on Agriculture and Fisheries, 2018). Herring stocks are currently of concern to DFO, and attempts are being made to manage this fishery to avoid becoming at risk in the area (PEI Standing Committee on Agriculture and Fisheries, 2018).

Marine fish can be affected by activities and components of the Project during construction, operation and maintenance phases. The Project has the potential to impact marine fish populations and fish habitat (e.g., adult fish, juveniles, eggs and larvae, invertebrates and marine plants) directly through injury and mortality, or indirectly through the alteration or destruction of their habitat. The current environmental assessment of marine fish is focused on changes in marine fish populations, which includes any physical injury or mortality on fish that is attributable to the Project, and any destruction or alteration of habitat from disturbance of the marine environment.

The EA states that project-related construction, operation and maintenance activities may result in adverse environmental effects such as changes to marine fish habitat and fish populations in the PFA. The proponent claims that it is not anticipated that changes would extend beyond the PFA and that any changes in fish habitat would persist only over the life of the Project and not beyond. The potential change in fish populations is attributable to direct and indirect disturbance/change of habitat and increased mortality risk.

3.3.2 Evaluation & Recommendations

Issue 3.10: The *Fisheries Act* focuses on protecting the productivity of CRA fisheries including a prohibition against causing “serious harm” to fish that are part of or support a Commercial, Recreational, Aboriginal (CRA) fishery (Section 35 of the *Fisheries Act*) and proponents of projects that cause serious harm to fish are required to offset that harm to maintain and enhance the productivity of the fishery. The deposition of a deleterious substance is also prohibited under Section 36(3) of the *Fisheries Act*.

Overall, the EA approaches the assessment of impacts to fish and fish habitat with very limited analysis and examines project activities in the context of “Serious Harm” as described in the Fisheries Act, as opposed to going beyond the limited provisions of the current version of the Fisheries Act. The provision of Serious Harm has been widely regarded as providing limited protection to fish habitat and does not account for all impacts to fish or fish habitat.

> **Recommendation 3.10:** In the interest of assessing the impacts to fish with the highest level of scrutiny and precaution, in our professional opinion, it is recommended that the Proponent should approach the EA with an analysis that goes beyond the provision of Serious Harm to a

shift in focus on avoiding harmful alteration, disruption or destruction (HADD) of fish and fish habitat. This approach is being contemplated proposed *Fisheries Act* amendments under Bill C-68. Given the high level of concern from fisheries groups regarding harmful alteration, disruption or destruction (HADD) of fish and fish habitat of the Northumberland Strait, and the potential adverse effects of the Project, NPNS must assess the proposed activities and design of the Project in the context of HADD avoidance. This approach enhances the measures described within the EA.

Issue 3.11: *Section 5.2.3.1 – Land-based Pipeline Portion:* The land-based pipeline portion extending from NPNS property to the edge of shore at Caribou Harbour will be approximately 11.4 km in length. The pipeline will be buried for the majority of the route. Based on the proposed design, there will be one area where the pipeline will be exposed and will cross the spillway of the Pictou Causeway, where it will be suspended and attached to the exterior of the bridge due to limited roadway width. The exposed area will be protected from damage by existing guide rails.

The EA does not describe the protections or safeguards that will go into an aerial or exposed stretch of pipeline along the causeway. It does not appear that NPNS has considered the impacts of effluent release spills that do not reach the diffuser. Very limited information is provided in terms of spill response or emergency planning. Should a spill event occur at the aerial location, effluent could be released into the harbour prior to reaching the diffuser and could cause adverse impacts to fish and fish habitat.

> **Recommendation 3.11:** NPNS needs to provide more detail on spill response and safeguards against potential accidents or malfunctions along the terrestrial portion of the pipeline. Without this information, it is unclear how the Minister can make an informed decision regarding whether adverse effects or significant environmental effects may be caused by the undertaking and whether these effects can be mitigated.

Issue 3.12: The EA states that a significant adverse residual environmental effect on marine fish and fish habitat is one where project related activities cause a significant decline in abundance or change in distribution of a marine fish population within the Northumberland Strait. One such change would be that natural recruitment may not re-establish the population to its original level within one generation. However, NPNS also states that no field work was conducted as part of this EA. Without understanding the current larval lobster population, there could be five to seven years of impacts that would go undetected until the current cohort reaches maturity.

> **Recommendation 3.12:** In our professional opinion, A comprehensive multi-year baseline study on all marine species present within the Northumberland Strait must be completed in order to understand potential adverse impacts that may result from project activities. Robust studies are required to better understand each species, and the potential impacts the Project could have on each. This type of baseline study is the foundation of an EA, especially one focused on a project that has the potential to cause serious environmental impacts.

Issue 3.13: The EA states that the main commercial, recreational and aboriginal fisheries are lobster, sea scallop, herring, mackerel and tuna. Beyond those species identified in the EA, the Northern Pulp EA

failed to mention Atlantic halibut, soft shell crab, American eel, gaspereau and silver sides. A complete list of species fished should have been composed with actual field-based studies and research concluded on their tolerance ranges, sensitivities and how different contaminants in the effluent could negatively affect that species. Each individual species has a different mechanism for expelling toxins from their body, thus comparing one species to another does not provide and accurate assessment of impacts.

> **Recommendation 3.13:** In our professional opinion, a more detailed environmental assessment that considers all potential fisheries in the Northumberland Strait needs to be completed to adequately assess project impacts. The EA should consider every species fished commercially in the area and should look at sensitivities of all of those fish to changes in water quality and negative health effects of contaminants

Issue 3.14: *Section 5.3.1 – Construction Phase:* The EA states that throughout project construction, environmental monitors will enforce construction specifications and site-specific environmental mitigation measures that are proposed for the Project's Environmental Management Plan (EMP). The EA states that a series of plans and guidance documents such as an Waste Management Plan (WMP), an Environmental Protection Plan (EPP), and an Emergency Response and Contingency Plan (ERCP) will be incorporated into the EMP. Applicable best practices, restrictions and details from the EMP will be included in the construction drawings so that construction methodology is in compliance with the EMP. The Proponent has not adequately addressed many construction-related issues in the EA that may have significant consequence to the aquatic environment. A robust Environmental Protection Plan will be imperative to minimize and address an impacts from construction.

> **Recommendation 3.14:** The Environmental Management Plan and the Environmental Protection Plan must be completed and circulated for review and consultation with stakeholders prior to the Project being approved. The Project should not be approved until all stakeholders have been consulted on all environmental protection measures within the Environmental Management Plan.

Issue 3.15: *Section 5.3.1 – Construction Phase*: As part of construction of the proposed Project, the effluent pipeline will "cross" watercourses and wetlands. The proposed Project does not intend to include in-watercourse or in-wetland crossings. Rather, at potential "crossing" locations of watercourses or wetlands, those sensitive environments will be avoided, where technically feasible, by adjusting the alignment toward the center of the road. In some cases, an alternate approach may be used to go under the watercourse/wetland. There are a number of freshwater fish species that occupy or use the watercourses along the pipeline route. Atlantic salmon, spawn in a number of the watercourses crossed by the pipe. It is unclear in the EA how the Proponent intends to complete these watercourse crossings along the terrestrial portion of the pipeline. The EA states that they will adjust the alignment of the pipe to "the centre of the road" to avoid instream work. This plan is not clear in the drawings provided within the EA Registration documents. The construction of the pipe over and around these watercourses is of major concern and must avoid disturbance and/or disruption of fish life cycle.

> **Recommendation 3.15:** The proponent must provide more detail on what is meant by moving the alignment to the centre of the road, and on which watercourses, in particular, they intend to carry this out.

Issue 3.16: *Section 5.3.1 – Construction Phase*: For watercourse crossings along the pipeline route, the option of using a Horizontal Directional Drill (HDD) is proposed to avoid in-water works. It is stated in the EA that the technical feasibility of an HDD installation is determined by the distance to be drilled, the diameter of the pipeline, and the subsurface conditions. However, it is also stated in the EA, that geotechnical information has not be gathered in order to determine whether HDD is feasible at the various crossing locations. Inconsistent bedrock and overburden conditions present impediments to the use of HDD technology. Without a comprehensive geotechnical assessment of the crossing locations that are proposed to be drilled, issues can arise when carrying out the HDD. In particular, without understanding the substrate that is to be drilled, the possibility of an inadvertent release of drilling fluid (frac) may occur. Fracs are highly impactful to fish and fish habitat as they may result in the release of large plumes of drilling fluid that can kill fish and can cover or destroy fish habitat both in the watercourse and in the marine environment.

> **Recommendation 3.16:** In our professional opinion, geotechnical assessments must be completed and reviewed by project stakeholders. This information is required before the Minister can make an informed decision on all potential impacts of the Project.

In addition, the Environmental Protection Plan must address prevention and emergency response related to horizontal directional drilling.

Issue 3.17: *Table 8.12-7: Mitigation Measures to Reduce or Avoid a Change in Marine Fish Populations:* There is no description of how negative impacts resulting from the laying of pipe will be mitigated during the Construction Phase. The mitigation tables merely provide standard measures that have no site-specific relevance on minimizing the impacts of pipe construction in open water. The table states that the duration of in-water work will be managed to the shortest time that is practical. The proposed actions are very unclear and do not outline what is actually practical or feasible. The likelihood of impacting benthic species, as well as mobilizing sediment and increasing turbidity, is very high during construction. Its unclear how NPNS plans to mitigate these disturbances to fish habitat.

The EA does not include sufficient analysis of construction methodologies that would reduce the risk to benthic species, as well as fish species in the area. Elevated levels of sediment and turbidity can reduce the productivity of aquatic systems by decreasing primary productivity. Further, levels of suspended sediment have been determined to be acutely lethal to fish ranging in the thousands of mg/l of TSS while sublethal effects begin in the hundreds of mg/l sediment (Birtwell et al. 1999). The construction of the pipe could result in fish mortality if not adequately mitigated. The EA does not provide a detailed plan to minimize impacts of sedimentation to fish and fish habitat.

> **Recommendation 3.17a:** The EA must provide more details on mitigating benthic disturbance and subsequent TSS mobilization during pipe construction in the Northumberland Strait.
>
> **Recommendation 3.17b:** The EA should examine the possibility of HDD drilling to facilitate the placement of the pipe into the Northumberland straight. HDD could reduce the risks of in-water works that could significantly impact fish and benthic communities.

Issue 3.18: The EA states that routine effluent discharge from the effluent outfall diffuser will cause a project-related change in water quality. The treated effluent will contain water quality parameters of concern including absorbable organic halides (AOX), total nitrogen (TN), total phosphorus (TP), color, biochemical oxygen demand (BOD), total suspended solids (TSS), dissolved oxygen (DO), pH, and water temperature. Potential effects of the effluent, as presented in the EA, could result from an increase in temperature, nutrients (nitrogen and phosphorus), and/or TSS, a change in color, chemical and BOD, DO, and/or pH; and/or a reduction in salinity from the discharge of relatively freshwater effluent into the Northumberland Strait.

The discharge of effluent containing elevated levels of TSS could also cause a change in sediment quality near the diffuser due to settlement of suspended sediment. A change to any of these parameters can have detrimental effects on the fisheries. The EA does not provide a detailed analysis of species-specific limits and tolerances with respect changes in water and sediment quality as a result of effluent discharge.

Further, the Pulp and Paper Effluent Regulations only stipulate the monitoring of a few parameters and are not always protective of the aquatic environment (ECCC, 2017). In fact, Environment and Climate Change Canada is currently reviewing the regulations to address such issues (ECCC, 2017).

> **Recommendation 3.18a:** The EA must outline species-specific limits of tolerance with respect to the above parameters described as well as upper and lower limits for toxins specific to mill effluent. A robust assessment of how changes to the marine environment, and the discharge of effluent contaminants, impact species inhabiting the area must be completed in order to understand impacts of the proposed Project.
>
> **Recommendation 3.18b:** The proposed changes to the PPER must be considered when addressing the species-specific effects including a quantitative evaluation of the impact of the proposed changes on the assumptions and conclusions of the EA.

Issue 3.19: The description of the existing physical environment conditions of water and sediment quality within the LSA is based on the results of previous research and existing scientific literature and environmental assessments. No field work was conducted as part of this EA Registration. This is a major data gap identified in the EA. It is unclear how potential impacts related to the Project will be characterized without a robust understanding of current baseline conditions.

> **Recommendation 3.19:** In our professional opinion, a project of this magnitude warrants comprehensive field work investigations to be completed. NPNS should conduct a comprehensive baseline assessment to characterize current conditions of the marine environment within the project assessment area, including sediment and water quality.

Issue 3.20: Pictou Harbour was used as a proxy for Caribou Harbour with respect to evaluating water quality, in the absence of available water quality data for Caribou Harbour. The EA only provides an overview of water quality sampling in Pictou Harbour in 1990, 1995 and 1998 (Dalziel et al. 1993; JWEL 1996) with no actual current or historical data from the proposed location at Caribou Harbour. The EA relies on data that are roughly 30 years old to make assumptions on the potential impacts to marine life

from the current Project. The EA registration documents lack of representative and current water quality data is a major gap.

> **Recommendation 3.20:** The proponent should collect and analyze current water quality data, from the proposed outfall location, in order for the EA to adequately assess impacts to the water quality from the Project, and to adequately plan for preventing or mitigating those potential impacts.

Issue 3.21: NPNS did not undertake field work to gather relevant data for sediment characterization at the proposed outfall location. NPNS relied, instead, on sediment data that are roughly 30 years old. As well, the EA presents metal concentrations in sediment samples collected in Pictou Harbour in 1993. Without current baseline information to inform the EA, it is not possible to understand the potential impact of the Project on sediment quality. Not having representative and current sediment quality data to inform the EA is considered to be a major data gap in the assessment.

> **Recommendation 3.21:** NPNS must collect current and relevant data on sediment characterization at the proposed outfall location.

Issue 3.22: *Section 8.12 Marine Fish and Fish Habitat:* Herring stocks are currently of concern to DFO, and attempts are being made to manage this fishery to avoid becoming at risk in the area (PEI Standing Committee on Agriculture and Fisheries 2018). Herring spawn between August and October in the southern Gulf of St. Lawrence, and DFO has identified fall spawning grounds for herring in the eastern Northumberland Strait. Currently, the fall spawning stock is in the critical zone and the spring spawning stock is in the cautious zone (DFO, 2018a). The EA states that concern has been raised about the effects of the effluent on herring spawn, however, the main fisheries in the LAA considered in the assessment are scallop and rock crab. There is no mention of what NPNS is doing to mitigate the potential risks to herring spawn due to the project. In addition, field or lab work has not been completed to address this potential risk and concern.

> **Recommendation 3.22:** Proper research needs to be completed to understand possible effects of the effluent on herring spawn, including sub-lethal effects. A rebuilding plan for herring is currently being developed to ensure the regrowth of the stock, and therefore any potential impacts to herring spawn must be fully considered in the EA.

Issue 3.23: *Section 8.12 Marine Fish and Fish Habitat:* The EA reports that mackerel is caught along the coast near the LAA, although most fishing occurs in the central and western portions of the Northumberland Strait. There is only one comment about mackerel in the EA, thereby demonstrating a lack of robust analysis regarding impacts. There is no mention of mackerel life stages or occurrence in the LAA. Data shows that the only key spawning area in Canada is the Southern Gulf of St. Lawrence and that surveys conducted on mackerel eggs are present in the East end of the Northumberland Strait (DFO, 2017) (Figure 6).

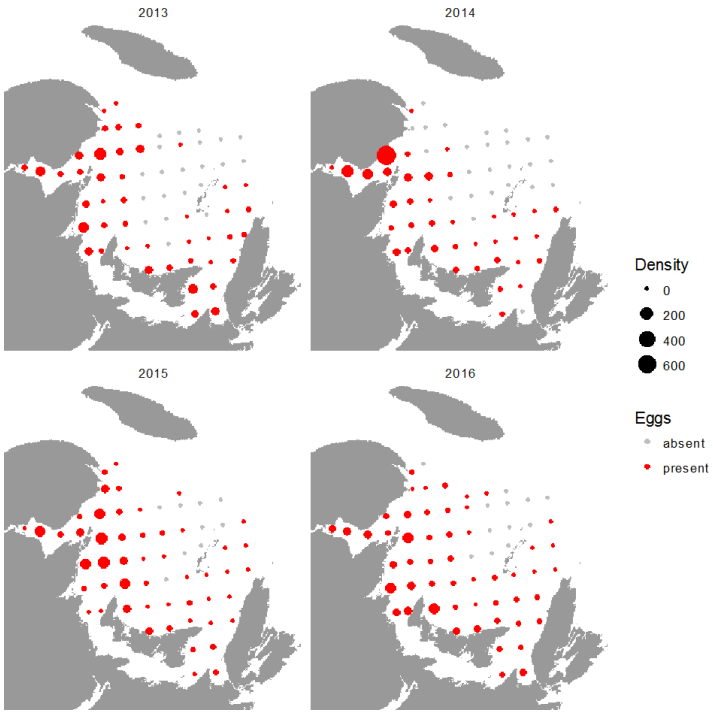

Figure 6. Distribution of Mackerel Egg (Stages 1 and 5) Densities (n/m2) Measured in Surveys in the Southern Gulf of St. Lawrence from 2013 to 2016 (DFO, 2017)

> **Recommendation 3.23:** Research must to be completed to understand possible sub-lethal effects of the effluent on mackerel eggs. Currently, the stock is in the critical zone (DFO, 2017) and a rebuilding plan is being developed to ensure the regrowth of the stock. The EA must clearly assess how potential impacts from the Project could affect stock regrowth.

Issue 3.24: *Section 8.12 Marine Fish and Fish Habitat:* Table 8.12-6 of the EA lists marine fish Species at Risk and Species of Conservation Concern with potential to occur in the LAA. This EA table lists American eel, American plaice, Atlantic bluefin tuna, Atlantic cod, Atlantic salmon, lumpfish, porbeagle, spiny dogfish, striped bass, and white hake, but does not list Atlantic sturgeon. This is another significant data gap in NPNS EA. There are two species of Atlantic sturgeon in Canada and both are listed as threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and are known to exist within the Northumberland Strait (COSEWIC, 2011).

> **Recommendation 3.24:** Atlantic sturgeon must be considered in the assessment, and potential impacts to the species identified. Once again, the Minister must consider '*potential and known adverse effects or environmental effects of the proposed undertaking, including identifying any effects on species at risk, species of conservation concern and their habitat'* (Nova Scotia Environment, 2018).

Issue 3.25: The Gulf of St. Lawrence (GSL) American lobster is of high value in the region, with 33,000 mt of lobster worth $445 million landed in 2016, and abundance indices still increasing throughout the Gulf (DFO, 2019a). The value of American lobster is not mentioned in the environmental assessment

submission. Lobster biomass is increasing as efforts have been taken toward voluntary management changes. It should also be noted that conditions like water temperature can impact the distribution of lobster and their catches (DFO, 2013). This is extremely important to the fishers in the area of the outfall considering the temperature being released will be above the average background water temperature when released to the Strait.

At this time, there have been no field trials or lab tests by NPNS to prove that they will not be jeopardizing the lobster fishery. Considering the significant value of lobster in the Gulf (worth $445 million in 2016), proper scientific research needs to be conducted on the potential impacts to the lobster and lobster fishery. The EA relies on desk top research and literature based on dated, 40 year old research.

> **Recommendation 3.25:** As stated in Appendix R of NPNS's EA Registration documents, it is recommended that more research be completed on the effect of the effluent on lobster in each life stage. It is important to highlight that the recommendation given in Appendix R regarding more research on the effect of effluent on lobster must be followed through and completed. It is unclear how the Minister will determine if the following has been addressed in the EA (as outlined in Nova Scotia Environment, 2018), given the lack of a robust consideration of lobster in the assessment:

Issue 3.26: *Section 8.12 Marine Fish and Fish Habitat:* Figure 8.12-5 of the EA presents scallop catch weights from 2010-2014 in the Northumberland Strait, where there is an overlap of the route of the pipeline and at the outfall location. Since 2014, a Scallop Buffer Zone in Scallop Fishing Area (SFA) 24 prevents scallop fishing in this area, except potentially at the location of the outfall. Sea scallops will normally grow in water between 8°C and 18°C; ideal temperature for growth is 13.5°C. Ideal salinity is between 30 to 32 ppt but they can tolerate salinities as low as 25 ppt. Sea scallops are prone to being stressed in environments outside of their normal ranges. They can get stressed at temperatures between 20°C and 23°C and mortality will occur at temperatures of 23.5°C and greater. Water temperatures will be affected by the effluent and will not reach background levels until 100 m from the outfall site. The proposed effluent release will be 26°C in the winter and 37°C in the summer. These temperatures are much higher than mortality-causing temperatures for the sea scallop.

> **Recommendation 3.26:** Detailed field assessment on the sea scallops that inhabit the area near the proposed outfall location must be completed prior to the release of the proposed effluent to ensure there will be no negative effects on the sea scallops. Otherwise, it is unclear how the Minister will be able to determine if adverse effects or significant environmental effects are likely to occur.

Issue 3.27: *Section 8.12.2.5:* NPNS have not completed any scientific field work or a comprehensive assessment of the impacts of the effluent on lobster larvae. NPNS has merely relied on a literature review (Appendix R), in the EA, to make an assumption on the "limited impacts" to lobster and lobster larvae. Further, the review of scientific literature related to the effect of BKME on American lobster (*Homarus americanus*) is mainly related to a small number of lab studies conducted in the 1960's (Sprague and McLees, 1968a 1968b). The limited literature on the subject, coupled with the lack of field

assessments, or detailed analysis of the impacts, indicates that NPNS is unable to conclude what the potential impacts will be to lobster and lobster larvae. A few studies suggest that sublethal effects of chemicals on lobster energetics may occur under laboratory exposure conditions (i.e., concentrations and duration) considered environmentally relevant, that might not be detected through the standard toxicology approaches (alive/dead animal as the only output measured). These physiological changes could result in great impairment under natural conditions (Sprague and McLees, 1968a 1968b). The information provided in the EA is insufficient to conclude whether or not adverse effects will occur to lobster larvae should the Project proceed.

> **Recommendation 3.27:** Detailed field and lab work must be carried out as part of a comprehensive EA that assesses and quantifies sublethal, chronic and cumulative effects on lobster larvae. The level of stakeholder concern regarding lobsters warrants the need for increased scientific understandings and fulsome assessment of impacts, in order for the Minister to make an informed decision regarding potential impacts of the Project to lobster.

Issue 3.28: NPNS has stated that they have attempted to engage commercial and Pictou Landing First Nation (PLFN) fish harvesters to obtain fisheries data in the area of the marine outfall; however they suggest that there was little interest from the fish harvesters to participate or provide any data. This comment is of concern to local harvesters as they did engage in discussions surrounding fishing grounds and it was made clear to NPNS that if there is water, there is fishing. Harvesters maintain their traditional grounds, but they consistently explore other areas outside as well.

> **Recommendation 3.28:** Individual species cannot be pinpointed to specific locations within the Northumberland Strait. Again, they do have traditional habitat and areas they are commonly found, but individuals are not restricted to these areas only. The ability, and likelihood, of each species to move throughout the Northumberland Strait must be considered and accounted for in a robust environmental assessment.

Issue 3.29: *Section 8.12 Marine Fish and Fish Habitat:* Rock crab is another species of extreme importance in the Northumberland Strait, both for its commercial value and its position in the food chain. According to the DFO, American lobster is largely carnivorous and decapods are the principal prey (57% to 84% of prey biomass), with rock crab being the single most important component of the lobster diet (45% to 78%) (DFO, 2019a). As such, a decline in the rock crab biomass could also be detrimental to the lobster biomass. While the majority of the commercial fishery for rock crab occurs in the central and western portions of the Northumberland Strait, there are areas in the eastern portion where rock crab is harvested, including Caribou Harbour where there is overlap with the proposed marine route of the effluent pipeline. The current EA does not consider how a potential decline in a prey species such as rock crab may have a detrimental impact on other commercially important species like lobster.

> **Recommendation 3.29:** The Northumberland Strait must be also assessed as an interwoven and interdependent ecosystem, not only on an individual species by species basis. NPNS must consider these ecosystem impacts in a more comprehensive and robust environmental assessment. Otherwise, it is unclear how the Minister will be provided with sufficient information to make an informed decision about the likelihood of adverse impacts.

Issue 3.30: *Section 8.12.5 Marine fish and fish Habitat Follow-up and Monitoring, Appendix H and G:* As stated in the Environmental Effects Monitoring Program Proposed in Appendix H, completed by Ecometrix and according to the PPER, biological field monitoring studies are recommended to consist of evaluations of benthic invertebrate community condition, fish population health, and dioxins and furans levels in fish tissues. For benthic invertebrates and fish health, the requirements to conduct field studies are only conditional on the spatial extent of the effluent plume in the receiving environment:

A study respecting the benthic invertebrate community, if the concentration of effluent in the exposure area is greater than 1% in the area located within 100 m of a point of deposit of the effluent in water.

A study respecting the fish population, if the concentration of effluent in the exposure area is greater than 1% in the area located within 250 m of a point of deposit of the effluent in water.

In the EA. a statement is made that the mill is only required to implement the field survey programs once it has begun to discharge effluent from the new proposed outfall location and that there is no statutory obligation as defined in the PPER to complete field surveys prior to this time.

> **Recommendation 3.30:** Despite the PPER regulations, given the high level of concern expressed by the public and harvesters, a biological monitoring program should be implemented prior to final commissioning of the proposed treatment plant and effluent outfall. The collection of this baseline information will significantly strengthen the interpretive power of the biological monitoring program as a whole. This baseline information will allow the biological monitoring program data to be analysed in a BACI (Before-After-Control-Impact) framework so that potential effluent related effects can be considered both spatially (i.e., exposure vs. reference) and temporally (i.e., pre-discharge vs post-discharge) .

Issue 3.31: *Section 8.12.5 Marine fish and fish Habitat Follow-up and Monitoring, Appendix H and G:* With respect to the scheduling of monitoring, the Benthic Invertebrate Community Assessment and Fish Population Health Assessment are not required through PPER to be completed in a pre-discharge survey. Further, post-discharge surveys are only being recommended to be performed within 24 months of the initiation of discharge from the new outfall location.

> **Recommendation 3.31:** Again, despite the PPER regulations, in our professional opinion, and due to the high level of concern expressed by the public and harvesters, the biological monitoring program should be implemented and remain continuous as soon as effluent is released to the Strait. Considering the level of concern from stakeholders in the region and coupled with the uncertainty of the effluent composition and the limited collection of existing environmental condition data, it is imperative that NPNS implement a robust continual biological monitoring program prior to effluent discharge and that continues through operations.

Issue 3.32: *Section 8.12.5 Marine fish and fish Habitat Follow-up and Monitoring;* As part of the Pictou Harbour Environmental Effect Monitoring (EEM), sublethal toxicity testing was completed on effluent from the stabilization basin that indicated sea urchin fertilization was affected at stabilization effluent concentrations of greater than 12%. The EA does not mention the results of the EEM or to assess the

potential impacts of the new Caribou Harbour project in the context of what has occurred at Pictou Harbour over the operational period of the mill.

Acknowledging that NPNS has stated that the new effluent will be "different" than the old Pictou Harbour effluent, it is still in the interest of all stakeholders to assess the proposed Caribou Harbour Project using a higher-level scientific scrutiny, due to the legacy impacts of the mill over time, such as the sublethal impacts discussed in the EEM. Currently the EA is lacking in the assessment of sublethal effects. The results of lethal and sublethal effects tests can not be directly correlated between species, because different marine species exhibit different degrees of sensitivity to pulp effluent (Sprague and McLeese, 1968).

> **Recommendation 3.32a:** The EA must consider both lethal and sublethal effects of the Project and must go beyond the provision of "serious harm" to incorporate how effects, other then direct mortality, could negatively impact the fisheries of the Strait.
>
> **Recommendation 3.32b:** In addition, analysis and monitoring of lethal and sublethal effects should be carried out independently of one another on locally important species such as lobster, crab, herring and Atlantic salmon.

3.4 Marine Mammals

3.4.1 Summary of EA Content

The NPNS proposed Replacement Effluent Treatment Facility has the potential to adversely affect marine mammals and because of this, they were scoped into the Project consideration through the Marine Mammals, Sea Turtles, and Marine Birds Valued Ecosystem Component (VEC). The spatial boundaries for this VEC include the Marine Project Footprint Area (PFA), which consists of a corridor of approximately 15m-wide and 4.1km-long that begins at the ordinary high-water mark and extends seaward into the Northumberland Strait until the pipelines terminates at the effluent outfall diffuser, and the Marine Local Assessment Area (LAA), which is an approximately 300m-wide and 4.1km-long corridor. The temporal boundaries for this VEC include the construction (estimated to take approximately 21 months following potential EA approval), operation and maintenance (estimated to occur for several decades), and decommissioning phases of the Project.

The description of the existing environment for this VEC was based on the results of previous research and existing scientific literature and environmental assessments, with a significant emphasis on the Environmental Impact Assessment (EIA) for the Prince Edward Island-New Brunswick Cable Interconnection Upgrade Project. For baseline information on marine mammals, in particular, NPNS relies upon data obtained from the Atlantic Canada Conservation Data Centre (ACCDC), Department of Fisheries and Oceans (DFO) and the Ocean Biogeographic Information System (OBIS).

According to the Project EA, the Gulf of St. Lawrence is known to provide habitat for 13 recorded species of cetaceans (e.g. whales and dolphins) and four species of pinnipeds (e.g. seals), ten of which have

been recorded within the Northumberland Strait and the Project LAA. The species of cetaceans known to occur in the Northumberland Strait include Atlantic white-sided dolphins (Gulf of St. Lawrence population), fin whale (Atlantic population), harbour porpoise (Northwest Atlantic population), long-finned pilot whales, minke whales (Atlantic subspecies), sperm whales; and the species of pinnipeds include grey seal, harbour seal (Atlantic subspecies), harp seal, and hooded seal. These species of pinnipeds are determined to occur in the area either frequently or occasionally, whereas most cetaceans are occasional or rare visitors. At-risk species include fin whale, harbour porpoise, and long-finned pilot whale. According to NPNS's EA, North Atlantic Right Whales are not known to occur in the vicinity of the LAA and there is no record of historical observations in the Northumberland Strait, as shown in Figure 7 below.

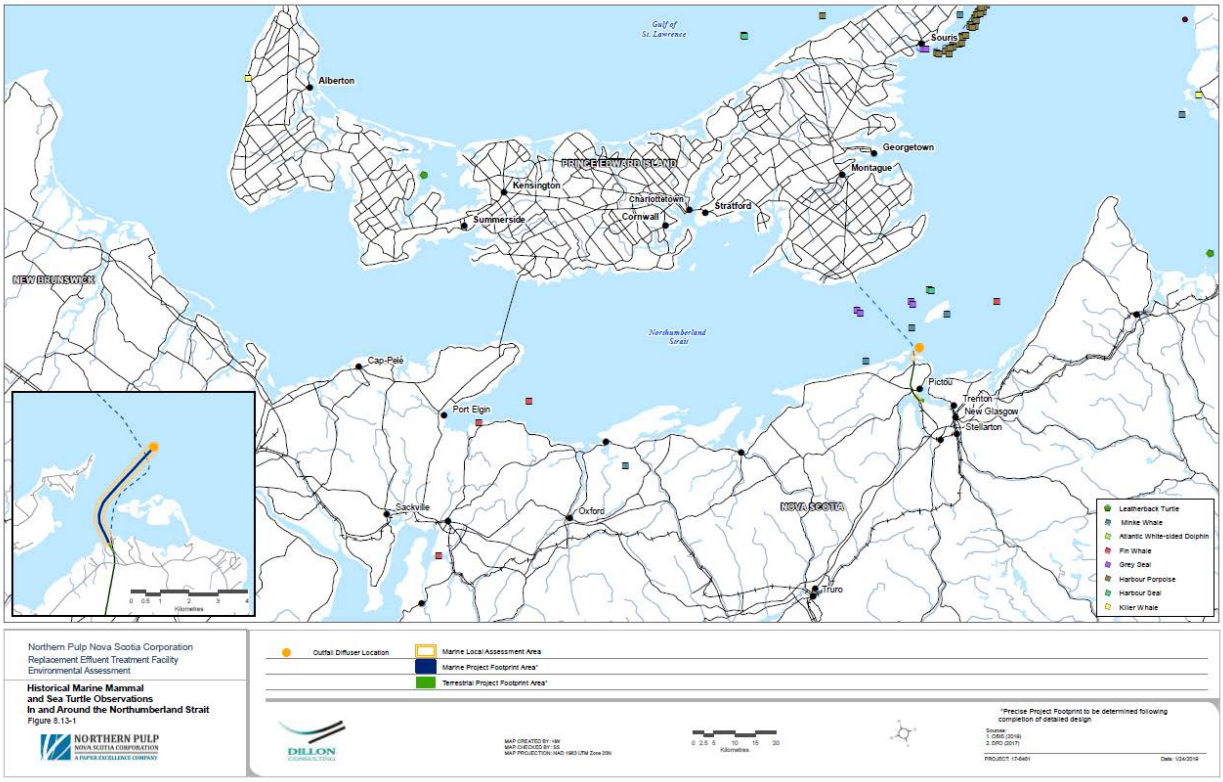

Figure 7. Map of Historical Marine Mammal and Sea Turtle Observations in and around the Northumberland Strait (Source: NPNS Replacement Effluent Treatment Facility EA Figure 8.13-1)

Despite, NPNS's assertion that North Atlantic Right Whales are highly unlikely to be present in the LAA, potential impacts to this species are discussed briefly throughout the effects assessment and considered to a certain extent in mitigation.

NPNS has determined that there is the potential for Project-related activities to result in a change in risk of injury or mortality and a change in habitat quality and use during both the construction and operations and maintenance phases of the Project. Specifically, marine mammals are at risk of injury of mortality due to potential collisions with Project vessels and equipment, potential entanglement in

anchor lines, and potential physical damage due to harmful levels of underwater sound and vibration during marine blasting. Marine mammals could also experience changes in habitat quality and use due to sediment resuspension from seabed disturbance during pipeline trenching and installation, underwater acoustic emissions, and changes in water quality caused by routine effluent discharge from the effluent outfall diffuser.

In order to mitigate these potential adverse effects, NPNS intends to undertake a number of measures including: requiring project vessels to operate a slow maneuvering speeds (e.g. maximum of 10 knots), employing marine mammal observers (MMOs) to monitor and report on marine mammals during marine blasting operations, requiring project vessels to adhere to the general guidelines for vessels operating near marine mammals as outlined in DFO's 2018 Notice to Mariners, minimizing risk of anchor line entanglement by promptly removing them after use and keeping them as taught as possible during use, maintaining buffer distances in the event marine mammals are present near operating Project vessels, and treating effluent in compliance with regulatory guidelines for effluent discharge quality.

Considering the implementation of these mitigation measures, NPNS has determined that significant adverse residual environmental effects on marine mammals are not anticipated.

North Atlantic Right Whale

There was no targeted assessment of the potential adverse effects of the Project on North Atlantic Right Whales, which are listed as endangered by both SARA (Schedule 1) and COSEWIC. They occur in the northwest Atlantic, ranging from Florida to Newfoundland and in the Gulf of St. Lawrence (COSEWIC, 2013). Their wintering and calving grounds are generally located off the coast of Florida and Georgia, however, not all individuals will occupy these areas and the whereabouts of adult males, in particular, is largely unknown (COSEWIC, 2013). Researchers have also recently found a possible breeding ground located in the middle of the Gulf of Maine (COSEWIC, 2013). Female whales will use calving grounds during the early winter then migrate north in the winter and spring to feed in the Great South Channel and Massachusetts Bay areas. During the summer and fall, North Atlantic Right Whales can be found congregating and feeding in the lower Bay of Fundy and in the Roseway Basin on the western Scotian Shelf. However, since 2010 there has been a noticeable shift in the distribution of North Atlantic Right Whales, particularly in their summer foraging range which has led to increasing uncertainty regarding their use of north Atlantic waters (Brillant et al., 2015; Davis et al., 2016; Plourde et al., 2016; Meyer-Gutbrod & Greene, 2018). These changes in distribution are thought to be driven by the changing abundance of North Atlantic Right Whales' primary prey species, *Calanus finmarchius*, which have been shown to be declining in the Bay of Fundy and Roseway Basin, but present in the Gulf of St. Lawrence (Plourde et al., 2016).

The primary threats facing this species are ship strikes and entanglement in fishing gear, both of which have contributed to its endangered status and limited population recovery (COSEWIC, 2013). Most notably, an unusual mortality event was declared in 2017 due to the discovery of 12 North Atlantic Right Whale carcasses in the Gulf of St. Lawrence and 5 near the Gulf of Maine. In most of these cases, causes of death we determined to be blunt force trauma due to ship strikes or entanglement in snow crab

fishing gear (Daoust et al., 2017). Since this time, DFO has worked with industries (e.g. fishing, shipping) to drastically change its management measures to protect North Atlantic Right Whales. Mitigation measures that have been implemented include mandatory vessel speed restrictions, snow crab and lobster fishing closures, and experimentation with new fishing gear technologies (DFO, 2018c; DFO, 2018d).

Underwater noise from increased ship traffic, wind or tidal power projects, and offshore oil and gas exploration also threatens North Atlantic Right Whales by causing acoustic disturbance (COSEWIC, 2013), affecting feeding, migration, care for calves and defense against threats (e.g. vessel traffic). Finally, activities that reduce the quantity or quality of prey (e.g. copepods) are also known threats to the North Atlantic Right Whale habitat.

3.4.2 Evaluation & Recommendations

Issue 3.33: General Comment on EA Scope: An ecological risk assessment (ERA) should be completed to quantify potential risks to the health of marine mammals. This requires detailed information on the chemical characterization of the mill effluent including which chemical parameters are present in the effluent and at what concentrations. If chemicals of potential concern to environmental health are identified as being bioaccumulative, this must be fully considered in the assessment of risks to marine mammals. In particular, we are concerned about North Atlantic Right Whale exposure to contaminants, including but not limited to organochlorines that have the potential to be found in pulp effluent, through vector prey species such as *Calanus finmarchius*. Exposure to bioaccumulating chemicals may influence reproduction and population growth (Weisbrod et al., 2000; Durbin et al., 2002) and exacerbate their current endangered status.

> **Recommendation 3.33:** An ERA is required that considers ecological receptors, including marine mammals such as North Atlantic Right Whales, who may be exposed to chemicals of potential concern from the proposed Project.

Issue 3.34: EA Section Reference: EA Section 8.13.2.1 (p. 400): The description of the existing environment for marine mammals, which forms the basis of the Project effects assessment, is limited in many ways. We are therefore concerned that NPNS's conclusion that the Project is unlikely to cause adverse effects on North Atlantic Right Whales (*Eubalaena glacialis)* is inaccurate. Specifically, there is a lack of transparency and certainty regarding baseline data used, a lack of field studies undertaken, and growing uncertainty regarding the distribution of North Atlantic Right Whales in their summer foraging range.

First, there is a lack of transparency and certainty regarding the baseline data that was considered by NPNS. In Section 8.13.2.1, NPNS states that North Atlantic Right Whales are not known to occur in the vicinity of the LAA and that there have been no historical observations recorded in the Northumberland Strait, citing data obtained from the Atlantic Canada Data Conservation Centre (ACCDC) as of 2018, the Department of Fisheries and Oceans (DFO) as of 2017, and the Ocean Biogeographic Information System (OBIS) as of 2018. However, only the raw data from the ACCDC, and not DFO or OBIS, is provided in EA

Appendices for verification. Further, it is unclear whether these data were obtained from systematic surveys or represent incidental observation records.

Based on our own review of existing marine mammal data from the National Oceanographic and Atmospheric Association's (NOAA) Right Whale Sighting Advisory System, it is clear that NARW have been reported in the Northumberland Strait in the past, most recently in 2015 when a female and her calf were spotted in St. George's Bay (Figure 8).

Second, no field work was conducted as part of this EA registration for the marine mammals, sea turtles, and marine birds VEC. Instead, this section relied substantially on the EIA registration for the PEI-NB Cable interconnection upgrade project.

Third, there is growing uncertainty regarding the distribution of North Atlantic Right Whales in their summer foraging range; it is therefore inappropriate to determine they will not occur in the Northumberland Strait. Since 2010, there has been a noticeable shift in the distribution of North Atlantic Right Whales, particularly in their summer foraging range, which has created uncertainty regarding their use and occupancy of habitat in the north Atlantic (Brillant et al., 2015; Davis et al., 2016; Plourde et al., 2016; Meyer-Gutbrod & Greene, 2017). For example, approximately one third of the North Atlantic Right Whale population is not observed in its traditional or known summering habitats, and in some years, they will abandon these areas altogether (Plourde et al., 2016). Additionally, survey efforts for North Atlantic Right Whales within their summering ranges are concentrated around known critical foraging habitats such as the Bay of Fundy and Roseway Basin (Brillant et al., 2015), despite the fact that in recent years they have been concentrating in the Gulf of St. Lawrence (Plourde et al., 2016; Meyer-Gutbrod & Greene, 2018; Meyer-Gutbrod et al., 2018). This northward shift is distribution is driven in part by the changing relative abundance of their primary prey species *Calanus finmarchius*, and recent studies have shown potential new suitable foraging habitat in areas of the southern Gulf of St. Lawrence (Plourde et al., 2016), which is in close proximity to the Northumberland Strait.

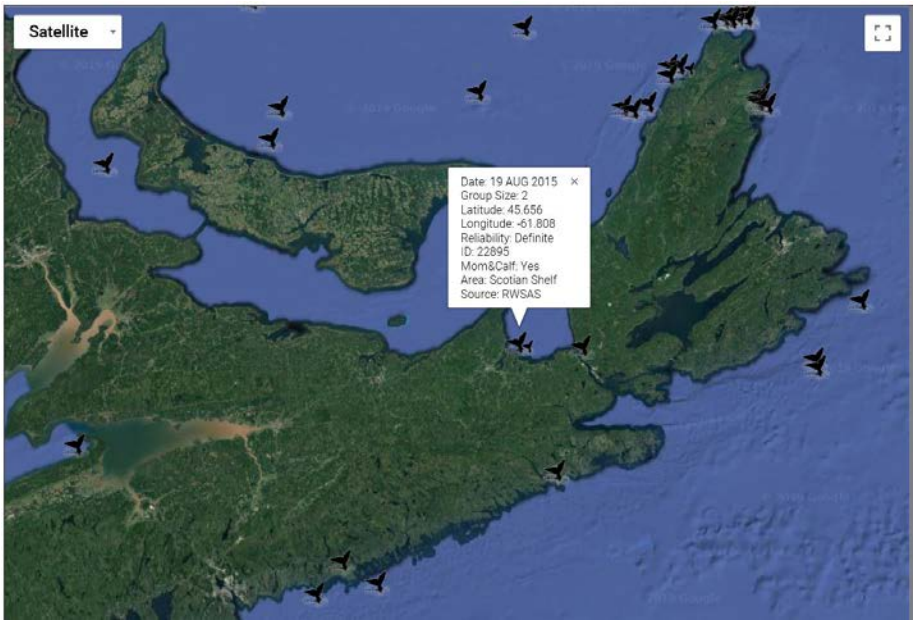

Figure 8. Sighting of North Atlantic Right Whale in the Northumberland Strait in 2015 along with Calf (Source: https://www.nefsc.noaa.gov/psb/surveys/MapperiframeWithText.html)

> **Recommendation 3.34:** The assessment of project effects on marine mammals, sea turtles, and marine birds VEC (Section 8.13) is considered to be incomplete and underscores the need for NPNS to conduct field studies for this Project, especially given growing uncertainty regarding the distribution of North Atlantic Right Whales in their summer foraging range.

Issue 3.35: EA Section Reference: EA Section 8.13.3.2 (p. 417-420): Section 8.13.3.2 does not provide enough information on the methodologies that will be employed by Marine Mammal Observers (MMOs). It is assumed that visual surveying methodologies will be employed based on the specification that MMOs will be equipped with 7x35-power binoculars, but no further details are provided. Visual surveys are known to be limited by a number of factors including daylight, weather conditions, and the availability of suitable monitoring platforms at appropriate times and appropriate locations (Brillant et al., 2015). By contrast, other methods such as passive acoustic monitoring (PAM) can provide continuous coverage of areas that are otherwise difficult to observe visually. Additionally, a rationale was not provided as to why marine mammal monitoring would likely only be undertaken during blasting activities and not all project vessel traffic.

There is also very little information on MMOs reporting requirements and the circumstances under which marine mammal monitoring will be required.

Without these further details on marine mammal monitoring, it is not clear that measures to mitigate the potential adverse effects of the Project on North Atlantic Right Whales will actually be effective.

> **Recommendation 3.35a:** NPNS must provide more detailed information on visual surveying methods and consider completing these in combination with other marine mammal monitoring

methods such as the deployment of passive acoustic monitors or aerial (helicopter or drone) surveys.

Recommendation 3.35b: NPNS must provide more information on MMO monitoring requirements, including information on reporting intervals, accessibility of reports to stakeholders, and whether reporting will trigger any adaptive management measures.

Recommendation 3.35c: NPNS should also consider requiring marine mammal monitoring during all project activities that require vessel travel.

Issue 3.36: EA Section Reference: EA Section 5.3 (p. 49-81); EA Appendix F (p. 1-91); EA Section 8.13.3 (p. 415-424) NPNS acknowledges that marine mammals could be adversely affected by a project-related change in risk of injury or mortality by way of potential collisions with project vessels and equipment (Sect. 8.13.3.1, p. 415). However, there is very little information on the vessel traffic that will be required to complete Project activities (e.g. marine portion of pipeline installation, marine surveying for pipeline route planning, marine outfall construction, pipeline maintenance and inspection, etc.), specifically regarding vessel types, sizes, routes, speeds, and schedules. NPNS does state that "project vessels used for construction and for potential maintenance and repairs during operation will be relatively small in size and draft and will not be present in large numbers" (Sect. 8.13.3.1, p. 417), and that 'Project vessels may operate up to 24 hours a day, 7 days a week during construction" (Sect. 8.13.3.3, p. 420), but this information is not clearly summarized in Section 5.3 or Appendix F in detailed or definitive terms. Subsequently, it is unclear how NPNS came to the conclusion that Project vessels are unlikely to harm North Atlantic Right Whales without providing clear, detailed information on vessel activity.

Additionally, NPNS intends to prevent injury or harm to marine mammals by adhering to general guidelines for vessels operating near marine mammals, as specified in section A2 of the annual edition of Notices to Mariners (DFO, 2018d). This includes measures such as approaching areas of known or suspected wildlife activity with extreme caution, reducing vessel speeds and avoiding approaches within certain distances (e.g. 400m and 100m). However, NPNS has not provided any information on how they intend to detect marine mammal while navigating Project vessels and has stated that they will likely only employ MMOs during blasting activities. This is an information gap that must be addressed.

Recommendation 3.36a: More detailed and definitive information on the vessel traffic (including vessel type, size, route, speed, schedules) that will be required to complete Project activities must be provided and considered in the EA, given potential impacts to marine mammals.

Recommendation 3.36b: NPNS should ensure that observers are present on all Project vessels to identify the presence and location of marine mammals and to ensure appropriate mitigation measures outlined in EA Section 8.13.3.2 are adequately triggered and implemented.

3.5 Cumulative Effects

3.5.1 Summary of EA Content

Cumulative environmental effects are described in the EA as residual environmental effects that are likely to result from a project in combination with the environmental effects of other projects or activities that have been or will be carried out and also referred to as past, present, and reasonably foreseeable future projects or activities (CEA Agency 2014).

The EA claims that the existing environment conditions described in the report reflect the cumulative environmental effects of past and present project activities; however, there is also a need to assess the potential for additional project-related cumulative environmental effects, particularly with respect to potential interactions with other pending projects that are in advanced planning stages, or existing ones that may be subject to modifications or expansion.

The cumulative environmental effects assessment methodology undertaken for the Project is only a high-level approach which is said to have been recommended by the Canadian Environmental Assessment Agency's (CEA Agency) publication titled "Assessing Cumulative Environmental Effects under the *Canadian Environmental Assessment Act, 2012* – Interim Technical Guidance" (CEA Agency 2018).

According to CEAA's guidance document, a cumulative environmental effects assessment should accomplish the following:

- determine if the Project will have a residual environmental effect on a valued component;
- determine if the incremental effect acts cumulatively with the effects of other past, existing, or future actions; and
- determine if, after mitigation, the combined environmental effects may cause a significant change in the VEC.

NPNS acknowledges that there is a high level of existing disturbance in the Northumberland Strait associated with the Northumberland Ferries service, commercial shipping, and commercial fishing in Caribou Harbour and the Northumberland Strait, but that there are few other likely projects or activities in the marine portion of the RAA.

Key cumulative activities that may adversely affect a number of important marine fish and mammal species include increased acoustic emissions, impacts to habitat associated with future dredging activities in Caribou Harbour in support of Transport Canada shipping lane maintenance, potential collisions with other vessels, pollution from bilge water and the accidental release of hydrocarbons.

However, it was determined that most marine fish and mammals are likely to avoid construction activities, and the PFA overall, due to noise and activities. Subsequently, it was predicted that the

residual cumulative effects on marine mammals are not likely to be substantive overall, and that they are not anticipated to extend beyond the PFA.

3.5.2 Evaluation & Recommendations

Issue 3.37: The Gulf of St. Lawrence has been identified as an area of rapid coastal deoxygenation by Claret, M. et. al (2018). Their analysis notes increases in surface water temperature and salinity, as well as decreases in oxygen saturation. This must be accounted for the in the assessment of cumulative effects of the Project, within the EA.

> **Recommendation 3.37:** The EA must assess cumulative effects of the proposed Project on the marine environment, in light of current stressors that have already been identified, including increases in surface water temperature and salinity, as well as decreases in oxygen saturation.

Issue 3.38: In Section 8.14.3.6 (Employment and Economy), within the *Commercial Marine – Harbours, Ferries, and Other Infrastructure* sub-section, the EA describes Northumberland Ferries' operations and traffic and carrying capacity. Yet in the socio-economic section of the EA, there is no analysis or discussion regarding how the potential marine related potential risks may interact as cumulative effects.

> **Recommendation 3.38:** Discussion is required around the interactions between potential impacts from the new ETF discharges from the outfall, and ferry discharges within the harbour and Strait, and in turn the implications for ecological and human health risks, from a cumulative effects assessment standpoint.

3.6 Human Health

3.6.1 Summary of EA Content

A human health risk assessment (HHRA) was not completed as part of the Environmental Assessment Registration Document submission. Rather, NPNS completed a Human Health Evaluation (HHE), intended to prepare for the potential completion of an HHRA, which could be required as part of the conditions of approval for the Project (as stated in the EA). The HHE followed guidance from Health Canada.

The Human Health Evaluation focused on two primary sources of emissions or discharges that have the potential to result in exposure of humans to project-associated chemicals, namely (1) treated effluent released to the marine environment and (2) air emissions from the replacement effluent treatment facility and the existing NPNS mill. As such, the following human health exposure pathways were considered in the HHE for infants, toddlers, children, teens and adults:

- Incidental direct contact with sea water and/or marine sediments;
- Ingestion of marine food items, including those that are part of the commercial fishery and aquaculture;

- Inhalation of air contaminants during construction, operation and maintenance phases of the Project; and

- Ingestion of potentially impacted drinking water.

A quantitative assessment of potential exposures to project-associated chemicals of potential concern (COPC), and any resulting human health risks was not completed in the EA. This is, in part, due to the project-specific effluent chemistry not being fully known (because the chemical process engineering design work has not been completed). As such, the chemical composition of the effluent, including chemical concentrations, has not been fully characterized. Eventually, in the HHRA, it is expected that COPCs will be chosen based on an evaluation of baseline data, chemical toxicity, amount released, chemical fate and behaviour, and the resulting environmental concentrations.

As part of the HHE, NPNS completed a review of published reports (i.e., reports from Toxikos, 2006; Hewitt et al., 2006 as referenced in the EA) to inform the prediction of COPCs. It is stated, within the EA Registration Document, that the list of COPCs for the Project is expected to be relatively small and may include metals/metalloids (including mercury), polycyclic aromatic hydrocarbons (PAH), polychlorinated dibenzo(*p*)dioxins and furans, resin acid compounds, chlorophenolic compounds, non-chlorinated phenolic compounds and chlorinated volatile organic compounds (VOC).

3.6.2 Evaluation & Recommendations

Issue 3.39: A Class 1 Environmental Assessment does not specifically require the completion of an HHRA prior to the registration of the Project EA. However, the "Proponent's Guide to Environmental Assessment, September 2017" issued by Nova Scotia Environment, states that the registration document for a Class 1 undertaking should include any effects on environmental health, such as contaminants that may affect human health that will be released into the atmosphere, water or land. In addition, it is stated that the information included in the registration document needs to be sufficient for the Minister to make a decision on the undertaking. Without a complete HHRA that clearly quantifies potential exposures and risks (if any) to project-associated chemicals of potential concern, it is unclear how this stipulation will have been met through the provision of the HHE. Given the potential for risks to human health to occur as a result of exposure to chemicals of potential concern related to the proposed Project, the Human Health Evaluation, as presented, is not considered to be an adequate assessment of health risks.

> **Recommendation 3.39:** A robust and comprehensive assessment of potential health risks (i.e., through the completion of a Human Health Risk Assessment) is required in order to determine if adverse health effects from the Project are likely.

Issue 3.40: Overall, within the EA Registration Documents, numerous assumptions are made regarding potential impacts to the receiving environment. It is unclear if an adaptive management plan or strategy has been developed should some of these assessment predictions differ from what is observed when the Project commences.

Recommendation 3.40: An adaptive management plan should be provided to address discrepancies between project assumptions and predictions, and what is found to occur in the environment once the Project begins. This plan should include an assessment of changes to predicted risks to human health, should the Project assumptions not hold true.

Issue 3.41: Section 9.2 - It is noted that Pictou Landing First Nation members traditionally harvest various species including lobster, rock crab, herring and American eel; however, the extent and details of their harvesting and consumption patterns are not known. It is also stated that possible local harvesting and consumption of bivalve shellfish may occur along shoreline areas around Caribou and Munroes Island. There appears to be uncertainty regarding fish consumption activities for both Indigenous and non-Indigenous people within the assessment area. This is a significant data gap in understanding the potential human health impacts related to the proposed Project.

Recommendation 3.41: The assessment of potential risks (if any) to human health associated with the Project requires a fulsome understanding of both the exposure concentrations of Contaminants of Potential Concern in the marine environment, and the exposure pathways identified as being of concern to human health (i.e., the consumption of fish and shellfish).

Issue 3.42: Section 9.1 – It is stated that effluent chemistry (i.e., chemicals present and their associated concentrations) is not known and won't be known until the Project is operational. In addition, other areas of uncertainty listed in the Project documents include limited (recent or current) environmental baseline data and food item chemistry data, and limited data on traditional harvesting and consumption patterns. As such, the Human Health Evaluation, as presented in the assessment, is based only on data and study results currently available. Again, the data gaps, as described by NPNS, are significant barriers to properly assessing potential risks to human health. It is unclear when a more robust set of baseline environmental data will be obtained and why this was not completed prior to the Project being registered. Baseline data is of extreme importance to the EA process, and specifically to the identification of Contaminants of Potential Concern in the assessment of health risks. In fact, within the EA, it is stated that consultation with Health Canada in relation to the HHE and potential HHRA resulted in a stated expectation by Health Canada to include both baseline and future conditions exposures scenarios.

Recommendation 3.42: A more robust assessment of baseline conditions (such as water quality, sediment quality, land use patterns, fish consumption rates and other relevant environmental attributes) must be completed prior to project approval, to understand potential risks to human health related to the Project.

Issue 3.43: Section 9.3 - With respect to air emissions, it is anticipated that a pilot study of the combustion of hog fuel and sludge in the power boiler will be conducted. Can NPNS confirm that this will be completed? It should be noted that Health Canada, in consultation with NPNS regarding potential health risks, outlined expectations regarding the need for an evaluation of potential changes in local air quality due to co-burning of sludge in the power boiler.

Recommendation 3.43: NPNS must confirm that the pilot study will be completed to evaluate the potential impacts to air quality due to the combustion of hog fuel and sludge in the power

boiler and must outline adaptive management strategies should the results of the air monitoring and pilot study not align with the assumptions and predictions of the current assessment.

Issue 3.44: Section 9.2.4.1 – Stantec (2019) reported that ambient air monitoring data for 2015, 2016, and 2017 showed no exceedances of the applicable Nova Scotia regulatory Air Quality Criteria for monitored air contaminants. It is unclear if 2018 data are available.

> **Recommendation 3.44:** If 2018 air monitoring data are available from Stantec (2019), they should be included in the assessment.

Issue 3.45: Section 9.2.4.1 – It is stated that based on modeling results, predicted concentrations of the air contaminants of concern—namely CO, NO_2, SO_2, TSP, $PM_{2.5}$ and H_2S—from the operation of the existing and future mill are expected to be in compliance with the reference criteria at the representative off-property discrete receptors. Modelled exceedances of H_2S were estimated to occur less than 0.05% of the time and believed to be an artifact of model inputs. However, it was reported that some odour occurrences were found that were associated with H_2S. A more fulsome discussion of what is meant by an artifact of model inputs is required. The EA does not discuss which adaptive management measures will be put in place to manage non-compliance issues should actual air emissions differ from predicted air emissions.

> **Recommendation 3.45:** Details are required regarding adaptive management measures, to address the potential for actual air emissions to be greater than predicted emissions (based on modelling exercises). In addition, further discussion in the EA is needed regarding what is meant by an artifact of model inputs related to modelled exceedances of H_2S (Section 9.2.4.1).

Issue 3.46: Section 9 and Table 12.1-2 – The Human Health Evaluation did not acknowledge or address the potential for cumulative effects to impact overall human health. Surrounding land uses, including agricultural areas, may contribute to the overall contaminant load in the receiving water, and subsequently marine food items.

> **Recommendation 3.46:** The potential risks to human health associated with cumulative impacts of the Project and current stressors must be considered in the assessment.

3.7 Socio-Economics

3.7.1 Summary of EA Content

Within NPNS's EA for its new effluent treatment facility, the socio-economic environment was considered for its "potential interaction with local communities, how land and water is used in the vicinity of the Project, and the potential interaction between the Project and the economic well-being of these communities" (Section 8.14).

The socio-economic environment's LAA is represented by the communities whose activities

intersect with the PFA and includes: Pictou Landing First Nation, local residents, and local industries located in the Municipality of Pictou County or the towns of New Glasgow, Stellarton, Pictou, Westville, and Trenton.

Within the EA socio-economic section introduction, NPNS describes the interdependencies of other VECs that need to be considered to assess impacts to the social and economic values, including health of communities, accidents and malfunctions, noise, air quality, heritage resources, drinking water, fishing, connection to the water and land (i.e., recreational enjoyment). The mitigations described for addressing the potential socio-economic effects that NPNS has identified within its Project's EA involve:

a) Mitigations and assessment results within other EA sections (i.e., Section 8.11 - Effects on harbour physical environment, water quality, and sediment quality; and Section 8.12 - Marine Fish and Fish Habitat);

b) A communication plan (i.e., notifications to surrounding communities during construction)

c) Ongoing engagement and information exchanges with the Community Liaison Committee;

d) Noise and dust management through the EPP;

e) Scheduling work to avoid or minimize interactions with other VECs (e.g., ferries, fisheries)

f) Possible future mitigations should DFO or TC deem it necessarily as a result of their review.

During construction, the Proponent has identified the following potential effects that could occur on various aspects of the Socio-economic environment:

- Potential localized impact to commercial fisheries in the area due to construction interactions with target species;
- Short-term interruption to Jitney Trail use while construction occurs in that vicinity;
- Potential for periodic, short-term but planned delays to marine traffic including the NS-PEI Ferry and commercial fisheries leaving the marinas east of Northumberland Ferries marine terminal during construction stage where the pipeline route is anticipation to cross the navigational channel;
- Potential short-term traffic delays; and
- Potential for short-term nuisance (e.g., noise, dust) to local residents from construction activities, particularly in the vicinity of Caribou where residences are along Highway 106.

The Proponent states that with mitigation measures applied, the residual environmental effects of the Project on the socio-economic environment during construction will be temporary and not significant in nature.

During operation, NPNS states that "[A]s a result of the design and mitigation measures proposed, residual environmental effects are not expected to the socio-economic environment during operation and maintenance" (Section 8.14.4.3 Characterization of Residual Environmental Effects). The rationale provided is based on the following points or mitigations:

- The measures outlined in the EPP and the mitigation measures identified for other VECs will mitigate interactions with the socio-economic environment;
- Follow up and monitoring will be completed to monitor the environmental effects of the Project and mitigation any (socio-economic) impacts;
- Communications and Compensation Plan for Commercial Fisheries and Aquaculture, in coordination with NSE, DFO, and potentially impacted stakeholders;
- Anyone with concerns about the Project and its interactions with the environment may contact NSE's Area office in Granton; and
- The Community Liaison Committee will continue to facilitate two-way communication and advice to NPNS

Follow up and monitoring related to socio-economic value components will entail the mitigations listed within other VECs and ongoing meetings with the Community Liaison Committee.

3.7.2 Evaluation & Recommendations

Issue 3.47: In Section 8.14.1 (Boundaries), the EA states that "once the ETF or pipeline is nearing the end of a useful service life, a decommissioning plan will be developed and will be submitted for a separate review requiring NSE approval". It is unknown what the pipeline's anticipated lifecycle will be before land disturbance will be required again for its decommissioning, upgrading or replacing.

> **Recommendation 3.47:** Provide information on the pipeline's lifecycle length and anticipated activities for its decommissioning (i.e., expansion, upgrades, replacement etc.)

Issue 3.48: In Section 8.14.2 (Interdependency with Other VECs), NPNS identifies the environmental VECs and impacts that the socio-economic environment relies on to identify impacts including: health of communities, accidents and malfunctions, noise, air quality, heritage resources, drinking water, fishing, connection to the water and land (i.e., recreational enjoyment). Although briefly discussed in the baseline section, missing in the EA are VECs and associated potential effects that reflect the economic and social factors triggered by the Project such as impacts to the local and regional economy, employment, and dynamics during construction phase (e.g., construction activities, workforce and social issues; direct, indirect and induced positive and adverse economic impacts).

NPNS must include VEC, and more importantly, a robust and consistent effects assessment on indicators related on the acknowledged VEC "health of communities" to capture missing elements of health and wellbeing, including the protection of a resilient fishery and associated economies including harvesting

and processing plants; employment, analysis of economic risks and/or benefits at community, regional and provincial level; description for, and management plans for anticipated workforce at both construction and operation phases.

Issue 3.49: In Section 8.14.3.4 (River and Marine Based Uses), NPNS states that "The lobster fishery has for many years been the largest fishery in the area by landing value (DFO 2008 and DFO 2017). However, the assessment of socio-economic effects will not place the importance of this fishery above others. An 'ecosystem approach' for impact assessment that looks at the health and resilience of the Strait as a whole was put forward and confirmed during discussions with all stakeholders, fishermen, and Pictou Landing First Nation." Later in the assessment however, there is no evidence of how stakeholder, fishermen and Pictou First Nation's concerns regarding direct and indirect impacts on the health of the marine eco-system nor fishing economy have been considered into the EA, let alone an ecosystem approach to the effects assessment (e.g., inclusion of eco-systemic interdependencies; species lifecycle differences; food chain dependency ripple effects across species etc.); there is no acknowledgement of industry and conservation efforts to maintain the integrity of commercial fisheries; there is no indication of understanding or indication of interest to understand the direct adverse economic and social impacts any disruption in fishing will have on harvesters – both Indigenous and non-indigenous, in the region; nor indication of how individuals within the lobster fishery or other fisheries (or their children as future participants in the fisheries sector) will be compensated or accommodated for losses as a result of the Project's construction and/or operations activities - missing just a *few days* of the fishing season is a *serious impact to fisheries*. Moreover, an analysis of the risks to a province and region whose economy is primarily dependent on its fisheries sector is absent from the socio-economic section altogether.

> **Recommendation 3.49a:** Apply an actual ecosystem and integrated approach for the effects assessment that considers VEC interdependencies and an economic risk analysis to other economic sectors in the region – fisheries in particular;
>
> **Recommendation 3.49b:** Provide a detailed description of the region's economic reliance on commercial fisheries, including individual harvester economic baselines and dependencies as they relate to fishing.
>
> **Recommendation 3.49c:** Provide analysis of the Project's construction and operation phase effect mechanisms and interactions with harvesters' ability to fish (in terms of access); as well as potential risks to fishing economy due to risks to species' habitat, spawning area integrity and health.
>
> **Recommendation 3.49d:** Describe how individuals within the lobster fishery (and other fisheries) will be compensated or accommodated for losses as a result of the Project's construction and/or operations activities. An explicit acknowledgement of the adverse economic impacts (and in turn social impacts on regional and community wellbeing and health) for fishers when even just a few days of fishing are interrupted is critical for a balanced effects assessment.

Issue 3.50: In Section 8.14.3.6 (Employment and Economy), within the *Manufacturing* sub-section, the EA describes how "…NPNS directly employs over 330 residents of Northern Nova Scotia; provides indirect and induced employment to Pictou County and the province of Nova Scotia in general; and that

NPNS' operations' maintain and create well over 2,000 jobs across the province in the forestry sector". This is appropriate baseline information, however the baseline information for employment and economy has a glaring, inappropriate and unacceptable omission of information to describe the how the region's socio-economic resilience is uniquely and primarily dependent on the health of the Northumberland Straight ecosystem to maintain the Province's primary economic sector: fisheries.

For instance, according to the Nova Scotia Department of Fisheries and Aquaculture, there are over 18,000 people working in the fishing sector within the Province; Lobster is the most valuable seafood export ($947 Million in 2017); followed by crab ($314 Million); scallops ($144 Million); and shrimp ($126 Million) (Nova Scotia Department of Fisheries and Aquaculture, https://novascotia.ca/fish/). In 2012, the lobster fishing industry in the Gulf Region consisted of 2,966 commercial lobster licence holders which included 215 communal commercial licences held by 18 Aboriginal organizations. Each of these commercial enterprises employs numerous people, bringing the total to about 7,100 individuals involved in the harvesting sector in the Gulf Region. In addition, there were nine Indigenous organizations which received communal lobster fishing licences for food, social and ceremonial (FSC) purposes (Fisheries and Oceans Canada, 2014).

The baseline neglects to acknowledge the Province's primary economy altogether: Of Nova Scotia's 5.4 billion export economy, seafood amounted to $2 billion in 2017. Lobster and crab account for $1.26 billion (Nova Scotia Department of Fisheries and Aquaculture; Government of Canada, n.d.). The baseline does not mention Government of Nova Scotia and fishing industry efforts and plans for the region such a legislated mandate to promote, support and develop the fishing, aquaculture, seafood processing and sportfishing industries that contribute to the economic, environmental and social prosperity of Nova Scotia's coastal and rural communities (Government of Nova Scotia, 2018).

Despite a hasty mention of these value components, 'economy' or 'employment' are not actually described in a way that reflects the region's socio-economic reality and are not carried forward at all into the socio-economic impact assessment. No analysis has been conducted of the risks that the Project's short- and long-term activities will pose to the existing, heavily relied upon, commercial fishing sector. This is unacceptable. A more comprehensive baseline is required to demonstrate the unique socio-economic regional context surrounding the proposed Project so that potential effects can be more accurately considered and in turn avoided or mitigated. As referenced in AMEC's *Northumberland Strait Ecosystem Overview Report* (2007), "[L]obster provides the largest share of total landed values for the main species (approximately 85%), and declines in this species alone are cause for concern"…"…the magnitude and longevity of the decline in commercial fisheries for highly dependent communities is more problematic than cyclical patterns experienced elsewhere or in the past (AMEC, 2007. Accessed from: https://docs.wixstatic.com/ugd/b61814_1639a02cebd94db4ba24787ad9a4cac7.pdf.)

Moreover, there has not been any consideration of other facets of the commercial fishing sector such as processing plants in Pictou County, and potential project interactions (e.g., between the plant's water intake pipes and NPNS's effluent discharge areas; such interactions could have devastating human health and economic impacts to the sector and product consumers).

Recommendation 3.50: NPNS must provide a balanced and accurate description of the existing regional socio-economic context, including regional health and wellbeing dependencies on the fish harvesting and fish processing sectors. Using complete baseline information, an economic effects assessment is required that carries forward information referred to within the baseline section including: Project effect mechanisms and interactions with existing fisheries economic sector, at a granular level i.e., net losses anticipated due to forecasted days of interruptions due to construction and operations); human health effect mechanisms and interactions with economic risks related to fish processing plant operation requirements and interactions with effluent discharges; project workforce requirements; wages and salaries, and supply chain procurement needs during both construction and operations.

Issue 3.51: In Section 8.14.3.6 (Employment and Economy), within the *Tourism* sub-section, the EA describes how tourism in the county and region is heavily relied upon for its revenues. Given the level of priority this is for the LAA, the EA would have benefited from more relevant information within its baseline and EA analysis.

Recommendation 3.51: Provide more baseline information describing the specific aspects of the tourism sector within the LAA that have inter-connections with water – either from recreational usage or from drinking and/or other water uses. These details would be relevant within an eco-system approach to the socio-economic impact assessment**.**

Issue 3.52: In Section 8.14.4.1 (Potential Environmental Effects), NPNS identifies the following (8) potential socio-economic related effects that may occur as a result of construction:

1. Temporary delays to Nova Scotia – Prince Edward Island ferry due to marine construction;
2. Temporary delay or access distribution to marine areas (commercial or recreational) due to marine construction;
3. Traffic delays could occur on Highway 106 during construction;
4. Traffic delays (vehicular and ferry) discouraging tourists from entering the area or using the ferry;
5. Local road network could deteriorate from additional vehicular use due to traffic detouring;
6. Temporary nuisance (noise, dust) could be perceived by local residents during construction;
7. Temporary property access disruption to properties adjacent to construction may occur, particularly in vicinity to residents along Highway 106 at Caribou Harbour; and
8. Temporary access disruption to section of Trans Canada Trail or other recreational uses on land during construction of the effluent pipeline

These effects list access and disruption issues to various economic sectors and related activities, which in turn would negatively impact the local economy. However, the potential risk of these adverse effects are minimized if not completely ignored; they are not discussed nor analyzed. Mitigations from other VECs are referred to as the solution and in turn no effects of consequence are predicted. Unfortunately, as this technical review report demonstrates, the EA is riddled with data gaps and generic mitigations that simply do not provide confidence in their ability to address the potential risks as a result of the Project's construction and operations activities.

There is also mention of noise and dust nuisance, which is related to human health. Missing from this list of project effect mechanisms and interactions is the consideration of:

- Adverse social impacts to individuals and families who rely on uninterrupted or disturbed access to the fisheries;
- Cumulative effect of effluent discharge and ferry related discharges in the harbour and straight; which in turn have implications for human and eco-systemic health;
- Increased health and safety risks from an increase in traffic along Hwy 106 (i.e., vehicular/human accidents)
- Socio-economic impacts related to employment and supply chain procurement during construction and operations; and
- Potential social impacts related to the temporary construction workforce.

Recommendation 3.52: NPNS must provide information and analysis of the following:

a) Discussion and analysis of risks and in turn, potential adverse social impacts to individuals and families who rely on uninterrupted or undisturbed access to the fisheries; including mitigations for avoiding this adverse impact.

b) Identification of positive socio-economic effects from employment during the 21-month construction period as well as operations and maintenance. It is acknowledged that the Project description states that no additional jobs would be created during operations as existing personnel would be retrained for the new facility. Both phases of the Project need to be discussed in terms of what economic benefits would occur (even if no change during operations) within the socio-economic effects assessment. This allows the impact evaluation to demonstrate both the potential negative as well as the potential positive socio-economic impacts that would be predicted as a result of the Project's various activities, including employment generation and associated indirect and induced impacts during the 21 months' construction.

c) A description of human and ecological health pathways, project interactions and effect mechanisms within the socio-economic effects assessment including a human health

risk assessment (i.e., drinking water within the LAA's wells; recreational water usage; Indigenous community members' land uses, water and wild foods consumption).

d) A discussion and demonstrated planning for health and safety considerations of the surrounding communities as related to construction, should there be a temporary, non-resident workforce hired for construction. Include whether the construction workforce will be housed in surrounding local communities and/or within temporary workcamps. How many workers are anticipated to be hired for the construction phase?

Issue 3.53: In Section 8.14.4.1. (Potential Environmental Effects), within the *Operations and Maintenance* sub-section, NPNS identifies the following (2) potential socio-economic related effects that may occur as a result of operations:

1. Interference with resources harvested for cultural, commercial, and recreational uses (e.g., if Project introduces odour, or negatively affects fisheries); and

2. The project impacts could negatively affect the local economy by interfering with resources needed for goods production, or transportation of those goods

Similar to the issues identified with the potential effects mentioned for construction, there is little acknowledgement (if not dismissal) of the risks the long term effects the operations will have on the local and regional fisheries. And based on the review of the fisheries, water and other aspects of the Project's design within the EA's registration documents, there are too many gaps in data and modelling to dismiss the potential for long term effects on the health of species; their habitat and/or migration due to effluent discharge and/or temperature change from the outfall.

Also missing from this assessment is consideration of impacts on tourism due to visual impacts and/or human health risks and/or perceived fear of recreational marine use; nor is there consideration of effects from pipeline integrity management activities (e.g., integrity digs and associated land disturbances).

Recommendation 3.53a: NPNS must provide discussion and analysis of potential effects to the health and integrity of the region's commercial fisheries based on results of more comprehensive effluent modelling, data upgrades and effects analysis as per the results of this EA's technical review of these inter-dependent VECs.

Recommendation 3.53b: NPNS must provide discussion and analysis of tourism impacts and human health risks related to Indigenous land and resources, and non-Indigenous lands and resources (i.e., drinking water and marine based recreation)

Recommendation 3.53c: NPNS must provide discussion and analysis of potential impacts of pipeline operations and maintenance (specifically integrity digs) on land and resource use for both Indigenous and non-Indigenous citizens.

Issue 3.54: In Section 18.4.2 (Mitigation), under the *Construction* sub-section, NPNS puts forth the following recommended mitigations to address the identified socio-economic impacts during construction:

"Standard construction best practices" for…

1. Communication;
2. equipment operation;
3. construction staging; and
4. Roads which are travelled regularly by construction vehicles will be repaired.

The suggested mitigations are seemingly abstract plans without details nor commitments. In some cases, they are simply referred to as discussions to occur with various government agencies such as DFO. And all is deferred to mitigations within other VEC sections such as water and fisheries (8.11 and 8.12). The results of the review of these sections, however, point to limited or outdated data from which assumptions have been made in regards to impacts. And mitigations for water and fisheries are relatively general. There is not enough information, nor solid enough mitigations in place to provide assurance for the minimization and dismissal of the socio-economic effects.

> **Recommendation 3.54:** NPNS must provide more fulsome consideration, description and commitment for specific mitigation, management and monitoring measure to address both the ecological and social factors related to the Project's activities at construction and operations as listed in previous comments.

Issue 3.55: In Section 8.14.3.6 (Employment and Economy), within the Manufacturing sub-section, the EA describes how "…NPNS directly employs over 330 residents of Northern Nova Scotia; provides indirect and induced employment to Pictou County and the province of Nova Scotia in general; and that NPNS' operations' maintain and create well over 2,000 jobs across the province in the forestry sector". This is appropriate baseline information, however the baseline information for employment and economy has a glaring, inappropriate and unacceptable omission of information to describe the how the region's socio-economic resilience is uniquely and primarily dependent on the health of the Northumberland Straight ecosystem to maintain the Province's primary economic sector: fisheries.

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organizations which received communal lobster fishing licences for food, social and ceremonial (FSC) purposes (Fisheries and Oceans Canada, 2014).

The baseline neglects to acknowledge the Province's primary economy altogether: Of Nova Scotia's 5.4 billion export economy, seafood amounted to $2 billion in 2017. Lobster and crab account for $1.26 billion (Nova Scotia Department of Fisheries and Aquaculture; Government of Canada, n.d.). The baseline does not mention Government of Nova Scotia and fishing industry efforts and plans for the region such a legislated mandate to promote, support and develop the fishing, aquaculture, seafood processing and sportfishing industries that contribute to the economic, environmental and social prosperity of Nova Scotia's coastal and rural communities (Government of Nova Scotia, 2018)

Despite a hasty mention of these value components, 'economy' or 'employment' are not actually described in a way that reflects the region's socio-economic reality and are not carried forward at all into the socio-economic impact assessment. No analysis has been conducted of the risks that the Project's short- and long-term activities will pose to the existing, heavily relied upon, commercial fishing sector. This is unacceptable. A more comprehensive baseline is required to demonstrate the unique socio-economic regional context surrounding the proposed Project so that potential effects can be more accurately considered and in turn avoided or mitigated. As referenced in AMEC's Northumberland Strait Ecosystem Overview Report (2007), "[L]obster provides the largest share of total landed values for the main species (approximately 85%), and declines in this species alone are cause for concern"…"…the magnitude and longevity of the decline in commercial fisheries for highly dependent communities is more problematic than cyclical patterns experienced elsewhere or in the past (AMEC, 2007).

Moreover, there has not been any consideration of other facets of the commercial fishing sector such as processing plants in Pictou County, and potential project interactions between the plant's water intake pipes and Northern Pulp's effluent discharge areas. Such interactions could have devastating human health and economic impacts to the sector; product consumers; and workforce employed by the plants:

For instance, there is no mention within the baseline section of the North Nova Seafoods Processing Plant in Pictou County, a fish processing plant in very close proximity to the proposed effluent outfall. The plant operates year-round processing a variety of species and employs over 150 people in Pictou County amounting to over $Million in wages. Approximately 60 of the employees are fishermen that operate from NNS's private wharf in Caribou in front of the processing plant. In addition, the plant supports fishermen from 10 other wharfs on the Northumberland Strait and an additional 50 wharfs in Cape Breton to Yarmouth and into PEI and NB (Paul Logan, North Nova Seafoods).

Critical to the processing plant's operations is its use of an intake pipe in the harbour that uses water for the plant's cleaning process. The water is tested regularly to ensure that it is cleared to use. This is a very sensitive issue as the plant is making a ready to eat product and there are strict CFIA guidelines that are followed. The plant's intake pipe will be a few kilometers away from where the proposed effluent pipe is going to be located. With a proposed discharge of 70-90 million litres of treated effluent from a bleached kraft mill every day, it will prevent the plant from using the intake pipe for the necessary water to operation (Paul Logan, North Nova Seafoods). This will have substantial adverse ecological, and in

turn socio-economic impacts by way of possible human health issues from product contamination and may result in the closure of the processing plant which would have devastating economic impacts to the region.

Figure 9. Location of Nova North Seafood Processing Plant in Relation to Northern Pulp's Proposed Outfall Location

Recommendation 3.55: Provide a balanced and accurate description of the existing regional socio-economic context, included regional health and wellbeing dependencies on the fish harvesting and fish processing sectors. Using complete baseline information, an economic effects assessment is required that carries forward information referred to within the baseline section including: project effect mechanisms and interactions with existing fisheries economic sector, at a granular level (i.e., net losses anticipated due to forecasted days of interruptions due to construction and operations); human health effect mechanisms and interactions with economic risks related to fish processing plant operation requirements and interactions with effluent discharges; project workforce requirements; wages and salaries, and supply chain procurement needs during both construction and operations.

4.0 Conclusion

As outlined above, numerous issues and concerns related to ETF design, effluent modelling, impacts to the marine environment, socio-economics, as well as risks to human and ecological health have been identified in the review of the Project EA Registration Documents.

Given the significant information and data gaps outlined in this technical review, it is apparent that the Minister has not been provided with the appropriate data and information required to make an informed decision regarding the Project. A lack of baseline environmental data, effluent chemical composition data, quantified risks to human health and marine life, and a detailed socio-economic assessment, indicates that the potential for 'adverse effects or environmental effects' of the proposed undertaking has not been adequately characterized. The EA does not acknowledge or address the magnitude of potential adverse effects on the region's commercial fisheries and the thousands of (Indigenous and non-Indigenous) citizens who are dependent on a resilient fishery.

As such, in our professional opinion, the Project cannot be approved as currently registered. Given the numerous issues, data gaps and information gaps identified in the EA, we recommend that the Minister, as per Section 13 of the Environmental Assessment Regulations made under Section 49 of the Environment Act, determine either that

- the registration information is insufficient to allow the Minister to make a decision and additional information is required (Section 13(1) (a)), or

- a review of the information indicates that there may be adverse effects or significant environmental effects caused by the undertaking and an environmental-assessment report is required (Section 13(1) (d)).

5.0 References

AMEC, 2007. *Northumberland Strait Ecosystem Overview Report*. Accessed from: https://docs.wixstatic.com/ugd/b61814_1639a02cebd94db4ba24787ad9a4cac7.pdf.

AMEC Earth & Environment. 2007. Northumberland Strait Ecosystem Overview Report. Submitted to Fisheries and Oceans Canada Gulf fisheries Centre, Moncton, New Brunswick.

Birtwell et al, 1999. The Effectsof Sediment on Fish and Their Habitat. Canadian Stock Assessment Secretariat Research Document 99/139.

Brillant, S. W., Vanderlaan, A. S., Rangeley, R. W., & Taggart, C. T. (2015). Quantitative estimates of the movement and distribution of North Atlantic right whales along the northeast coast of North America. *Endangered Species Research*, *27*(2), 141-154.

Chassé, J., Lambert, N., Comeau, M., Larouche, P., Galbraith, P., and Pettipas, R. 2013 Physical Environment Conditions in the southern Gulf of St. Lawrence. DFO, GFC-IML-BIO.

Chassé, J. and Miller, R.J. 2010. Lobster Larval Transport in the Southern Gulf of St. Lawrence. Fish. Oceanogr. 19:5, 319-338.

Claret, Mariona & Galbraith, Eric & Palter, Jaime & Bianchi, Daniele & Fennel, Katja & Gilbert, Denis & Dunne, J. (2018). Rapid coastal deoxygenation due to ocean circulation shift in the northwest Atlantic. Nature Climate Change. 8. 10.1038/s41558-018-0263-1.

COSEWIC. 2011. COSEWIC assessment and status report on the Atlantic Sturgeon Acipenser oxyrinchus in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiii + 49 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC. 2013. COSEWIC assessment and status report on the North Atlantic Right Whale *Eubalaena glacialis* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xi + 58 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

Davis, G. E., Baumgartner, M. F., Bonnell, J. M., Bell, J., Berchok, C., Thornton, J. B., ... & Clark, C. W. (2017). Long-term passive acoustic recordings track the changing distribution of North Atlantic right whales (Eubalaena glacialis) from 2004 to 2014. *Scientific reports*, *7*(1), 13460.

Daoust, P.-Y., E.L. Couture, T. Wimmer, and L. Bourque. 2017. *Incident Report: North Atlantic Right Whale Mortality Event in the Gulf of St. Lawrence, 2017*. Collaborative report produced by the Canadian Wildlife Health Cooperative, Marine Animal Response Society, and Fisheries and Oceans Canada, 256 pp.

DFO. 2005. The Gulf of St. Lawrence, A Unique Ecosystem. The Stage for the Gulf of St. Lawrence Integrated Management (GOSLIM). Oceans and Science Branch, Fisheries and Oceans Canada. Cat. No. FS 104-2/2005

DFO. 2011. Assessment of the scallop fishery (Placopecten magellanicus) of the southern gulf of St. Lawrence. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2011/039.

DFO, 2012. State-of-the-Ocean Report for the Gulf of St. Lawrence Integrated Management (GOSLIM) Area.

DFO, 2014. Lobster Overview. Accessed from: http://www.glf.dfompo.gc.ca/Gulf/FAM/IMFP/2014-Lobster-Overview#Participants.

DFO. 2017. Assessment of the Atlantic Mackerel Stock for the Northwest Atlantic (Subareas 3 and 4) in 2016. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2017/034.

DFO. 2018a. Assessment of the southern Gulf of St. Lawrence (NAFO Div. 4T) spring and fall spawner components of Atlantic herring (*Clupea harengus*) with advice for the 2018 and 2019 fisheries. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2018/029

DFO. 2018b. Stock Assessment of Atlantic Halibut of the Gulf of St. Lawrence (4RST) in 2016. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2017/052.

DFO. 2018c. What we heard report: A summary of comments from the 2018 Pan-Atlantic Roundtable on North Atlantic Right Whales. Published October 23, 2018. Retrieved from: http://www.dfo-mpo.gc.ca/species-especes/publications/mammals-mammiferes/2018-roundtable-tableronde/index-eng.html

DFO. 2018d. Fishery management measures for right whale protection. Retrieved from: http://www.dfo-mpo.gc.ca/species-especes/mammals-mammiferes/narightwhale-baleinenoirean/fm-gp/index-eng.html

DFO, 2019a. Update of the Stock Status Indicators of the American Lobster, Homarus Americanus, Stock of the Southern Gulf of St. Lawrence to 2018. Canadian Science Advisory Secretariat Gulf Region Science Response 2019/008

Durbin, E., Teegarden, G., Campbell, R., Cembella, A., Baumgartner, M. F., & Mate, B. R. (2002). North Atlantic right whales, Eubalaena glacialis, exposed to paralytic shellfish poisoning (PSP) toxins via a zooplankton vector, Calanus finmarchicus. *Harmful Algae*, *1*(3), 243-251.

Ecometrix, 2019. Environment Effects Monitoring Program Investigations Associated with eh New Proposed Treated Effluent Discharge Configuration at the Northern Pulp Nova Scotia Corporation Mill. Appendix G of NPNS Environmental Assessment.

ECCC (2017). *Proposed modernization of the Pulp and Paper Effluent Regulations: Consultation document*. Environment and Climate Change Canada: Gatineau, QC.

Government of Nova Scotia, 2018. 2018-2019 Business Plan – Department of Fisheries and Aquaculture. Accessed from: https://novascotia.ca/government/accountability/2018-2019/2018-2019-business-plan-Department-of-Fisheries-and-Aquaculture.pdf.

Jacques Whitford Environmental Limited (JWEL). 1996. First Cycle Final Report – Aquatic Environmental Effects Monitoring Program – Boat Harbour Wastewater Treatment Facility. Report to the Nova Scotia Department of Supply and Services.

Lauzier, L.M. 1965. Drift bottle observations in Northumberland Strait, Gulf of St. Lawrence. Journal Fisheries Research Board of Canada 22(2): 353-368.

Logan, Paul. Letter to CEAA requesting CEAA federal assessment (n.d.).

Nova Scotia Environment, 2018. A Proponent's Guide to Environmental Assessment.

Nova Scotia Department of Fisheries and Aquaculture; Government of Canada (n.d.) Accessed from: https://www.ic.gc.ca/eic/site/tdo-dcd.nsf/eng/Home

Galbraith, P.S., Chassé, J., Gilbert, D., Larouche, P., Caverhill, C., Lefaivre, D., Brickman, D., Pettigrew, B., Devine, L., and Lafleur, C. 2014. Physical Oceanographic Conditions in the Gulf of St. Lawrence in 2013. DFO Can. Sci. Advis. Sec. Res. Doc. 2014/062. vi + 84 p.

Hannah M. Murphy, Jonathan A. D. Fisher, Arnault Le Bris, Mathieu Desgagnés, Martin Castonguay, Timothy Loher & Dominique Robert (2017) Characterization of Depth Distributions, Temperature Associations, and Seasonal Migrations of Atlantic Halibut in the Gulf of St. Lawrence using Pop-Up Satellite Archival Tags,Marine and Coastal Fisheries, 9:1, 1-356, DOI: 10.1080/19425120.2017.1327905

Hanson, J.M. and Comeau, M. 2017. Progress on the Ecosystem Research Initiative for the Northumberland Strait since October 2012. Can. Manuscr. Rep. Fish. Aquat. Sci. 3145: ix + 29

Encyclopedia Britannica: Scientific Model - https://www.britannica.com/science/scientific-modeling.

MacCarthy, A., and C. Egilsson. 2019. Caribou Harbour and Caribou Channel – dynamics, tides, ice, marine species and fisheries. Submission from Local Fishermen, February 21, 2019. 12 p.

Meyer-Gutbrod, E. L., & Greene, C. H. (2018). Uncertain recovery of the North Atlantic right whale in a changing ocean. *Global change biology*, *24*(1), 455-464.

Meyer-Gutbrod, E. L., Greene, C. H., & Davies, K. T. (2018). Marine Species Range Shifts Necessitate Advanced Policy Planning: THE CASE OF THE NORTH ATLANTIC RIGHT WHALE. *Oceanography*, *31*(2), 19-23.

Newcombe and Jensen, 1996. Channel Suspended Sediment and Fisheries: A Synthesis for Quantitative Assessment of Risk and Impact. North American Journal of Fisheries Management 16:693-727.

Plourde, S., Lesage, V., Gosselin, J., Johnson, C., & Brown, M., and J. Goldbogen. (2016). A Spatial Climatology of Calanus Species Biomass and New Potential Feeding Habitats of NARW on the Eastern Scotian Shelf and in the Gulf of St. Lawrence (Canada). NARWC Annual Meeting, New Bedford, 2-3 November 2016.

Sprague, J.B., and McLeese, D.W. (1968). Toxicity of kraft pulp mill effluent for larval and adult lobsters and juvenile salmon. *Water Research, 2,* 753-760.

Stantec Consulting Ltd. (Stantec). Preliminary Receiving Water Study for Northern Pulp Effluent Treatment Plant Replacement, Pictou Harbour, Nova Scotia. August 2017.

Stantec Consulting Ltd. (Stantec). Addendum Receiving Water Study for Northern Pulp Effluent Treatment Facility Replacement Project – Additional Outfall Location CH-B, Caribou Point, Nova Scotia. December 2018.

Rondeau, A., J.M. Hanson, M. Comeau, and T. Surette. 2016. Identification and Characterization of Important Areas based on Fish and Invertebrate Species in the Coastal Waters of the Southern Gulf of St. Lawrence. DFO Can. Sci. Advis. Sec. Res. Doc. 2016/044. vii + 70 p.

Weisbrod, A. V., Shea, D., Moore, M. J., & Stegeman, J. J. (2000). Organochlorine exposure and bioaccumulation in the endangered Northwest Atlantic right whale (Eubalaena glacialis) population. *Environmental Toxicology and Chemistry*, *19*(3), 654-666.

Project Team Curricula Vitae

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Appendix A, Dr. Andrea Battison, Animal Health Perspective with a Focus on Crustaceans.pdf
Appendix B, Dr. Battison, publications.pdf
Appendix C, FOIPOP excerpts.pdf

Good evening ,

In addition to the technical review submitted earlier today by Shared Value Solutions on behalf of the Gulf Nova Scotia Fleet Planning Board, and their Fishermen's Working Group for the Northern Pulp Environmental Assessment, I am attaching and additional document including three appendices as part of our review of the NPEA.

Please note, we will will be forwarding you an addendum to this submission tomorrow.

Thank you in advance,

Linda Townsend
On behalf of Fishermen's Working Group for the NPEA

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Review of the Environmental Assessment Registration Document Regarding Northern Pulp Nova Scotia's Proposed Replacement Effluent Treatment Facility from an Animal Health Perspective with a Focus on Crustaceans

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EXECUTIVE SUMMARY

CrustiPath was engaged by the Harvester Working Group to review the January 2109 Environmental Assessment (EA) on the Northern Pulp Nova Scotia replacement effluent facility. The focus was to be on the health of the fish, crustaceans and bivalves; specific to local commercially important species including an understanding of how contaminants in the effluent may negatively affect the reproduction and growth rate. After a preliminary review of available information and given the very short timeline available, it was decided to focus the review on the changes known or potentially possible to happen to crustaceans, particularly American lobsters

Although improvements in treatment of BKME have decreased acute toxicity (mortality) to fish, effluent from pulp and paper mills continues to release bioactive substances that affect fish metabolism and reproductive performance. The identity of the responsible compound(s) remains undetermined. The roles of hormones e.g., estrogens, androgens, anti-estrogens, anti-androgens, neuroactive substances and altered nutritional effects are possibilities. There are reports of moult inhibition in crustaceans exposed to estrogenic, androgenic, anti-estrogens and anti-androgens. Five studies on American lobster (*Homarus americanus*) exposed to BKME from Abercrombie Point between 1968 and 1973 suggested: larvae were relatively resistant to BKME and adult lobster more so; no significant change in larval numbers after opening of the mill; and, that lobster movement and feeding behaviour were unchanged at low levels of BKME. The latter could also be interpreted as an inability to detect and avoid potentially deleterious BKME. These studies were limited in scope, used BKME different from that anticipated to be produced by the NPNS, and did not include sublethal toxicity or generational testing. These limitations were noted in Appendix R of the EA, but not mentioned in Section 8.12.3.3. There are few data on the sublethal effects of exposure of crustaceans to the pulp mill effluents created today e.g., elemental or total chlorine free, secondary biological treatment, particularly in marine environments.

Section 9 of the EA (Human Health Evaluation) used model studies to identify cadmium, mercury, selenium, (and polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/F)) as chemicals of potential concern (COPC) that might accumulate in tissue of fish exposed to effluent. While the intent was to examine the fish tissue from a food safety perspective, it could also be concluded that these chemicals also represent a health risk to species in the receiving waters. With respect to crustaceans, cadmium has been shown to negatively effect moulting and growth, reproduction, and cause variation in hemolymph glucose (sugar) levels, possibly via an 'endocrine disruption' effect. Anticipated levels of these COPCs in the effluent are not provided in the EA, precluding assessment of possibility toxicity to crustaceans.

The current Environmental Effects Monitoring (EEM) program uses the caged blue mussels (*Mytilus edulis*) as a representative invertebrate for testing purposes. Bivalves are different from crustaceans in many ways. It would be desirable to know if bivalves and crustaceans respond similarly to BKME for EEM purposes.

Development of a new reef structure creating habitat for lobsters and other fish as a result of the pipe infrastructure is mentioned. Whether or not this would encourage fish to stay near the outflow in an area of maximal effluent and whether this could have a negative, neutral or positive effect on fish health is not discussed.

Given the limited, and often dated, information available regarding the potential for adverse effects on the health, in particular growth (moulting) and reproduction, of marine species of commercial interest such as the American lobster and rock crab, upon exposure to the mill effluent to be produced by the proposed facility at NPSNS, further studies (acute, sublethal, and generational) are recommended.

SCOPE OF REVIEW

The overall pertinent sections of the environmental assessment (EA) were reviewed: Section 8.12 Marine and Fish Habitat, Section 9 Human Health Evaluation, Appendix G Proposed EEM Program, Appendix H Proposed Follow Up and Monitoring Program, Appendix R Scientific Literature BKME Effects on Lobster, and the 2016 EEM report and summary documents. Literature searches on: the historical effects of BKME on finfish, bivalves and crustaceans; known or proposed mechanisms of action of BKME; effects of BKME on finfish, bivalves and crustacean since the introduction of new effluent treatment measures; and known or suspected effects on crustaceans of the chemicals of potential concern (COPC) identified in Section 9 of the EA. There is heavy reliance on the review paper by Hewitt at al in 2006 regarding the chemistry and effects of BKME. The conclusions and recommendations are based primarily on the information provided in the EA and how it relates to published information on crustaceans rather than a global review of potential health effects to marine species exposed to BKME.

CONCEPTS OF HEALTH

Animal, or human, health can be loosely defined as an absence from disease. Disease can be defined as the impairment of normal function or structure of a living organism. A more specific definition of health is provided by the World Health Organization (WHO) and states the following "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity (Grad, 2002). The presence of disease be assessed by looking at changes in physiological systems e.g., respiratory, reproductive, immune, integument (skin, shell, carapace), muscular, skeletal and nervous systems, and behaviour. Testing methods can include: physical examination; changes in weight; collection of blood (or hemolymph) samples to test e.g., immune function, organ function or toxin accumulation; pathology exams at the gross or microscopic (histology) level; gene expression; and, more recently metabolomics.

Pulp Mill Effluent Effects on Finfish Health

The review paper by Hewitt et al. (Hewitt, Parrott, & McMaster, 2006), summarises the path of research of two identified responses in finfish exposed to pulp mill effluent 1) induction of detoxification enzymes (suggesting exposure to a toxin) in fish tissues, and 2) reproductive effects e.g., "smaller gonad (ovary) and egg size, increased age to maturation, decreased levels of reproductive steroid hormones, and altered expression of secondary sex characteristics". The earlier focus on absorbable organic halides (AOX) switched to bioactive substances released from the wood during pulp digestion (in kraft mills, present in black liquor and chemical recovery condensates). Of note is the study of the **AhR** (aryl hydrocarbon receptor), cytochrome **cyt p450,** P-4501A1, and **EROD** (ethoxyresorufin O-deethylase) molecules which are involved in the detoxification process.

The authors note that despite the improved quality of effluent with decreases in compounds producing acute toxicity (mortality), organochlorine discharges and AOX levels, effects persist *"…, effluents from pulp and paper mills continue to release into Canadian aquatic receiving environments bioactive substances that affect fish metabolism and reproductive performance*" (Hewitt et al., 2006). The authors also note in their conclusions that "*The bioactive substances in pulping processes appear to be derived from original pulp digestion and/or from residual lignin removal during bleaching. The identities of the responsible compounds have remained elusive, thereby impairing any evaluation of the effectiveness of secondary treatment and other process changes in the industry*".

A review in 2010 (van den Heuvel, 2010) indicated that reproductive impairment noted in fish exposed to pulp and paper effluent, although decreasing, continues and the causative agent(s) remains to be definitively identified. Exposure to hormones (estrogenic, anti-estrogen, and androgens) derived from the wood itself, neuroendocrine compounds that interfere with hormone balance, or nutritional effects are possible mechanisms under consideration. The metabolic disruption response (decreased gonad size associated with increased liver size and greater body condition) "*remains a prevalent pattern in data generated as part of Canada's federally mandated Environmental Effects Monitoring Program*" (van den Heuvel, 2010).

A long term review of effluent at a mill in New Zealand concluded that subtle effects on fish reproductive physiology, while substantially decreased, continue to be observed even with extensive efforts to improve the quality of the effluent (van den Heuvel, Slade, & Landman, 2010). The example described was that of swim-up fry being substantially shorter and lighter than fry from the reference site. This was attributed to a chronic, eight- month, exposure of the maternal fish to the test effluent, suggesting a next-generation effect.

Interestingly, Davis et al. (Davis et al., 2013), used metabolomics (the study of a set of metabolites within a cell, tissue, or organism) to demonstrate short term response of fathead minnows to short term changes in effluent levels in Lake Superior during a temporary shut down of a paper and pulp mill in the region. The effect was most pronounced in male fish… "*Thus, we demonstrate the potential utility of field-based metabolomics for performing biologically based exposure monitoring and evaluating remediation efforts occurring throughout the Great Lakes and other ecosystems*". This represents another potential way to assess fish health.

Pulp Mill Effluent Effects on Crustacean Health

The effects of BKME on crustacean physiology are not as well studied as in fish. Crustaceans have a complex endocrine (hormone) system that is responsible for regulating reproduction, growth and moulting, and metabolism as in vertebrate species. The effects of pollutants (pesticides, herbicides, effluents, heavy metals) on the physiology of these animals are not as well documented as in fish, birds and mammals. Review papers by Fingerman (Fingerman, Jackson, & Nagabhushanam, 1998) and Rodríguez (Rodríguez, Medesani, & Fingerman, 2007) concisely summarise some of these endocrine (hormone) disruptive effects and the known or suspected mechanisms in crustaceans.

Disturbance or disruption of the normal processes of reproduction and moulting were the most common effects studied. While many of these were ascribed to pesticides, xenoestrogens (synthetic or naturally occurring compounds that mimic estrogen), testosterone (an androgen), juvenoids (synthetic compounds designed to mimic the structure or effect of insect juvenile hormone; often used as insecticides) the impacts of the metals cadmium, and to a lesser extent, copper, mercury and zinc are also described (Rodríguez et al., 2007). In their concluding remarks, the authors stated "*crustacean molting can be inhibited by any one of several organic compounds (including androgenic, estrogenic, as well as antiandrogens and antiestrogens) as well by some heavy metals."* The need for further study to determine mechanisms, with an emphasis for multigenerational studies to assess long-term processes such as reproduction and growth was emphasised (Rodríguez et al., 2007).

Cadmium has been associated with moult inhibition in the crab, *Chasmagnathus granulatus* and *Daphnia magna,* and inhibition of ovarian growth in fiddler crabs (*U. pugalotor*) exposed to cadmium for two weeks (Rodríguez et al., 2007). Cadmium is suspected to inhibit moulting by inhibiting the secretion of the moulting hormone ecdysone (Rodríguez et al., 2007). Lethal concentrations (LC-50 at 96 hours) of cadmium, copper, and mercury for stage I *Homarus americanus* larvae were determined to be 78 µg/L, 48 µg/L, and 20 µg/L, respectively (Johnson & Gentile, 1979). Heavy metals can inhibit food intake by small crustaceans (Rodríguez et al., 2007). Changes (transient increases (hyperglycemia) in acute exposures, decreases in chronic exposures) in hemolymph (blood) glucose levels in response to metal exposure have been documented in crayfish and in the shrimp *Palaemon elegans* exposed to mercury, cadmium, and copper crabs (Rodríguez et al., 2007). Chronic (two week) exposure to cadmium in the crab, *Chasmagnathus granulatus* appeared to interfere with crustacean hyperglycemic hormone (CHH) – the crustacean 'stress hormone' and lowered hemolymph glucose levels.

Information on the specific effect of BKME on American lobsters is extremely scarce with all five papers found during a literature search being written before 1973 (McLeese, 1970, 1973; Scarratt, 1969; Sprague & McLeese, 1968a; Sprague JB, 1968b).

Comparisons of surface plankton tows conducted in 1966, before opening of the pulp mill at Abercrombie Point, and in 1968 after the mill had been in operation determined that the variation in total catch of 746 larvae in 1968 from 1814 larvae in 1966 was within the range of normal catch fluctuations in the Strait (Scarratt, 1969). The study concluded that "*the mill effluent was not having any immediate, direct effect on the abundance and distribution of lobster larvae in the Pictou area*." No

measurements (weight, length), gross or microscopic observations for abnormalities or adverse effects are reported.

One day old American lobster larvae and adult lobsters were exposed to a range of diluted BKME and acute toxicity evaluated (Sprague JB, 1968a). The BKME represented a mixture of material from the bleachery 'chlorination effluent', (40%), bleachery 'caustic extraction effluent' (30%) and effluent from the kraft screen room sewer (30%) and neutralised to pH 7. The authors concluded that larvae were reasonably resistant to BKME concentrations below 10% and that adults were "*even more resistant*". When comparing the responses of salmon parr (*Salmo salar* L.) and *Homarus americanus* larvae to biologically oxidised BKME, lobster larvae were described as more sensitive than parr at the one week time point, suggesting different responses by different animals to the same conditions (Sprague & McLeese, 1968b). There was no histologic examination of tissues to assess for injury, long term, sublethal, or generational effects evaluated for survivors in either study.

Adult American lobsters to exposed to 10% - 20% BKME (spillway material) in a test tank passed through the BKME-seawater boundary 98 out of 103 approaches (McLeese, 1970). Of the five initial reversals, lobsters passed through the boundary on subsequent approaches. The conclusion was that 10% - 20% BKME did not affect movement of adult lobster. A later study examined if BKME would alter the feeding response of American lobster in the presence of BKME (McLeese, 1973). It was concluded that "*exposure to low concentrations of BKME for short periods does not reduce the response of lobsters to freeze dried cod solution or, if so, to a minor extent only*". The investigator also indicated "*the possibility that long term exposure might affect the response, or that other behavior stimulated by chemoreceptors may be affected, was not tested".* An additional interpretation of these results is that failure to avoid the effluent might represent a risk to the health of the lobster if there is a component in the effluent that could generate an adverse effect in the lobster.

While these studies did investigate the effect of BKME on American lobster specifically, it is important to note that the effluent composition has changed over the past 50 years (Hewitt et al., 2006; van den Heuvel, 2010) and probably does not reflect what would be entering the receiving waters in the current proposal. The studies were relatively limited in scope and depth – essentially looking at acute toxicity data, a behaviour response, and one abundance and distribution study. These represent very limited investigations by current standards with a notable lack of sublethal, chronic exposures or examination of generation effects, assessment of growth or reproduction indices, etc.. The relevancy of the findings in these studies to the composition of the effluent, which is not clearly defined within the EA, from the proposed NPNS effluent treatment facility is uncertain.

A study of the decapod crustacean, *Pacifastacus leniusculus,* a freshwater crayfish, demonstrated induction of cytochrome p450 in response to dioxin (TCCD) exposure (injected) (Ashley, Simpson, Holdich, & Bell, 1996). The response may have involved the AhR system as noted in vertebrates. This is an interesting finding as it could mean that crustaceans have the potential to respond to BKME in a manner similar to fish. Expression of genes for cytochrome p450-form has been studied in American lobster (Tarrant, Franks, & Verslycke, 2012). This suggests that physiologic responses of American lobster could be studied at the gene expression level as in finfish.

More recently, Chamorro et al. (Chamorro et al., 2016) investigated the sublethal effects of chlorine-free kraft mill effluents using the small freshwater crustacean, *Daphnia magna* as the model species. This is a tiny, freshwater, planktonic, water flea used in studies for ecologic monitoring purposes. The study was conducted to address the concern of biologically active compounds that might remain in wastewater despite the use of chlorine-free bleaching and biological treatment of wastewater. A chronic feeding test and two standardised tests - an acute lethality test, OECD 202 (Organisation for Economic Co-operation and Development., 2004) and a chronic assay testing reproduction, OECD 211 (Organisation for Economic Co-operation and Development., 2012) were used. The latter "uses reproduction as a basic biological endpoint, but the test design allows for the measurement of other relevant variables like mortality and growth". The investigators reported mixed results with stimulatory effects on some parameters at low concentrations of effluent while reproductive effort was reduced at higher concentrations of effluent. The potential for this to be a hormetic effect, where a biphasic dose response to an environmental agent characterized by a low dose stimulation or beneficial effect and a high dose inhibitory or toxic effect was considered (Mattson, 2008).

The reproductive assay and the chronic feeding test are directly and indirectly looking at animal health and examining for sublethal effects. Further investigation as to the applicability of these tests to a marine environment and/or extrapolation of any results to larger decapods and species of commercial interest requires further investigation and is beyond the scope of the current report.

Taken together, these studies suggest the potential for impact on crustacean health by several organic compounds (androgenic, estrogenic, antiestrogenic, antiandrogenic) which have suspected roles in impaired reproductive potential in finfish exposed to BKME. Metals such as cadmium that could be present in BKME are also recognised to impact growth and reproduction in crustaceans.

COMMENTS ON SELECTED SECTIONS OF THE ENVIRONMENTAL ASSESSMENT SUBMITTED BY NPNS

Section 8.12.3.3 Characterization of Residual Effects

The report on scientific literature of BKME effects on lobster (Appendix R) summarises literature on responses of American lobster, *Homarus americanus* to BKME and related salinity, temperature and dissolved oxygen changes. The limitations and the need for further study, including sublethal testing using current BKME was indicated in the executive summary and in the report's concluding remarks as follows: "*Studies to more accurately assess the potential for impact to adult lobsters including lethality, behavior, and sublethal impacts are recommended to be carried out with current treated BKME. Completing studies of lobster larvae with today's treated BKME would allow for confirmation and better understanding of potential lethal and sublethal effects."*

These recommendations are valid and appropriate; however, do not appear in Section 8.12.3.3 (Marine and Fish Habitat. Impact Evaluation/Effects Assessment. Characterisation of Residual Effects) where much of Appendix R is referenced.

The concept of a reef effect at the site of the pipe is mentioned as a beneficial aspect of the change "from a soft-bottomed benthic community to hard-bottom community". It was also noted that "*Marine plants, which are important components of habitat for lobster and other commercially important species, will also colonize the hard substrate of in-water structures*." While it may provide new habitat, the potential to encourage animals to feed and remain close to the outflow site might have the unintended consequence of increasing the exposure of animals to the effluent. The studies by McLeese suggested that adult American lobsters would detect and consume feed in the presence of BKME of the day (McLeese, 1970, 1973). The effects on marine animal health of this behaviour are unknown and would be an area for further evaluation.

Environmental Effects Monitor (EEM) for Monitoring Stage (Appendix G)

Appendix G provides an outline of the components of an EEM program should the NPNS EA submission be approved. It states that modifications from the current EEM will be required to address the change in treatment plant and discharge structure. The current EEM uses caged bivalves (*Mytilus edulis*), blue mussels, as *"Caged bivalves provide a reasonable alternative to finfish to assess the effects of pulp and paper effluent on fish* (Environment Canada, 2010) when marine discharges are used .

The assays to be conducted on caged mussels include*: "Various morphological measurements will be made on individual mussels (shell length, shell width, shell height, whole animal weight wet (WAWW), soft tissue fresh weight, and, gonad somatic index (GSI)) in order to generate measures of key potential effect endpoints, such as reproductive effort, growth, energy storage and survival."*

As the crustaceans, American lobster and rock crab, represent two of the commercial resources identified in the EA, it would be reassuring to see evidence that the caged bivalve system is also an approved alternative for crustacean species. This information could not be found in the EA.

Proposed Follow Up and Monitoring Program (Appendix H)

"*Follow up and Monitoring will include: sublethal toxicity testing of treated effluent; phytoplankton and zooplankton community assessments; benthic invertebrate community sampling; water quality sampling; fish community and fisheries resource characterization; and fish and shellfish tissue chemistry investigations*". More detailed monitoring is proposed in the event that "*monitoring results indicate that either end-of-pipe effluent quality data or receiving environment data deviate from those predicted in the EA the potential consequences (if any) of such deviations would be investigated. In this instance, additional or modified performance monitoring components could be proposed and/or implemented, as appropriate"* or *"Alternatively, where EA-related predictions are confirmed reduced monitoring effort may be indicated".*

Tissue chemistry monitoring would include collecting tissues from potential species of interest including lobster, rock crab, scallop, blue mussel, softshell clam, oyster, and locally relevant finfish (e.g., Eel, Smelt, Gaspereau, Striped Bass, Mackerel, Atlantic Herring). *"Tissue specimens will be collected from the exposure area (i.e., the area potentially influenced by mill effluent) and up to two reference areas that are beyond the potential zone of influence of the effluent. Overall, it is envisioned that 5 to 8 replicate samples of 3 to 4 species from 2 to 3 sampling areas will be submitted for analysis of the following parameters: total phenols; total metals contents; low level mercury; and, resin and fatty acids.*

Tissue chemistry testing will generate data on the levels of these chemicals in fish tissues (presumably for use in food safety assessments) but is only an indirect assessment on the health of the fish and shellfish themselves. If the sublethal testing is limited to bivalves, it is unknown is this would adequately reflect effects on crustacean health.

Section 9.0 Human Health Evaluation (as pertains to marine health)

As part of the review of human health risks, a report by Toxikos prepared for a pulp mill deemed to have similar characteristics as NPNS was used to determine candidate chemicals of potential concern (COPC) for human health within the effluent anticipated to be produced by NPNS. The initial list had 39+ compounds listed which was reduced to four identified in Section 9.2.4.2. *"The outcome of the screening approach to identify substances that may accumulate in fish was a greatly reduced list of candidate COPCs. The final COPCs selected in the Toxikos HHRA study were: Cadmium, Mercury, Selenium, polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/F)".* The Toxikos report indicated that "*PCDD/F was included due to regulatory and public concerns only, as it was noted there is no technical justification to include PCDD/F in effluent from an ECF mill…*". No information on projected levels of these metals or PCDD/F were provided in the EA so it is not possible to compare them to known LC50s in American lobster larvae for cadmium, mercury, and copper.

There are studies (see Pulp Mill Effluent Effects on Crustacean Health, this report) describing adverse effects of metals, particularly cadmium, on crustacean health with respect to moulting, reproduction and the glycemic/stress response. Given these studies, and the statement in the EA that these metals could accumulate in fish tissues, these metals could be considered COPC with regards to crustacean health.

CONCLUSIONS & RECOMMENDATIONS

Taken together, these studies suggest the potential for impact on crustacean health by several organic compounds (androgenic, estrogenic, antiestrogenic, antiandrogenic) which have suspected roles in impaired reproductive potential in finfish exposed to BKME. Metals such as cadmium that could be present in BKME are also recognised to impact growth and reproduction in crustaceans.

Due to the limited and dated information available regarding the potential for adverse effects on the health of the marine species of commercial interest, in particular growth and reproduction of crustaceans such as the American lobster and rock crab, upon exposure effluent to be produced by the proposed replacement effluent treatment facility at NPNS, further studies (acute and sublethal) are recommended.

REFERENCES

Ashley, C. M., Simpson, M. G., Holdich, D. M., & Bell, D. R. (1996). 2,3,7,8-tetrachloro-dibenzo-p-dioxin is a potent toxin and induces cytochrome P450 in the crayfish, Pacifastacus leniusculus. *Aquatic Toxicology*, *35*(3–4), 157–169. https://doi.org/10.1016/0166-445X(96)00014-8

Canada, E. (2010). Pulp and paper environmental effects monitoring (EEM) Technical Guidance Document Revised April 2013.

Chamorro, S., López, D., Brito, P., Jarpa, M., Piña, B., & Vidal, G. (2016). Sublethal Effects of Chlorine-Free Kraft Mill Effluents on Daphnia magna. *Bulletin of Environmental Contamination and Toxicology*, *97*(6), 843–847. https://doi.org/10.1007/s00128-016-1936-y

Davis, J. M., Collette, T. W., Villeneuve, D. L., Cavallin, J. E., Teng, Q., Jensen, K. M., … Ekman, D. R. (2013). Field-Based Approach for Assessing the Impact of Treated Pulp and Paper Mill Effluent on Endogenous Metabolites of Fathead Minnows (*Pimephales promelas*). *Environmental Science & Technology*, 130830150520002. https://doi.org/10.1021/es401961j

Fingerman, M., Jackson, N. C., & Nagabhushanam, R. (1998). Hormonally-regulated functions in crustaceans as biomarkers of environmental pollution. *Comparative Biochemistry and Physiology Part C: Pharmacology, Toxicology and Endocrinology*, *120*(3), 343–350. https://doi.org/10.1016/S0742-8413(98)10072-5

Grad, F. P. (2002). The Preamble of the Constitution of the World Health Organization. *Bulletin of the Worlld Health Organization*, *80*(12), 982.

Hewitt, L. M., Parrott, J. L., & McMaster, M. E. (2006). A decade of research on the environmental impacts of pulp and paper mill effluents in Canada: Sources and characteristics of bioactive substances. *Journal of Toxicology and Environmental Health - Part B: Critical Reviews*, *9*(4), 341–356. https://doi.org/10.1080/15287390500195976

Johnson, M. W., & Gentile, J. H. (1979). Acute toxicity of cadmium, copper, and mercury to larval American lobsterHomarus americanus. *Bulletin of Environmental Contamination and Toxicology*, *22*(1), 258–264. https://doi.org/10.1007/BF02026939

Mattson, M. P. (2008). Hormesis defined. *Ageing Research Reviews*, *7*(1), 1–7. https://doi.org/10.1016/j.arr.2007.08.007

McLeese, D. W. (1970). Behaviour of Lobsters Exposed to Bleached Kraft Mill Effluent. *Journal of the Fisheries Research Board of Canada*, *27*(4), 731–736. https://doi.org/10.1139/f70-076

McLeese, D. W. (1973). Response of Lobsters *Homarus americanus* to Odor Solution in the Presence of Bleached Kraft Mill Effluent. *Journal of the Fisheries Research Board of Canada*, *30*(2), 279–282. https://doi.org/10.1139/f73-046

Organisation for Economic Co-operation and Development. (2004). *202. Daphnia sp. Acute Immobilisation Test*. OECD Publishing.

Organisation for Economic Co-operation and Development. (2012). *Test no. 211 : Daphnia magna reproduction test*. OECD Publishing.

Rodríguez, E. M., Medesani, D. A., & Fingerman, M. (2007). Endocrine disruption in crustaceans due to pollutants: A review. *Comparative Biochemistry and Physiology Part A: Molecular & Integrative Physiology*, *146*(4), 661–671. https://doi.org/10.1016/j.cbpa.2006.04.030

Scarratt, D. J. (1969). Lobster Larvae off Pictou, Nova Scotia, Not Affected by Bleached Kraft Mill Effluent. *Journal of the Fisheries Research Board of Canada*, *26*(7), 1931–1934. https://doi.org/10.1139/f69-177

Sprague, J. B., & McLeese, D. W. (1968). Different toxic mechanisms in kraft pulp mill effluent for two aquatic animals. *Water Research*, *2*(11), 761–765. https://doi.org/10.1016/0043-1354(68)90010-9

Sprague JB, D. M. (1968). Toxicity of kraft pulp mill effluent for larval and adult lobsters, and juvenile salmon. *Fisheries Research Board of Canada*, (985), 1–15. Retrieved from https://www.sciencedirect.com/science/article/pii/0043135468900092

Tarrant, A. M., Franks, D. G., & Verslycke, T. (2012). Gene Expression in American Lobster (*Homarus americanus*) with Epizootic Shell Disease. *Journal of Shellfish Research*, *31*(2), 505–513. https://doi.org/10.2983/035.031.0210

van den Heuvel, M. R. (2010). Recent Progress in Understanding the Causes of Endocrine Disruption Related to Pulp and Paper Mill Effluents. *Water Quality Research Journal*, *45*(2), 137–144. https://doi.org/10.2166/wqrj.2010.017

van den Heuvel, M. R., Slade, A. H., & Landman, M. J. (2010). Summary of a decade of research on the effects of a New Zealand pulp and paper millon reproduction in fishes. *Water Quality Research Journal of Canada*, *45*(2), 123–135.

Dr. Andrea Battison –
Publications & Presentations

Papers in Refereed Journals

Daoud D, Battison A, Natalie, LR, Van Geest JL. (2016). Repeated sublethal exposures to the sea lice pesticide Salmosan® (azamethiphos) on adult male lobsters (*Homarus americanus*) causes metabolic dysfunctions, functional hypoxia, and mortality. Ecotoxicol Environ Saf. 34(1), Dec:106-115

Simon CJ, Fitzgibbon QP, Battison A, Carter CG, Battaglene SC. 2015. Bioenergetics of nutrient reserves and metabolism in spiny lobster juveniles *Sagmariasus verreauxi*: Predicting nutritional condition from hemolymph biochemistry. Physiol Biochem Zool 88(3). ePub March 19, 2015. DOI: 10.1086/681000

Ciaramella M, Battison A, Horney B. 2014. Measurement of tissue lipid reserves in the American lobster *(Homarus americanus*): Hemolymph metabolites as potential biomarkers of lipid reserves in the American lobster, *Homarus americanus*. J Crus Biol. 34(5):629-638.

Battison A. 2013. Subcuticular uric acid deposition in an American lobster (*Homarus americanus*): A case report. Vet Pathol. May; 50(3):451-6.

Battison AL, Summerfield R. 2008. Isolation and partial characterisation of four novel plasma lectins from the American lobster *Homarus americanus*. Dev Comp Immunol. 33:198-204

Battison AL, Deprés B, Greenwood SJ. 2008. Ulcerative enteritis in *Homarus americanus*: Case report and molecular characterisation of intestinal aerobic bacteria of apparently healthy lobsters in live storage. J Invert Path. 99(2): 129-135.

Battison AL, Summerfield R, Patrzykat A. 2008. Isolation and characterisation of two antimicrobial peptides from haemocytes of the American lobster *Homarus americanus*. Fish Shellfish Immunol. 25: 181-187.

Battison A. 2007. Apparent pseudohyperkalemia in a Chinese Shar-Pei dog. Vet Clin Pathol. (36)1, 89-93.

Battison A. 2006. Tissue distribution and hemolymph activity of six enzymes in the American lobster (*Homarus americanus*): Potential markers of tissue injury. J Shellfish Res. 25(2), 553-560.

Battison AL, Cawthorn R, Horney B. 2004. Response of American lobsters (*Homarus americanus*) to infection with a field isolate of *Aerococcus viridans* var. *homari* (Gaffkemia): Survival and haematology. Dis Aquat Org. Nov; 61(6): 263-268.

Battison AL, Cawthorn R, Horney B. 2004. Classification of *Homarus americanus* hemocytes and the use of differential hemocyte counts in lobsters infected with *Aerococcus viridans* var. *homari*. J Invert Path; 84: 177-197.

Battison AL, Cawthorn R, Horney B, MacKenzie A. 2002. Mushroom tyrosinase as a control material for phenoloxidase assays used in the assessment of crustacean 'health'. J Shellfish Res Jun 21(1): 295-298.

Battison A, MacMillan R, MacKenzie A, Rose P, Cawthorn R, Horney B. 2000. Use of injectable potassium chloride for euthanasia of American lobsters (*Homarus americanus*). Comp Med Oct; 50(5):545-50.

Archer FJ, Battison A. 1997. Difference in electrophoresis patterns between plasma albumins of the cockatiel (*Nymphicus hollandicus*) and the chicken (*Gallus gallus domesticus*). Avian Path; 26: 865-870.

Battison A, Buckzowski S, Archer FJ. 1996. The potential use of glutamate dehydrogenase activity for the evaluation of liver disease in the cockatiel (*Nymphicus hollandicus*). Vet Clin Pathol. 25(2):43-47.

Battison AL, Machin KL, Archer FJ. 1996. Ascites and hepatic cirrhosis in a cockatiel (*Nymphicus hollandicus*). Am Anim Hosp Assoc. May-Jun;32(3):237-42.

Battison AL, Buckzowski S, Archer FJ. 1996. Plasma bile acid concentration in the cockatiel. Can Vet J. Apr 37 (4): 233-4

Grahn BH, Szentimrey D, Battison A, Hertling R. 1995. Exophthalmos associated with frontal sinus osteomyelitis in a puppy. J Am Anim Hosp Assoc. Sep-Oct; 31(5):397-401.

Conference Proceedings (Oral Presentation)

Battison A, Lavallée J. 2011. A summary of hemolymph plasma biochemistry profile results from American lobsters (*Homarus americanus*) in Atlantic Canada (2007-2010). 9th International Conference and Workshop on Lobster Biology and Management, Bergen, Norway.

Burton M, Battison A, Lavallée J. 2011. Physiological assessment of American lobsters (Homarus americanus) held in a specialized live seafood transport system. 9th International Conference and Workshop on Lobster Biology and Management, Bergen, Norway.

Summerfield R, Battison A. 2011. Examination of protein expression during ovary maturation in American lobsters (*Homarus americanus*). 9th International Conference and Workshop on Lobster Biology and Management, Bergen, Norway.

Battison A. 2009. Hemolymph triglyceride concentration: A potential non-lethal method to assess ovary maturation in the American lobster (*Homarus americanus)*. ACCESS conference. University of Prince Edward Island.

Battison A, Summerfield R, Patrzykat A. 2007. Isolation of two antimicrobial peptides from *Homarus americanus* hemocytes. 8th International Conference and Workshop on Lobster Biology and Management. Charlottetown, Canada.

Battison A. 2005. Relative tissue distribution and haemolymph activity of six enzymes in *Homarus americanus* - potential markers of tissue injury. 6th International Crustacean Congress (ICC6), Glasgow, Scotland.

Battison A, Horney B, Cawthorn R. 2002. Hemocytes of *Homarus americanus* stained with a modified Wright-Giemsa stain: description and comparison to current classification schemes. National Shellfisheries Association Conference, Mystic, CT.

Battison A and Erb H. 1998. Automated method for the determination of rabbit serum albumin on the Hitachi 911. The American College of Veterinary Pathologists, 49th Annual Meeting, St. Louis, MO.

Battison A, Stokol T, Blue JT, van Gessel Y, McDonough S. 1998. Chronic myelomonocytic leukemia in a horse. The American College of Veterinary Pathologists, 49th Annual Meeting, St. Louis MO.

Conference Proceedings (Poster Presentations)

Battison A, Burton M, Comeau M, Silva A, Summerfield R. 2011. Hemolymph triglyceride and cholesterol concentrations as potential aids to determine ovary maturity in the American lobster. 9th International Conference and Workshop on Lobster Biology and Management, Bergen, Norway.

Battison A. Subcuticular uric acid deposition in an American lobster (*Homarus americanus*): A case report. 2009. Annual meeting of the American College of Veterinary Pathologists and American Society of Veterinary Clinical Pathology, Monterey, CA.

Summerfield R, Battison A. 2009. Bromocresol Green binds to lobster (*Homarus americanus*) hemocyanin. Annual meeting of the American College of Veterinary Pathologists and American Society of Veterinary Clinical Pathology, Monterey, CA.

Summerfield R, Battison A. 2007. Development of an ELISA for the measurement of an N-acetyl-D-glucosamine binding protein in plasma of *Homarus americanus*. 8th International Conference and Workshop on Lobster Biology and Management. Charlottetown, Canada.

Battison A., Summerfield R. 2007. Isolation and characterisation of an N-acetyl-D-glucosamine binding protein from *Homarus americanus* plasma. 8th International Conference and Workshop on Lobster Biology and Management. Charlottetown, Canada.

Battison A, Cawthorn R, Horney B. 2007. Bumper Car Disease - Comparison of Experimental and Naturally Acquired Infections. 8th International Conference and Workshop on Lobster Biology and Management. Charlottetown, Canada.

Battison A. 2005. Pseudohyperkalemia and poikilocytosis in a Chinese Shar Pei dog. American College of Veterinary Pathologists and American Society of Veterinary Clinical Pathologists Annual Meeting, Boston, USA.

Battison A, Cawthorn R, Horney B, MacKenzie A. 2003. Plasma prophenoloxidase in American lobsters (*Homarus americanus*): variation in a natural population and changes associated with two infectious diseases. American College of Veterinary Pathologists and American Society of Veterinary Clinical Pathologists Annual Meeting, Banff, AB.

Horney B, Battison A, MacKenzie A. 2002. Cytocentrifuge preparations: An alternate method to examine the hemocytes of the American lobster *Homarus americanus*. National Shellfisheries Association Conference, Mystic, CT.

Battison A, MacKenzie A, MacMillan R, Cawthorn R, Horney B. 2001. Gaffkemia: Old disease, new findings. Graduate Studies and Research Days, Charlottetown, PE.

Battison A. 2000. Plasma Prophenoloxidase Activity in American Lobsters (*Homarus americanus*) Infected with the Ciliate *Anophyroides haemophila*. Graduate Studies and Research Days, Charlottetown, PE.

Professional Presentations - Invited

Battison A. 2011. Lobster Blood Biochemistry: There's more to it than just protein! Fishermen & Scientists Research Society Annual General Meeting. Truro, NS.

Evaluating Hemolymph: Clinical Pathology in the American Lobster. 2010. ASVCP Veterinary Laboratory Professionals. Baltimore, MD.

Crustacean Immunity & Health Assessment Techniques in the American Lobster (*Homarus americanus*). 2006. Saint Francis Xavier Biology Department Seminar Series.

Management of laboratory samples: Improving their diagnostic value. 1997. Vermont Veterinary Medical Association. Killington, VT.

Lay Extension

Battison A & Lavallée J. 2011. Lobster health in early life stages. Atlantic Lobster Sustainability Foundation Meeting. Moncton. NB.

Battison A. 2011. Hemolymph Biochemistry: An Indicator of Nutritional Status? 7th Annual Lobster Science Workshop. Charlottetown, PE.

Battison A. 2009. Investigation of Mushy Tail in American lobsters. 5th Annual Lobster Science Workshop. Charlottetown, PE.

Battison A. 2008. In the Lab. 4th Annual Lobster Science Workshop, Moncton, NB.

Battison A. 2006. Ecosystem Health: Lobster as a Sentinel Species. 3rd Annual Lobster Science Workshop, Charlottetown, PE.

Battison A. 2005. Biochemistry profiles- Another tool for assessment of lobster health? 2nd Annual Lobster Science Workshop, Charlottetown, PE.

Battison A. 2001. Questions and answers about blood (hemolymph) protein. Lobster Blood Protein Workshop, Shelburne, NS.

Battison A. 2001. Refractometers: Uses and limitations. Lobster Blood Protein Workshop Shelburne, NS.

Contract Research Reports *(selected)*

Moriyasu M, Allain R, Battison A, Boudreau M, Allard J, Gerber RP, Courtenay S and Hall D. 2015. Establishment of biological baseline information for snow crab *Chionoecetes opilio* in the southern Gulf of St. Lawrence and on the Scotian Shelf. OERA/DFO Collaborative Research Project #300-120-09-34.

Battison A, Greenwood S, and Lavalleé J. 2005. White Spot Syndrome Virus: Diagnostics, surveillance and transmission - A literature review. Prepared for the Fisheries and Oceans Canada.

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Honourable Minister Margaret Miller
Nova Scotia Environment
PO Box 442
Halifax, NS B3J 2P8

March 8th, 2019

Dear Hon. Minister Miller:

Please find below concerns expressed by the Gulf Nova Scotia Fleet Planning Board, the PEI Fishermen's Association, the Maritime Fishermen's Union and Pictou Landing First Nation. The four groups together represent approximately 3,000 commercial fishermen who make their living in the Northumberland Strait.

Following a thorough review of Northern Pulp Nova Scotia's (NPNS) EA Registration Documents, both by us and by independent experts, we are extremely concerned with NPNS's proposal to pump effluent into the Northumberland Strait. As detailed below, as well as in the attached review by Dr. Battison and in the separately submitted expert review by SVS Ltd., NPNS's EA Registration Documents provide no assurance that marine life will not be harmed, or that our fishing industry and our way of life will not be irrevocably damaged.

We implore you to reject NPNS's proposal as presented and require NPNS to file a **thorough and rigorous Environmental Assessment Report, per subsection 13(1)(d) of the Environmental Assessment Regulations,** given the project's high risk of environmental effects. Failing this, the lack of sufficient information in NPNS's proposal on the impacts of the effluent on marine life and the health of the Northumberland Strait requires that you, at a minimum, deem the Registration Documents as insufficient and require more information, per subsection 13(1)(a) of the Environmental Assessment Regulations.

In addition to the concerns expressed below, please find attached Dr. Andrea Battison's review of the EA registration documents from an animal health perspective with a focus on crustaceans (Appendix A), along with Dr. Battison's list of publications (Appendix B). Also attached are documents obtained through FOIPOP requests and are referenced in the comments below (Appendix C). Furthermore, SVS Ltd. is submitting an expert review of the NPNS EA Registration Document under separate cover. SVS Ltd. was contracted by several fishermen's organizations to conduct an independent expert review of NPNS's new ETF proposal.

Fishing Industry's Concerns with Northern Pulp's EA Registration Document:

1. ***EA Registration Document fails to assess potential impact of effluent on crustaceans and other marine life.***

In her February 25, 2019 review (submitted separately), veterinarian Dr. Battison notes that with respect to the potential sublethal effects of exposure of crustaceans to NPNS's pulp mill effluent, NPNS relied on studies that "were limited in scope, used BKME different from that anticipated to be produced by the NPNS, and did not include sublethal toxicity or generational testing."

Additionally, Dr. Battison notes that "anticipated levels of [chemicals of potential concern] in the effluent are not provided in the EA, precluding assessment of toxicity to crustaceans…."

Dr. Battison concludes that,

> *Given the limited, and often dated, information available regarding the potential for adverse effects on the health, in particular growth (moulting) and reproduction, of marine species of commercial interest such as the American lobster and rock crab, upon exposure to the mill effluent to be produced by the proposed facility at NPNS, further studies (acute, sublethal, and generational) are recommended.*

Furthermore, the EA Registration Document fails to explain how NPNS will improve upon the Cycle 7 EEM Results regarding sublethal toxicity testing, which indicated that "there are chronic effects seen in laboratory test species at relatively low effluent concentrations…" (Appendix J, page 144).

Moreover, NPNS's own EA consultant, Dillon Consulting, recommended to NPNS in a February 14th 2018 letter that,

> *Conducting research on lobster larvae, … needs to be completed to demonstrate to regulators that these were properly considered and stakeholder concerns are being addressed as much as reasonable possible…. The level of stakeholder (commercial fishers) concern regarding lobsters necessitates the need for increased scientific understandings…. (FOIPOP 2018-07644-TIR2, page 476 – 479, attached in Appendix C, pages 1 - 4).*

Despite this recommendation from NPNS's own consultant, NPNS failed to carry out this research.

RECOMMENDATION 1: The Minister cannot accept the EA Registration Document as submitted given the effluent's potential harm to crustaceans and other marine life and given the lack of information to demonstrate whether this harm is negligible or significant.

2. ***NPNS's proposal to test effluent toxicity sometime within 24 months after the new ETF is operational (Appendix H, page 90) presents an unacceptable risk of significant harm to marine life.***

NPNS fails to indicate how it will mitigate negative impacts of the effluent on marine life that may occur before effluent testing is conducted. Given that NPNS has failed to disclose what the effluent leaving the new ETF will contain, forgoing monitoring of the effluent for up to 24 months poses an unacceptable

risk to marine life in the Strait. If effluent contains chemicals of concern that bioaccumulate in marine life, NPNS's proposed testing of the effluent may be too late to stop or mitigate the potential harm these chemicals present.

RECOMMENDATION 2: The Minister cannot accept the EA Registration Document as submitted because NPNS's proposal to test effluent toxicity sometime within 24 months after NPNS starts pumping effluent into the Northumberland Strait presents too high of an unmitigable risk to marine life and the fishing industry.

3. NPNS presented misleading statements to the public about the quality of effluent to be discharged from the proposed ETF, thereby compromising NPNS's public engagement process.

NPNS repeatedly made public statements to the effect that the effluent from the proposed ETF would be no worse than the effluent currently entering Northumberland Strait. For example:

- In a letter to the Town of Westville obtained through a FOIPOP request, NPNS's Director of Corporate Communications wrote "Northern Pulp has been releasing effluent into the Northumberland Strait for five decades. … Treated effluent that will be discharged under the proposed new design will see an even greater improvement…" (FOIPOP 2018-07644-TIR4, page 1104 – 1105, attached in Appendix C, pages 5 - 6).

- In a letter to Advocate News, November 24th 2017, NPNS's Director of Corporate Communications wrote "… Treated effluent has been discharged into the Northumberland Strait for 50 years; it is important to recognize that current effluent discharge into the region has not impacted fishing activities nor will it in the future." (FOIPOP 2018-07644-TIR5, page 1175 – 1177, attached in Appendix C, pages 7 - 9).

- In a letter to CBC reporters, November 15th 2017, NPNS's Director of Corporate Communications wrote the following response to a reporter's question "Are [the fishermen] right to be concerned?": "Treated effluent has been flowing through Boat Harbour and into the Northumberland Strait for over 50 years. The new treatment facility and diffused outfall <u>will reduce the impact on the Strait</u>. …" (FOIPOP 2018-07644-TIR5, page 1268 – 1271, attached in Appendix C, pages 10 -13) (emphasis added).

- In a letter to NPNS's EA consultant company Dillon Consulting Ltd., November 26, 2017, NPNS wrote: "… mark the existing outfall clearly on the map with a thick red line and put a sentence on the outfall page that says something like 'New outfall and diffuser located xx nautical miles from the existing outfall … We want the NB and PEI fishermen to clearly see it is there already." (FOIPOP 2018-07644-TIR5, page 1170 – 1171, attached in Appendix C, pages 14 - 15).

Moreover, NPNS's message that the new ETF will not increase impact on the Strait was echoed in Minister of Environment (as he was then) Iain Rankin's form letter sent to citizens concerned with the proposed ETF. He wrote in a January 18, 2018 letter: "… I am sure you are aware that effluent from the pulp mill has been treated by the Boat Harbour effluent treatment facility and then discharged into the

Northumberland Strait for the last 50 years. …" (FOIPOP 2018-06097-ENV, page 88, attached as Appendix C).

In stark contrast to these statement to the public through the media, internal statements within NPNS indicated that NPNS believed that the effluent from the new system would be "worse" that the effluent currently entering the Northumberland Strait. For example:

- In a letter to NPNS's EA consultant Dillon Consulting Ltd., NPNS's Technical Manager stated "Some say effluent quality will be worse than today because of all the polishing that is happening across the BH basin – and they are correct to some extent…" (FOIPOP 2018-07644-TIR4, page 1037 – 1041, attached in Appendix C, pages 17 - 20).

- In a letter to Gary Porter, senior employee with NS's Department of Transportation and Infrastructure Renewal, November 15th 2017, NPNS's Technical Manager stated "Right now mill has BH as large buffer zone, so effluent at point C is not comparable to new effluent. Need to compare to Point D or speak to difference between current point C and D. … [Consultant] KSH study that says AST [activated sludge treatment / proposed for new ETF] quality not significantly different than ASB [aerated stabilization basin, ie, Boat Harbour / current ETF]." (FOIPOP 2018-07644-TIR5, page 1274 – 1277, attached in Appendix C, pages 21 - 24).

- In a 2014 report by KSH consultants commissioned by NPNS, KSH states: "A large, natural final polishing/stabilization basin follows prior to release to the Northumberland Straight [sic]. … Point C of the effluent treatment system also benefits from the settling effect of Boat Harbour prior to Point D, so the impact on marine environments is even less pronounced." (FOIPOP 2018-07644-TIR6, page 1815 and 1825, attached in Appendix C, pages 25 - 26).

Given that NPNS acknowledged that the effluent to be released into the Northumberland Strait might be worse than they currently release into the Strait via Boat Harbour, NPNS's statements to the public that the effluent from the new ETF would be better or at least no worse are disingenuous and misleading and thereby compromised NPNS's public engagement process. There is no way to know what concerns the public may have expressed if the public had been given the full account of the relative quality of the effluent to be discharged from the proposed ETF.

RECOMMENDATION 3: The Minister cannot accept the EA Registration Document as submitted because NPNS compromised their public engagement process by providing misleading statements to the public about the relative quality of the effluent to be discharged into the Northumberland Strait from the proposed ETF.

4. NPNS has not demonstrated how the proposed ETF will accomplish the "polishing" effect on the effluent currently achieved through the 25 – 30 day settling in Boat Harbour before released into the Northumberland Strait.

The EA Registration Document notes that NPNS's effluent currently undergoes a "polishing" effect thanks to the 25 to 30 day settling period in Boat Harbour before the effluent reaches the Strait (Appendix J, page 23). However, the Document fails to describe how the proposed ETF will provide for

these same effluent quality benefits, or whether the lack of a "polishing" effect could cause significant environmental impacts.

Furthermore, the EA Registration Document (Appendix I4, page 24) also notes that the 2017 yearly average test results for TSS (Total Suspended Solids), BOD (Biochemical Oxygen Demand) and COD (Chemical Oxygen Demand) at point C were 1563, 1300 and 36,506 kg/day respectively, and that the values for these parameters at Point D were 775, 792, and 34,250 kg/day, respectively. These results indicate that TSS is 2 times larger at Point C than at Point D, that BOD is 1.6 times larger at Point C than at Point D, and that COD is 1.07 times larger at Point C than at Point D. The EA Registration Document fails to indicate how the advantages in reduced TSS, COD and BOD due to Boat Harbour will be achieved in the proposed ETF, or whether increased TSS, COD and BOD relative to Point D will have a negative and significant impact on the environment.

RECOMMENDATION 4: The Minister cannot accept the EA Registration Document as submitted because NPNS fails to demonstrate whether the lack of "polishing" effect and reductions in TSS, BOD and COD currently achieved by the settling time in Boat Harbour will cause significant environmental impacts, or whether the "polishing" and TSS, BOD and COD reduction effect will be achieved through other means in the proposed ETF.

5. NPNS fails to describe what the effluent will be composed of when it is released into the Northumberland Strait via the proposed ETF.

NPNS notes in the EA Registration Document that it rejected the possibility of discharging effluent into Pictou Harbour due to "the accumulation and increasing concentration of residual contaminants contained in the treated effluent, over time" (page 68). NPNS fails to describe what the "residual contaminants" in the treated effluent will be. It is impossible to determine the extent of harmful impacts on the environment that may occur given this lack of information.

RECOMMENDATION 5: The Minister cannot accept the EA Registration Document as submitted because NPNS fails to provide information about what potentially harmful components will be contained in the effluent.

6. NPNS failed to demonstrate that ice scour will not damage the pipeline and/or the diffusers.

The EA Registration Documents indicate that the pipeline route to Pictou Harbour was abandoned due to risk of ice scour damage (pages 47 and 70), yet the Documents fails to demonstrate that ice scour risk will be negligible at the Caribou Harbour site. Appendix E notes that "… an outfall pipe is proposed to be extended parallel to the ferry route to a deeper water location that might help avoid potential issues of ice scour" (page 9) [emphasis added].

Given that Northumberland Strait is ice-bound for a significant portion of the year, a compromised pipe and/or diffuser could result in a large amount of effluent released in an unplanned manner for a months-long duration before the problem is identified and fixed, potentially resulting in significant environmental impacts.

RECOMMENDATION 6: The Minister cannot accept the EA Registration Document as submitted because NPNS fails to provide sufficient evidence that ice scour will not compromise the integrity and function of the pipeline and the diffusers.

7. NPNS fails to explain how it will deal with its effluent between February 1, 2020 and the date by which the new ETF is operational.

The EA Registration Document indicates that the new ETF will not be operational by the January 31, 2020 deadline to close Boat Harbour (page 48). Yet, the Document fails to provide a plan for the intervening time between the closure of Boat Harbour and commencement of the new ETF. Without such a plan, the proposal lacks an air of reality. Furthermore, NPNS's plan for dealing with its effluent between February 1st 2020 and the commencement date of the new system could have significant environmental impacts; these impacts cannot be evaluated in the absence of a plan from NPNS.

RECOMMENDATION 7: The Minister cannot accept the EA Registration Document as submitted because NPNS fails to provide a plan for its effluent for the time between February 1, 2020 and the commencement of the new ETF.

8. NPNS fails to respond to Nova Scotia Environment's requirement to address all potential substances of concern, not just those outlined in the Federal Pulp and Paper Effluent Regulations.

In a letter from Nova Scotia Environment to NPNS's General Manager on June 14th 2017, NSE issued the following requirement to NPNS, at NPNS's request, with the subject line "Minimum Requirements of a Receiving Water Study":

> *… The mixing zone principle does not apply to hazardous wastes or dangerous goods. Mixing zones also do not apply to bio-accumulative or persistence [sic] substances and despite the allowance of a mixing zone, effluent shall not be acutely toxic. It should be noted that in this particular case, a receiving water study must address all potential substances of concern not limited to those outlined in the Federal Pulp & Paper Effluent Regulations.*
>
> *… In order to protect important aquatic communities … no conditions within the mixing zone will be permitted which:*
>
> *a. are acutely lethal to aquatic life;*
>
> *b. cause irreversible responses which could result in detrimental post-exposure effects;*
>
> *c. result in bioconcentration of toxic materials which are harmful to the organism or its consumer;*
>
> *d. attract organisms to the mixing zones, resulting in a prolonged exposure;*
>
> *e. create a barrier to the migration of fish or other aquatic life.*

… Mixing zones should not impinge upon … important fish spawning and/or fishing areas.

… When background water quality conditions at a proposed mixing zone site are degraded, effluent discharge requirements established must ensure, at the very least, that background water quality is not further degraded.

The Department requires enough information to ensure each of the above concerns is adequately addressed. Specifically including but not limited to:

- *information about the effluent (substances of potential concern, volumes, etc.);*
- *information about the receiving water (physical characteristics, size, upstream and downstream water quality); …*

The information provided to the Department should include one year's worth of effluent characterization data. … Water quality considerations take precedence when contaminant discharges exceed the assimilative capacity of the receiving waters, even if the discharged loadings are within the treatment technology based effluent requirements based on the guidelines, regulations or policies. Receiving-water based effluent requirements also take precedence when ambient levels of contaminants are above acceptable levels. …

All effluent discharges must not be acutely lethal. (FOIPOP 2018-07644-TIR5, page 1422 – 1424, attached in Appendix C, pages 28 - 31)

The EA Registration Document fails to respond to the requirements detailed in NSE's letter to NPNS. The Document fails to provide detailed information about the effluent, fails to demonstrate how the mixing zone will not impinge upon important fish spawning and fishing areas, and fails to provide one year's worth of effluent characterization data. Without such information, the Minister cannot make an informed decision on whether the effluent will be acutely lethal to aquatic life, cause irreversible responses which could result in detrimental post-exposure effects, or result in bioaccumulation of toxic materials, among other potential impacts.

RECOMMENDATION 8: The Minister cannot accept the EA Registration Document as submitted because NPNS fails to respond to Nova Scotia Environment's specific information requirements to be included in the Document and therefore the Minister does not have sufficient information to determine whether the project will result in significant adverse environmental impacts.

All of the above is respectfully submitted to the Nova Scotia Minister of Environment, the Honourable Margaret Miller, within the 30-day public comment period with respect to Northern Pulp Nova Scotia's proposed Effluent Treatment Facility.

Sincerely,

Prince Edward Island Fishermen's Association, President

Maritime Fishermen's Union, President

Gulf Nova Scotia Fleet Planning Board, President

Chief Andrea Paul

Andrea Paul
Pictou Landing First Nation, Chief

From:
To: Environment Assessment Web Account
Cc: @juniperlaw.ca
Subject: Re: Review of Northern Pulp NS Environmental Assessment
Date: March 9, 2019 11:48:17 AM
Attachments: Working group submission - marine perspective (v2).pdf

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Hello ,
Further to my email yesterday, I am submitting our final document for our EA response. Please see attached document entitled, "Working Group Submission - Marine Perspective". You should now have in your possession the following documents from the Fishermen's Working Group.

1. Technical Review Submitted by Shared Valued Solutions on behalf of Fishermen's Working Group
2. Fisheries Industry Submission on NPNS ED
3. Appendix A. Dr. Andrea Battison, Animal Health Perspective with a Focus on Crustaceans
4. Appendix B, Dr. Battison's publications List
5. Appendix C, FOIPOP Excerpts
6. Working Group Submission - Marine Perspective

If you could acknowledge receipt of the above listed documents, it would be greatly appreciated.

Sincerely,

On behalf of the Fishermen's Working Group for the NPEA

On Fri, Mar 8, 2019 at 10:59 PM Linda Townsend <northumberlandfishermen@gmail.com> wrote:

> Good evening
> In addition to the technical review submitted earlier today by Shared Value Solutions on behalf of the Gulf Nova Scotia Fleet Planning Board, and their Fishermen's Working Group for the Northern Pulp Environmental Assessment, I am attaching and additional document including three appendices as part of our review of the NPEA.
> Please note, we will will be forwarding you an addendum to this submission tomorrow.
>
> Thank you in advance,
>
> On behalf of Fishermen's Working Group for the NPEA

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March 8th, 2019

Dear Hon. Minister Miller:

Please find below concerns expressed by the Gulf Nova Scotia Fleet Planning Board, the PEI Fishermen's Association, the Maritime Fishermen's Union and Pictou Landing First Nation. The four groups together represent approximately 3000 commercial fishing licenses including 215 communal commercial licenses held by 18 Aboriginal organizations

There are numerous commercially important species in the Northumberland Strait including but not limited to lobster, rock crab, Atlantic halibut, tuna, mackerel, herring and American eel. The Strait is considered somewhat of a closed system with a delicately balanced ecosystem based on a complex food web. The fishing associations are in a perfect position to examine Northern Pulp Nova Scotia's (NPNS) EA Registration Documents from the marine perspective because of their extensive knowledge of each species and their interaction with each other. This knowledge comes directly from harvester experience coupled with the organization's involvement in stock assessments, collaborative research with DFO, and numerous advisory groups.

Armed with this knowledge the fishing organizations are extremely concerned with the lack of solid evidence in NPNS's proposal that this effluent will not alter the ecosystem in the Northumberland Strait. An alteration of the ecosystem could be due to a change in water chemistry, sedimentation, or negative health effects on marine life.

The organizations feel strongly that this environmental assessment, submitted by Northern Pulp, is insufficient and it should have a more rigorous assessment. This needs to include field work and research from an ecosystem perspective with consideration given to the climate change currently being documented in the Gulf of St. Lawrence.

We are asking you to reject Northern Pulp's proposal as presented and require NPNS to file a thorough and rigorous Environmental Assessment Report.

It is important to point out that a request for a more rigorous federal assessment does not set a precedent for changes to other pulp mill treatment plants to go through a federal assessment. The current pulp and paper effluent regulations were developed in 1992 and are currently under review so this project is a unique case while regulations are being updated.

Background information:

The mean water flow in the Northumberland Strait is west to east and the residence time is weeks to months but this varies with seasons, storms, etc. (AMEC Earth & Environment 2007). There are also 2 gyres (figures 1 and 2) located at each end of the Northumberland Strait (Fisheries and Oceans Canada 2005) affecting the residence time. These gyres have the

capability to retain and redistribute particles, being larvae or toxins (AMEC Earth & Environment 2007). These are important to understand when considering different life stages of a species because it corresponds directly with larval drift and settlement.

It is noted in the American Lobster, *Homarus americanus*, stock status in the southern Gulf of St. Lawrence: LFA 23, 24, 25, 26a and 26b report (DFO 2013) that recent models show that the Northumberland Strait is basically a secluded system based on larval recruitment compared to the rest of the southern Gulf of St. Lawrence.

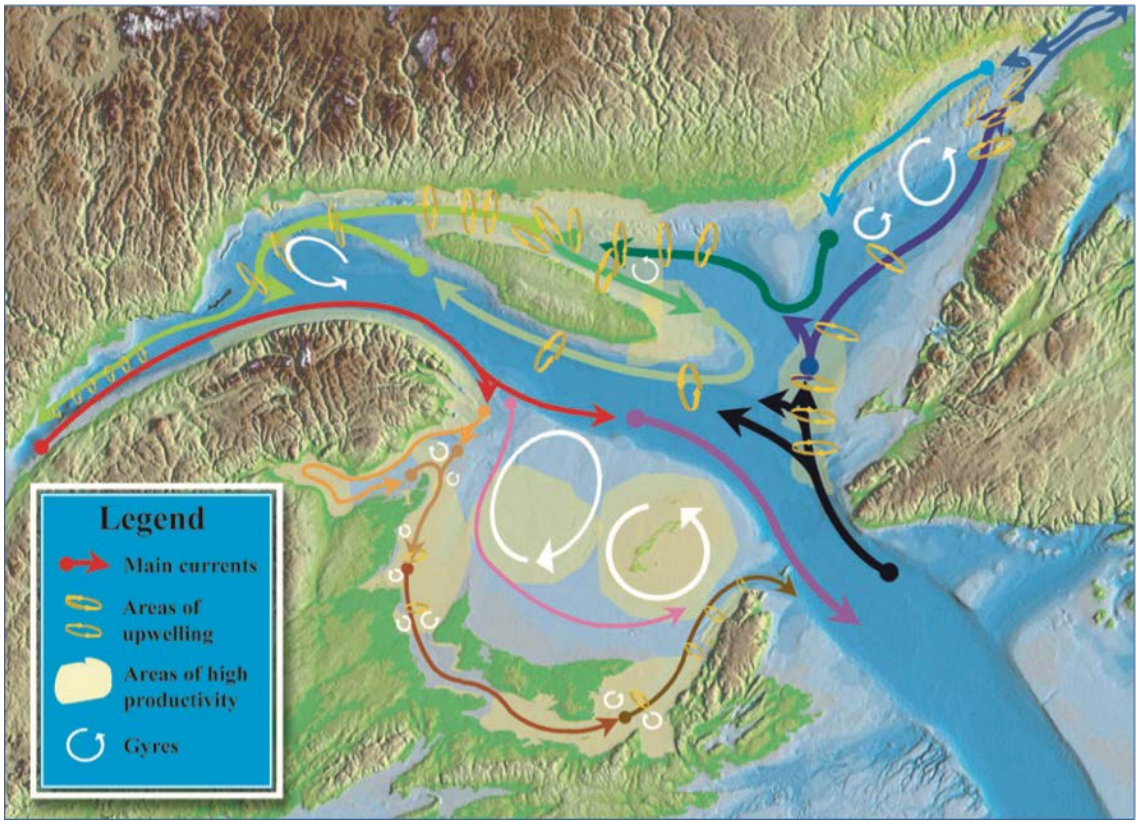

Figure 1: Currents, gyres, upwelling and areas of high productivity in the Gulf of St. Lawerence (DFO 2005).

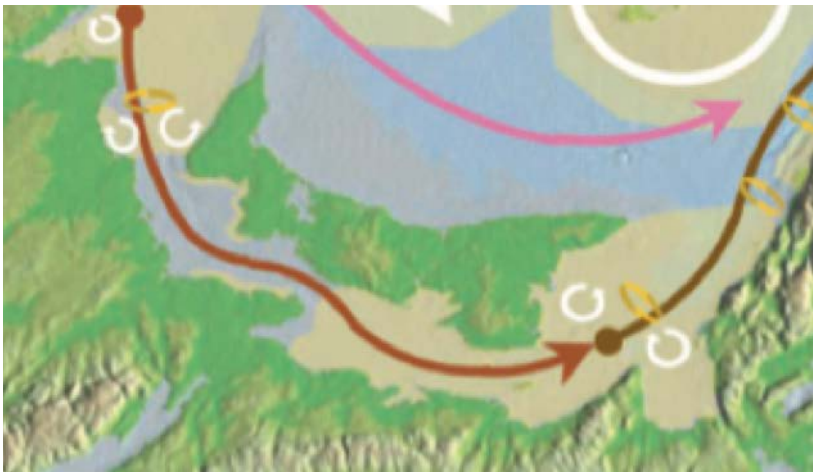

Figure 2: Section of the map from figure 5 zoomed in on the Northumberland Strait.

To give this some context, we can look at lobster larval transport in the Gulf. Based on the previous description above one can assume that anything entering the Northumberland Strait will drift toward the east, up along the Western side of Cape Breton to the Cabot Strait, and out of the Gulf, but the description leaves out the timeline of this taking place. In 2010 Joël Chassé and Robert J. Miller published “Lobster larval transport in the Southern Gulf of St. Lawrence”.

They broke down the Southern gulf to 25 larval source-sink areas (Figure 3) to look at the distribution between the time the eggs are released to the time the larvae settle. When the eggs are released they are reliant on the current for transport and only have the capability to swim to the bottom and seek out suitable habitat at stage 4 which occurs approximately 3-12 weeks after release from the abdomen. During the 3- 12 weeks the prior to settlement the larvae’s destination is a result of the direction of the current. Chassé and Miller (2010) showed that the larvae released in Pictou (area 21) actually seeds areas 23, 24, 22, 20, 18 and 19 (Figure 3). Seeding in areas 18 and 19 are to a lesser degree but still shows a distribution from east to west, exemplifying the weak current present in the Northumberland Strait. These models were run for the larval and post-larval season, June 1st to September 30th, over a 10-year period. This shows lobster larvae are retained in the Northumberland Strait for up to 120 days while a product of the current and some actually end up west of where they were released rather than east; completely contradicting the description our harvester working group is being given by Northern Pulp and their consultants. This model showed that particular circumstances result in east to west currents lasting days to weeks (Hanson and Comeau 2017).

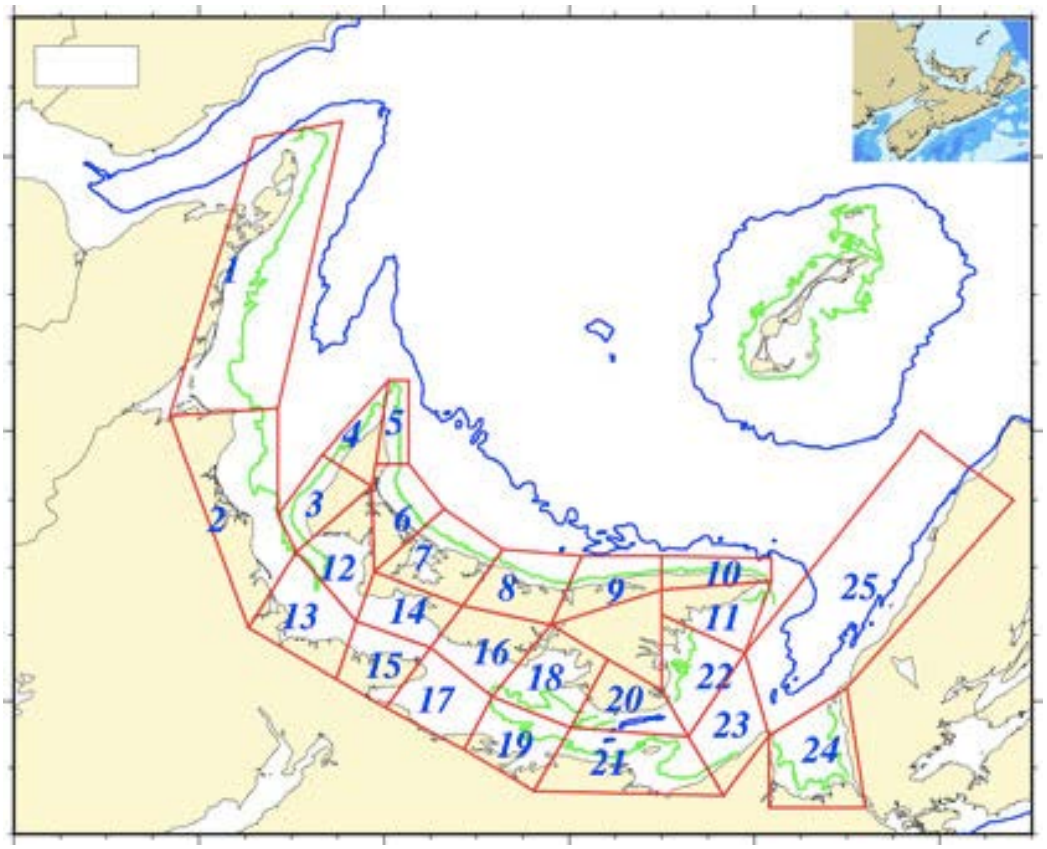

Figure 3: The 25 larval source-sink areas set up by Chassé and Miller, 2010 to analyze larval drift in the Southern Gulf of St. Lawrence.

This also shows the relationship that exists between the provinces in relation to the lobster fishery. Abundance in one area is not a product of the adults in the same area, but rather the adults in other areas and the currents that move the larvae through the Northumberland Strait and the Gulf of St. Lawrence.

Figure 4 showed a full year averaged currents in the Gulf of St. Lawrence and is represented by arrows, the darker and longer the arrows the stronger the current. It is apparent that the movement in the Northumberland Strait is greatly reduced compared to other areas within the Gulf of St. Lawrence further emphasizing the lack of circulation in the Northumberland Strait.

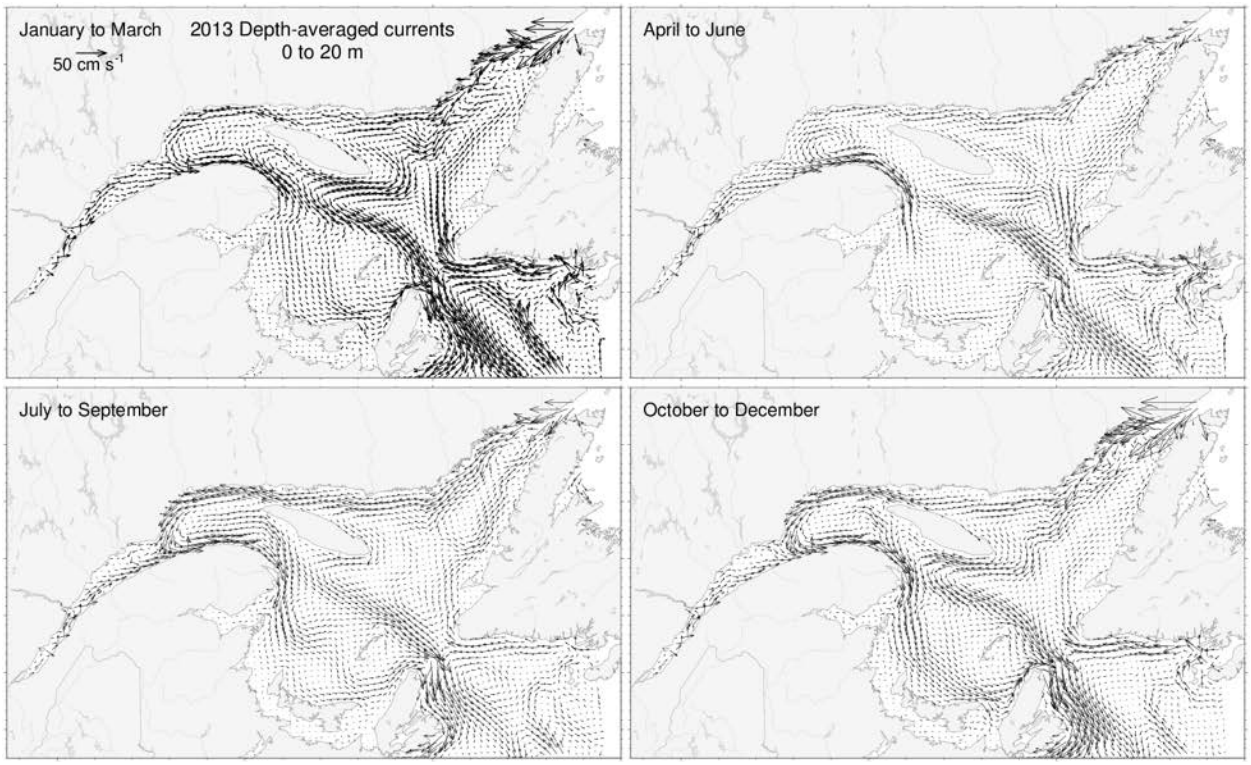

Figure 4: Depth-averaged currents from 0 to 20 m for each three-month period of 2013. (Galbraith et al. 2013)

The Gulf of St. Lawrence has been identified as an area of rapid coastal deoxygenation by Claret, M. et. al (2018). Their analysis shows increased surface water temperature, increased salinity and decreased oxygen saturation. Changes to any of these variables in isolation can cause stress on important commercial species, changes to all three has the potential for synergistic effects and should not be overlooked. The addition of hot, fresh water to the Northumberland Strait for an extended period should not be so easily passed by in this environmental assessment.

Specific Concerns from the Fishing Industry with Northern Pulp's EA Registration Document:

Issue 1: "The description of existing conditions for the harbour physical environment, water quality, and sediment quality in the Northumberland Strait, Caribou Harbour, and Pictou Harbour is based on the results of previous research and existing scientific literature and environmental assessments; no field work was conducted as part of this EA Registration." Pg. 337

Recommendation 1: A project of this magnitude warrants sufficient field work to be completed. The fact that there was NO field work adds to the gap in knowledge on this topic. Further studies should be carried out to confirm harbour physical environment, current water quality and sediment quality as a baseline for the future.

Issue 2: "Average sea surface temperature in May to December in the Northumberland Strait (1986-2012) are shown in table" (Pg. 338). The discussion around sea surface temperature draws attention to the changing ocean temperatures as a result of climate change. The Gulf of St. Lawrence has been identified as an area of rapid coastal deoxygenation by Claret, M. et. al (2018). Their analysis shows increased surface water temperature, increased salinity and decreased oxygen saturation. Changes to any of these variables in isolation can cause stress on important commercial species, changes to all three has the potential for synergistic effects and should not be overlooked. The addition of hot, fresh water to the Northumberland Strait for an extended period should not be so easily passed by in this environmental assessment.

Recommendation 2a: This data is not up to date but it is available. Care should have been taken to include up to date information. This represents a gap in scientific data.

Recommendation 2b: Fisheries in the Northumberland Strait take place throughout the entire water column. Surface, mid-water and bottom water therefore bottom water analysis is required. This is a gap in scientific data that is essential to understanding the changes that will take place going forward.

Issue 3: "This section provides an overview of water quality sampling in Pictou Harbour in 1990, 1995 and 1998 (Dalziel et al. 1993; JWEL 1996; ENSR 1999). Pictou Harbour was used as a proxy for Caribou Harbour with respect to water quality, in the absence of available water quality data for Caribou Harbour.**"** (Pg. 343).

As laid out in the opening sections of this document, proper water quality is extremely important to every species inhabiting the Northumberland Strait. Parameters have shifted over the years due to numerous stressors on the ocean, the Northumberland Strait is not an exception to this change.

Recommendation 3: Relying on data that is 30 years old is unacceptable considering the simplicity of completing these tests. This project focuses on releasing effluent into a highly productive section of the marine environment and the care should have been taken to collect all appropriate data.

Issue 4: "The main commercial, recreational and aboriginal fisheries are for lobster, sea scallop, herring and rock crab among other lesser species fished" (Pg. 356).
"Commercially important species with potential to occur in the Marine LAA include rock crab, lobster, sea scallop, herring, mackerel, and tuna" (Pg. 366).

Yes, these are some of the commercial, recreational and aboriginal fisheries that take place in the Northumberland Strait, but Northern Pulp failed to mention: mackerel, bluefin tuna, Atlantic halibut, soft shell crab, American eel, gaspereau, and silver sides.

In terms of those with potential to occur in the Marine LAA, any of these species listed have the potential to occur in the LAA, it is not restricted to rock crab, lobster, sea scallop, herring, mackerel and tuna.

A full and complete environmental assessment would take in to consideration every species fished commercially in the area to look at sensitivities of those fish to changes in water quality and negative health effects of contaminants. In this environmental assessment all species fished are not even listed, and none are researched to the extent they should be. A few examples of species missed and important information about them are below.

Atlantic Halibut are known to frequent the area and it seems that this is an area of interest during the summer/fall feeding period for them (personal communication with Dr. Arnault LeBris, 2019). Industry has played a large part in collecting data in collaboration with academia. Together we've pinpointed spawning areas through tagging studies and this is also how we know they are directly in the vicinity of the proposed pipe. This tagging study generated tracks or movements of each fish tagged. Figure 5 shows one halibut's approximate location in late June of 2015, which is directly overlapping the location of the outfall. Their normal temperature range in the summer and fall is 1°C and 15°C (Murphy, et al. 2017).

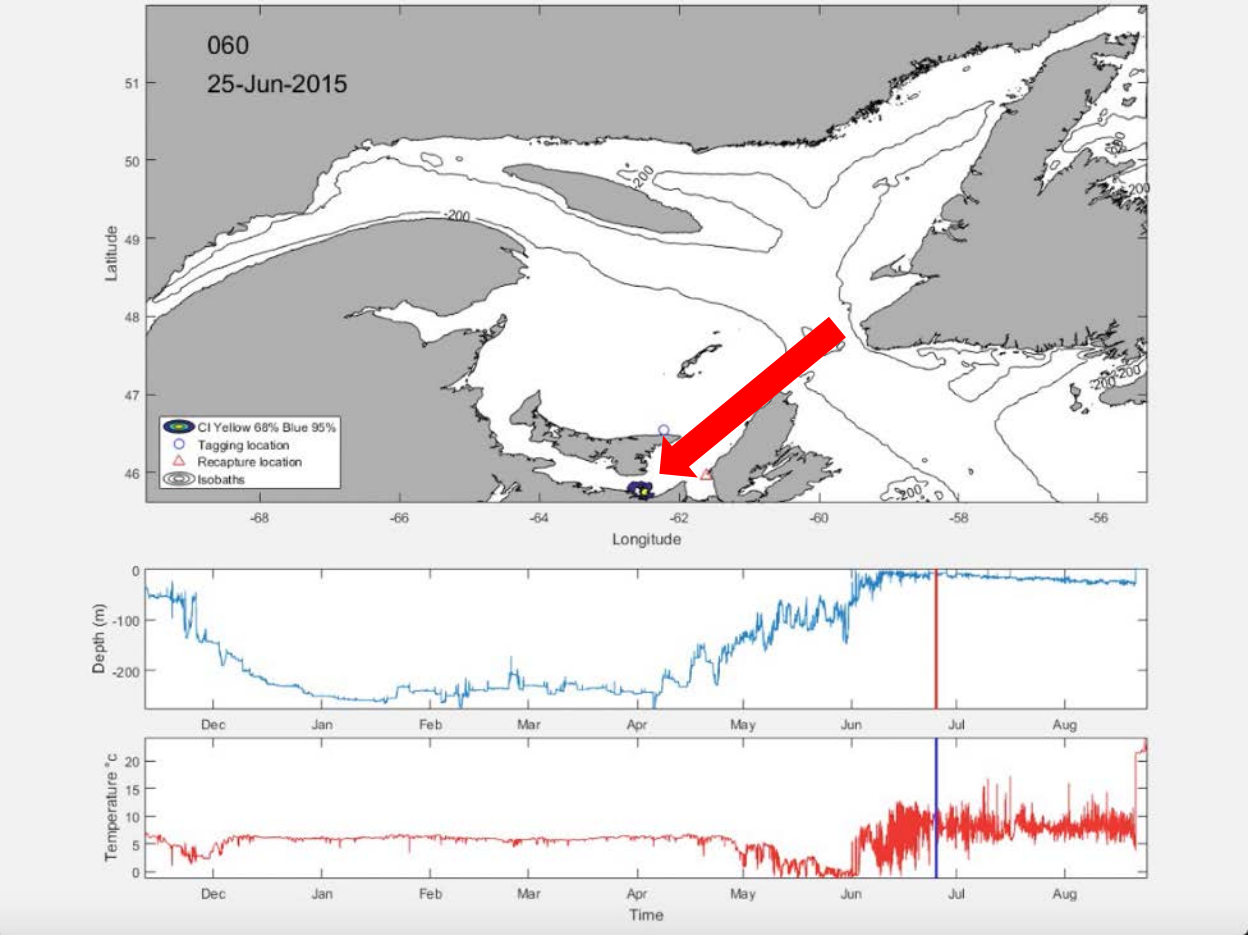

Figure 5: Location of a tagged Atlantic Halibut in late June 2015. (Arnault LeBris, Personal communication).

Recommendation 4: A complete list of species fished should have been composed with research on their tolerance ranges, sensitivities and how different contaminants in the effluent could negatively affect that species. Each species has a different mechanism for expelling toxins from their body so comparing one species to another does not work in the majority of cases.

Issue 5: Herring is caught along the shoreline of New Brunswick and Nova Scotia in the Northumberland Strait, including the Pictou area (Figure 8.12-6). There may be overlap with herring fishing and the location of the marine outfall. Concern has also been raised about the effects of the marine effluent pipeline on herring spawning as well as juvenile lobster (PEI Standing Committee on Agriculture and Fisheries 2018); however, the main fisheries in the LAA are for scallop and rock crab. Nevertheless, herring stocks are currently of concern to DFO, and attempts are being made to manage this fishery to avoid becoming at risk in the area (PEI Standing Committee on Agriculture and Fisheries 2018). Herring spawn between August and October in the southern Gulf of St. Lawrence and DFO has identified fall spawning grounds for herring in the eastern Northumberland Strait (DFO 2018) (Figure 8.12-7). (Pgs. 366-367)

This portion of the EA states that concern has been raised about the effects of the effluent on herring spawn, **however, the main fisheries in the LAA are for scallop and rock crab**. The DFO are making attempts to manage this fishery to rebuild the stock. There is NO mention of what Northern Pulp is doing

to mitigate the risk to herring spawn. Northern Pulp did not do any field or lab work on this possible interaction. This is another gap in data.

On February 20th and 21st, the Gulf small pelagic advisory met in Moncton. This advisory consists of DFO management and science, industry representatives and First Nation Communities. The advisory reviewed the current stock assessment, discussed landings and reviewed the draft of the rebuilding plan. In the management issues of the rebuilding plan the DFO state:

"Climate change and other human impacts on the ecosystem: the physical and biological shifts climate change brings, along with more direct human impacts … are modifying marine ecosystems in many ways, which often cannot be effectively monitored and quantified. Since herring are spawning in shallow coastal areas, these populations may be impacted by these changes" (Figure 6).

This clearly shows concern from the DFO regarding possible issues involved in rebuilding this stock.

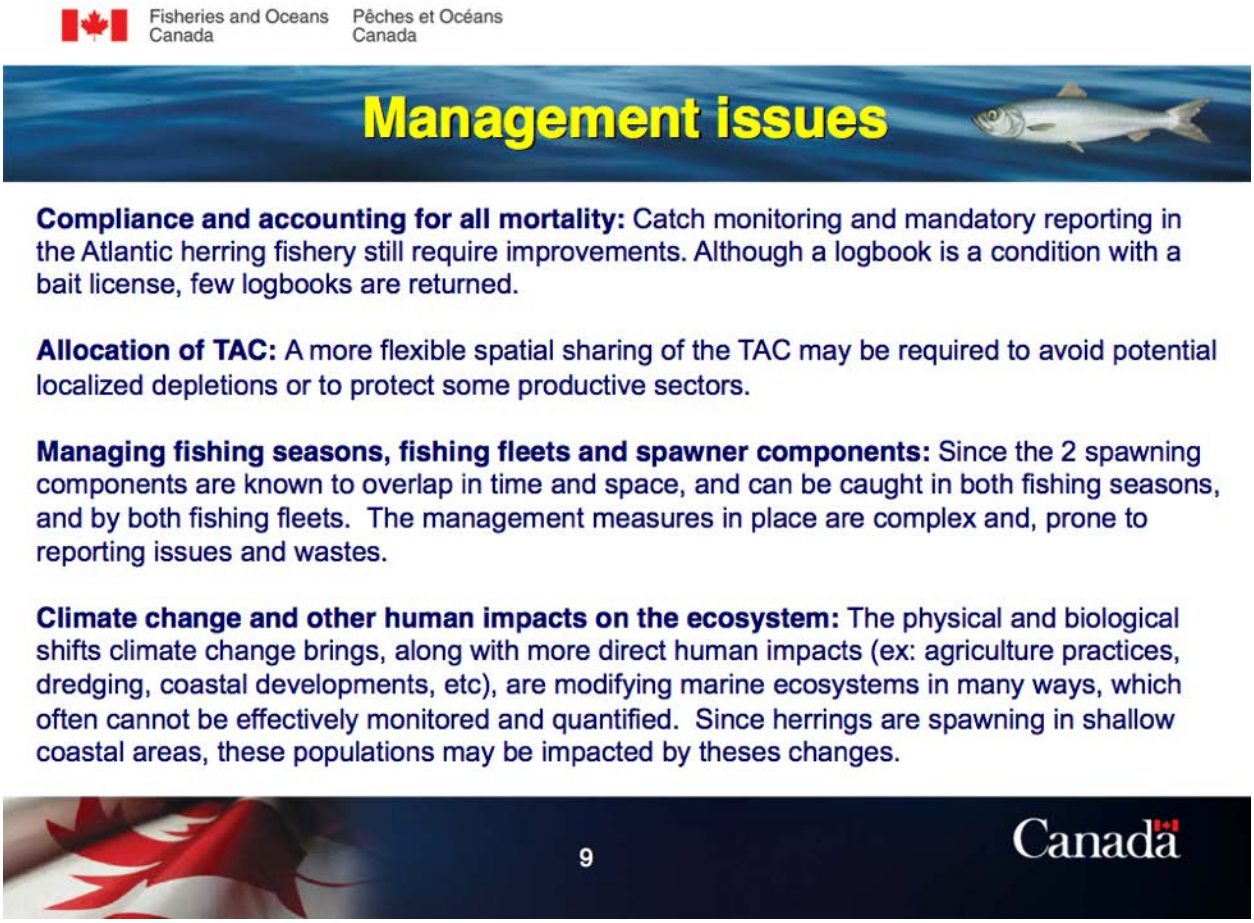

Figure 6: information on management issues from DFO's Herring Rebuilding Plan draft presented at the Small Pelagics Advisory meeting.

Recommendation 5: Proper research needs to be completed to understand possible sub-lethal effects of the effluent on herring spawn. Currently, the fall spawning stock is in the critical zone and the spring spawning stock is in the cautious zone (DFO, 2018) and a rebuilding plan is being developed to ensure the regrowth of the stock. The need for more research is obvious to assist in the rebuilding plan.

Issue 6: "Mackerel is also caught along the coast near the LAA, although most fishing occurs in the central and western portions of the Northumberland Strait (Figure 8.12-8)" (pg. 367).

This is the only comment about mackerel in the environmental assessment and it shows a lack of robust analysis. There is only a mention of fishing, no mention of life stages or their occurrence in the LAA. We know that the only spawning area in Canada is the Southern Gulf of St. Lawrence and that the egg survey has been slowly increasing since 2012 (DFO, 2017). We also know, based on those egg surveys that mackerel eggs are present in the East end of the Northumberland Strait (Figure 7).

Currently, this stock is in the critical zone but changes to management have allowed for a small increase in the last few years. For the past two years the DFO, industry and First Nations have been working together on a rebuilding plan.

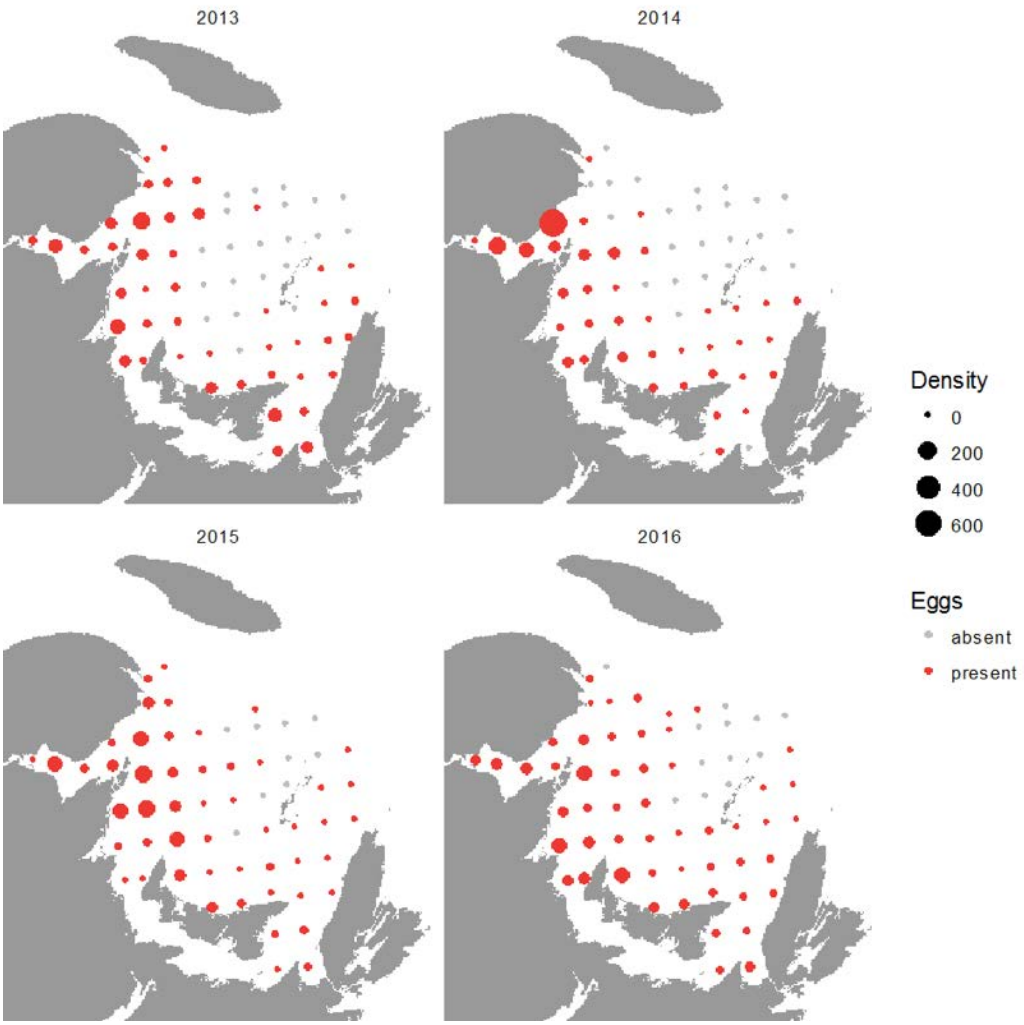

Figure 7:Distribution of mackerel egg (stages 1 and 5) densities (n/m2) measured in surveys in the southern Gulf of St. Lawrence from 2013 to 2016 (DFO, 2017)

Recommendation 6: Proper research needs to be completed to understand possible sub-lethal effects of the effluent on mackerel eggs. Currently, the stock is in the critical zone (DFO, 2017) and a rebuilding plan is being developed to ensure the regrowth of the stock. The need for more research is required to assist in the rebuilding plan and ensure all eco-system aspects are understood to give the stock biomass a chance to rebuild. This is clearly a gap in the environmental assessment data provided by Northern Pulp.

Issue 7: White Hake "This species was determined to have a high probability of being caught during DFO
research vessel trawl surveys in the eastern section of the Northumberland Strait, including the LAA (Rondeau et al. 2016)" (Pg. 381)

It is also noted on the same page, "The main reason for the decline of this species was overfishing in the late 1980s and early 1990s (COSEWIC 2013)."

This species may not currently be listed under SARA, but the DFO is currently undergoing consultation with the public regarding listing the Southern Gulf of St. Lawrence population under SARA as

endangered (Figure 8). Comment period ends on May 6th for this consultation. There is ample concern that is this species is listed and is known to be caught in the LAA what are the next steps?

White Hake stick to temperatures of 4°C to 10°C. The population normally migrates inshore in summer, and then to deeper waters during winter (DFO 2019).

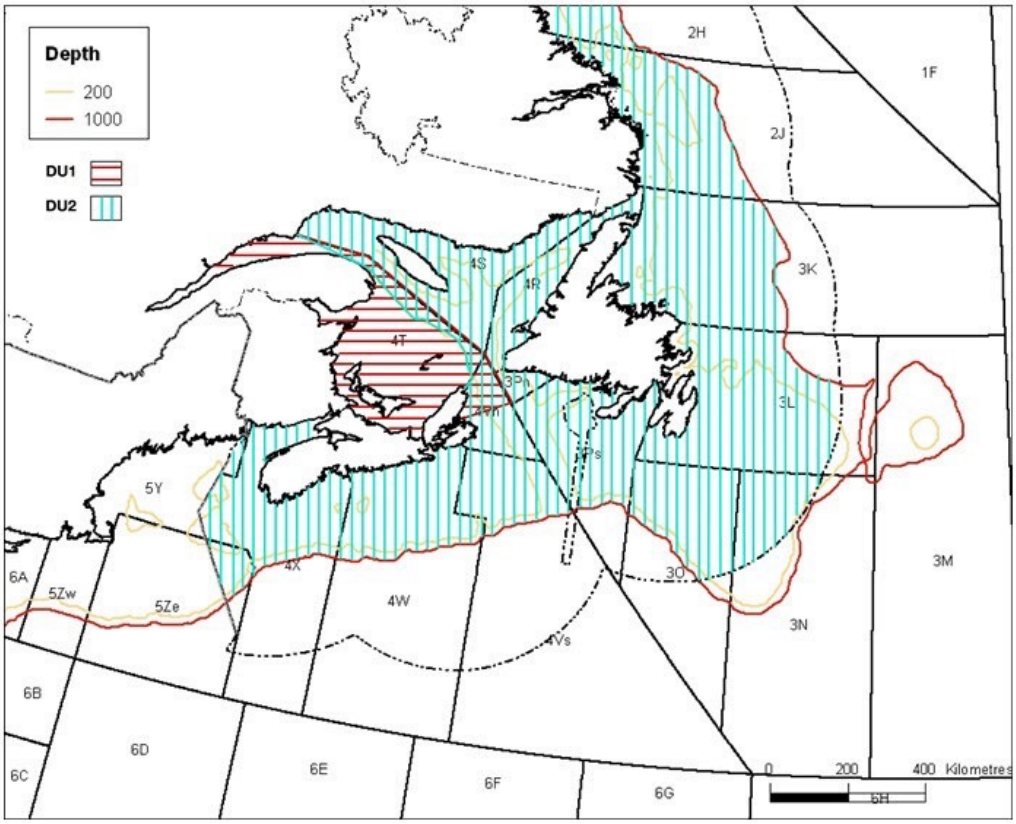

Figure 8: Differentiation between the two designated stocks of white hake, red horizontal lines show distribution of the Southern population (DFO. 2019)

Recommendation 7: The moment there is a SARA listed species in question in an environmental assessment it is supposed to trigger a federal assessment. The recommendation in this case is that Northern Pulp respect this process and request a federal assessment due to the fact that the federal government is currently seeking consultation on listing white hake as endangered under SARA. There is an enormous amount of time and energy spent on trying to rebuild stocks such as this one. Although Northern Pulp consultants laid the blame on the fisheries for the decline the truth is it was only a portion of the problem and fishing effort has nothing to do with the rebuilding struggles as DFO explains here:

"The main threat to White Hake in the sGSL is from an increase in natural mortality. Predation by Grey Seals is considered to be a major cause of this natural mortality. Over the past 3 generations (27 years), adult abundance declined by 91%. Levels of fishing removals that were sustainable in the 1970s and early 1980s became unsustainable when non-fishing

mortality increased in the late 1980s. No directed fishing for White Hake has been allowed in the sGSL since 1995."

This species is naturally struggling to rebuild and no work was done to determine how the effluent will affect the already stressed species.

Issue 8: Atlantic Sturgeon – "Table 8.12-6: Marine Fish Species at Risk and Species of Conservation Concern with Potential to Occur in the LAA." This table lists American eel, American plaice, Atlantic bluefin tuna, Atlantic cod, Atlantic salmon, Lumpfish, Porbeagle, Spiny dogfish, Striped bass, and White hake but it does NOT list Atlantic Sturgeon.

There are 2 species of Atlantic Sturgeon in Canada and both are listed as threatened by COSEWIC. There was an Atlantic Sturgeon caught off Pictou Island in 2018 as bycatch (personal communication, fall 2018). It was returned healthy and swimming to the ocean.

Recommendation 8: This is another instance of a lack of comprehensive research done by Northern Pulp on a very lucrative and productive marine eco-system. More research required.

Issue 9: Potential Environmental Effect "Routine effluent discharge from the effluent outfall diffuser will cause a project-related change in water quality. The treated effluent will contain the following water quality parameters of concern: absorbable organic halides (AOX), total nitrogen (TN), total phosphorus (TP), colour, biochemical oxygen demand (BOD), total suspended solids (TSS), dissolved oxygen (DO), pH, and water temperature. Potential effects could result from:

- an increase in temperature, nutrients (nitrogen and phosphorus), and/or TSS;
- a change in colour, chemical and BOD, DO, and/or pH; and/or
- a reduction in salinity from the discharge of relatively freshwater effluent into the Northumberland Strait.

The discharge of effluent containing elevated levels of TSS could also cause a change in sediment quality near the diffuser due to settlement of suspended sediment," (Pg. 347)

This paragraph amplifies industry concern. As mentioned above, with the few species discussed, a change to any of these parameters can have detrimental effects on the fishery and this paragraph states in black and white that potential effects could result from any of them.

Increased TSS coincides with a change to the habitat and possible suffocation of benthic species.

Recommendation 9: Time should have been dedicated to understanding each species upper and lower limits for their environment as well as upper and lower limits for toxins specific to Pulp and Paper Effluent. The Pulp and Paper Effluent Regulations only monitor a few levels and are not stringent enough. This is based on the fact that Environment and Climate Change Canada are currently reviewing the regulations to make them more stringent and include other contaminants. A review and research should be done to understand how changing water quality coupled with toxins could affect each species inhabiting the area.

Issue 10: "Modelling results indicate that there are few traces of relatively high diluted effluent after a period of 30 days" (Pg. 350)

This is part of the accumulation the industry is concerned with. This plant is not going to run for 30 days and then stop this pipe will dump effluent into the Northumberland Strait 24 hours a day, 7 days a week potentially for years to come. Those few traces will add up overtime, remaining in the Northumberland Strait.

It is also key to remember that a model is a prediction, it is not exact. A scientific model is defined by Encyclopedia Britannica as: "the generation of a physical, conceptual, or mathematical representation of a real phenomenon that is difficult to observe directly. Scientific models are used to explain and predict the behaviour of real objects or systems and are used in a variety of scientific disciplines, ranging
from physics and chemistry to ecology and the Earth sciences. Although modeling is a central component of modern science, scientific models at best are approximations of the objects and systems that they represent—they are not exact replicas."

Recommendation 10: The industry is interested in a better understanding of the long-term effects of the effluent. As stated in the early pages of this report fishing has existed for hundreds of years and with healthy oceans the stocks will continue for hundreds more. More work should have been done to look at the effluent remaining in the Northumberland Strait for the long term. This would also take into account the changing climate (increasing temperature, salinity and decreasing oxygen saturation).

Issue 11: "A significant adverse residual environmental effect on marine fish and fish habitat is one where project related activities:

- Cause a significant decline in abundance or change in distribution of a marine fish population within the Northumberland Strait such that natural recruitment may not re-establish the population to its original level within one generation"

"No field work was conducted as part of this EA registration" (Pg. 358)

One generation means very different timelines for each species. This could be 2 years for a species like mackerel, 5-7 years for a species like lobster or 12 years for an Atlantic Bluefin tuna. In any case too much damage could be done to a population during that timeline to be acceptable to the industry. If there is damage to larval lobster and it is not understood or mitigated until it reaches size at maturity there will be 5-7 year classes following that initial one that will also be negatively impacted.

Recommendation 11: Again, this is a gap in the data. More research should have been done to better understand each species with a mitigation plan in place for each with a timeline based on their generation timelines.

Issue 12: "Figure 8.12-5 presents scallop catch weights from 2010-2014 in the Northumberland Strait where there is an overlap of the route of the pipeline and at the outfall location. Since 2014, a Scallop Buffer Zone in Scallop Fishing Area (SFA) 24, discussed further in Section 8.12.2.7, prevents scallop fishing in this area, except potentially at the location of the outfall" (Pg. 366).

The above paragraph is basically the only mention of sea scallops in Northern Pulp's environmental assessment. They are a species fished directly in and around the LAA, but only get the same attention as species apparently not fished in the area (according to Northern Pulp's consultants). Sea scallops will normally grow when they are between 8°C and 18°C, ideal temperature for growth is 13.5°C. Ideal salinity is between 30 to 32 ppt but they can tolerate salinities as low as 25 ppt. Sea scallops, although a bivalve are still an animal and are prone to being stressed in environments outside of their normal ranges, in this case they get stressed between 20°C and 23°C and mortality will occur at temperatures of 23.5°C and greater. The Southern Gulf of St. Lawrence has experience mass die offs in the past. (DFO, 2011)

Temperatures will not reach background levels until 100 m from the outfall site and the proposed effluent release will be 26°C in the winter and 37°C in the summer. This is much higher then mortality causing temperatures for the sea scallop.

Figure 9 shows locations of fishing effort in 2009. Although this effort is outdated fishing takes place on scallop beds so the concentrated effort would still be around the same areas as seen in 2009. The purpose of this map is to point out that a large portion of the fishery takes place in the vicinity of the proposed outfall location and therefore there are numerous sea scallop beds in the location susceptible to increased water temperatures.

For more information on collaborative research between the fishing organizations, the DFO and academia please see Appendix A.

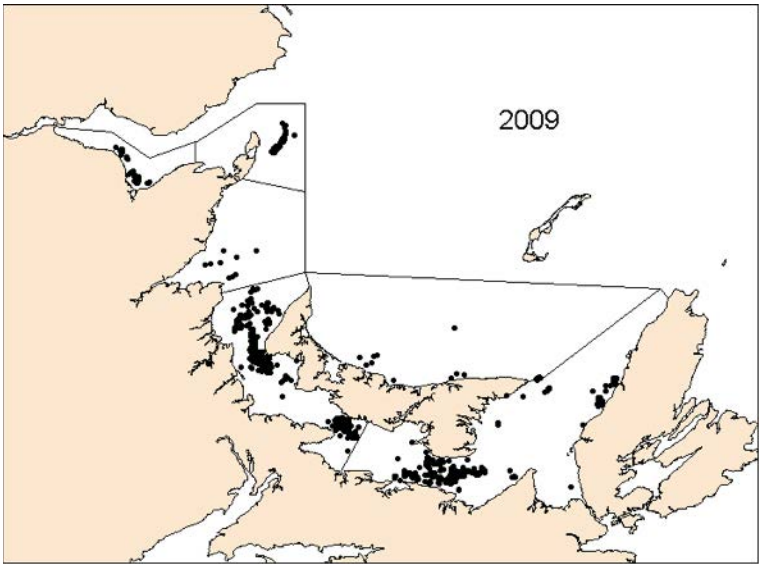

Figure 9:Map of fishing effort positions reported in the 2009 fish harvesters' logbook (DFO. 2011)

Recommendation 12: The information provided proves the susceptibility of sea scallops to temperature and that they inhabit the area near the proposed outfall location. This justifies the completion of detailed field work and trials in the area prior to the release of the proposed effluent to ensure there will be no negative effects on the sea scallops.

Issue 13: "NO field work was conducted as part of this EA registration for marine mammals, sea turtles and marine birds. In particular, this section relies substantially on the EIA registration for the PEI-NB Cable interconnection upgrade project" Pg. 395

Recommendation 13: A project of this magnitude warrants sufficient field work to be completed. The fact that there was NO field work adds to the gap in knowledge on this topic. Further studies should be carried out to confirm frequency of marine mammals in the area.

Issue 14: "NARW are not known to occur in the vicinity of the LAA and no historical observations of this SAR have been recorded in the Northumberland Strait, according to data obtained from DFO (2017) and OBIS (2018)." Pg. 400

"As noted in Sec?on 8.13.2.1, several North Atlan?c right whales were killed by vessel collisions and fishing gear entanglement in the Gulf of St. Lawrence (outside of the Northumberland Strait) during the

summer of 2017. However, this SAR is not known to occur in the Northumberland Strait and is therefore unlikely to be at increased risk of injury or mortality from vessel strikes or entanglement from the project." Pg. 420

Recommendation 14: If all documentation is reviewed it is clear that NARW have been reported in the Northumberland Strait in the past, most recently in 2015 when a female and her calf were spotted in St. George's Bay (Fig. 6).

There are currently strict management measures in place to prevent interactions between fishing and North Atlantic Right Whales. These management measures include flexibility outside of the designated dynamic zones. The management measures outside of the dynamic zone are on a case by case basis. A sighting of one whale may be handled different than a sighting of 3 whales together and different again for a sighting of a mom and calf.

Considering there is at least one reported sighting in the Northumberland Strait, it should be noted that there is an increased risk of injury or mortality from vessel strikes or entanglement from the project.

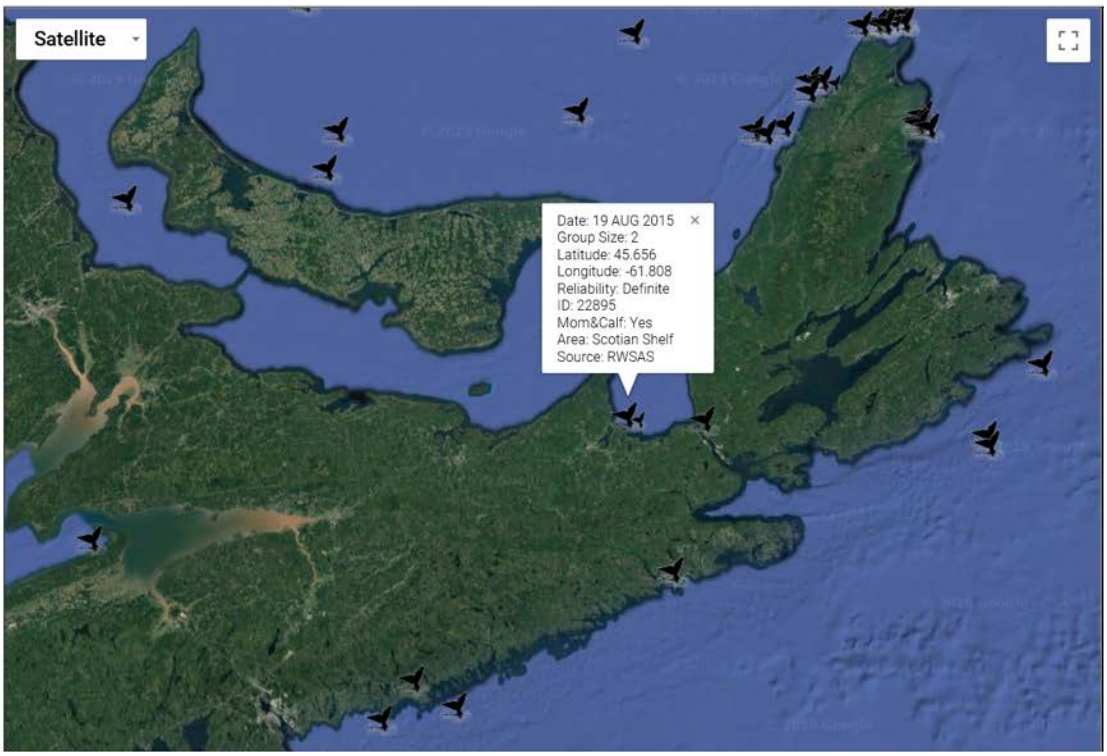

Figure 10: Sighting of North Atlantic Right Whale in the Northumberland Strait in 2015 along with calf (https://www.nefsc.noaa.gov/psb/surveys/MapperiframeWithText.html)

Issue 15: "A significant adverse residual environmental effect on the socio-economic environment is one where project-related activities directly interfere with the use of the land or water such that their intended use is no longer possible" (Pg. 431)

This is significance defined by Northern Pulp and/or it's consultants. The lobster fishing season lasts 2 months, a total of 61 days (minus Sundays as they do not fish on Sunday). This

leave a little over 50 fishing days. A loss of 5 or more of these fishing days is significant to the harvesters. This loss could be due to construction interference, negatively affected water quality driving the species off fishing grounds or sound from marine blasting driving the species away.

Recommendation 15: The definition of significant needs to be changed in this case (and others). What is defined as significant to Northern Pulp and/or their consultants is not an agreed level of significance to the harvesters in the area. If Norther Pulp would have completed proper consultation through this process the harvesters could have explained this.

Issue 16: "NPNS has attempted to engage commercial and PLFN fish harvesters to obtain fisheries data in the area of the marine outfall, but there was little interest from the fish harvesters to partcipate or provide any data (see Sec**?**on 6 Public, Regulatory and Indigenous Engagement)." (Pg. 366)

This comment is concerning to the Harvester working group because they did engage in discussion surrounding fishing grounds. It was made clear to Northern Pulp that if there was water there was fishing. Harvesters do maintain their tradition grounds, but they consistently explore other areas outside of their traditional areas. As biomasses evolve so do the traditional grounds they are found on. Lobster stocks are currently on the rise, so they are being found in areas they not have been found previously.

Recommendation 16: Each species cannot be pinpointed to specific locations within the Northumberland Strait. Again, they do have traditional habitat and areas they are commonly found, but individuals are not restricted to these areas only. The capability of each species to move throughout the Northumberland Strait must be considered and accounted for.

Issue 17: "While the majority of the commercial fishery for rock crab occurs in the central and western portions of the Northumberland Strait, there are areas in the eastern portion where rock crab is harvested, including Caribou Harbour where there is overlap with the proposed marine route of the effluent pipeline (Figure 8.12-3)." (Pg. 366)

Rock crab is another species of extreme importance in the Northumberland Strait, both for its commercial value, and it's position in the food chain. According to the DFO 2013 CSAS on *Homarus americanus* (American Lobster) which represents the most recent full CSAS, "Lobster is largely carnivorous and decapods were the principal prey (57% to 84% of prey biomass), with rock crab being the single most important component of the diet (45% to 78%). About 70% of the rock crab consumed by lobster represented fresh prey (muscle or gills attached) and the remainder consisted of old carapaces."

A decline in the rock crab biomass could also be detrimental to the lobster biomass

Recommendation 17: On numerous occasions in discussions with Northern Pulp the harvester working group recommended understanding the Northumberland Strait as an eco-system not on an individual species by species bases. This has not been accomplished in the environmental assessment submitted by Dillon Consulting on behalf of Northern Pulp.

Issue 18: "Lobster is caught throughout the central and eastern portions of the Northumberland Strait and there is overlap with the proposed route of the effluent pipeline and the location of the marine outfall (Figure 8.12-4)." (Pg. 366)

The Gulf of St. Lawrence (GSL) American lobster is the most valuable in the region, with 33,000 mt of lobster worth $445 million landed in 2016 (DFO 2016), and abundance indices still increasing

throughout the Gulf (DFO 2016, DFO 2016, DFO 2016, DFO 2016). The value of American lobster is never mentioned throughout the environmental assessment submission. The fact that the biomass is increasing is mentioned, but the reasons for the increase are not mentioned. The harvesters in the Gulf region have been working for years toward voluntary management changes to help increase the biomass. These include but are not limited to increased carapace size, returning window females (all females within a certain size range) back to the water, escape mechanisms, returning berried females, etc. Below you will see a comparison between 2012 management measures (figure 11) and 2018 management measure (figure 12) to demonstrate the efforts harvesters make to ensure a sustainable fishery.

Table 1. Key management measures in the lobster fishery in the southern Gulf of St. Lawrence that were in effect in 2012.

	Lobster Fishing Area (LFA) and subarea										
	23				24	25	26A			26B	
	23A	23B	23C	23D			26A1	26A2	26A3	North	South
Fishing season	May 1 to June 30				May 1 to June 30	Aug. 13 to Oct. 14	May 1 to June 30[1]			May 2 to June 30	May 1 to June 30
Number of licences											
Category A Category B	636 33				635 1	708 6	703 5			223 3	
Number of traps per licence	300				300	250 (PEI 240)	280 (PEI 273)	275	250	250	
Number of traps per line	na	na	3 (portion)		na	na	6 (part of PEI) 5 Gulf NS	6	2	5	na
Maximum size entrance (mm diameter)	152				na	152	na	152	na	152	na
Minimum legal carapace size (mm)	75	75	72	71	71	71	71	73	76	81	79
Female size restriction (mm)[2]	115-129				115-129	>= 114	115-129			na	

[1] Fishing season for the portion of LFA26A from Point Prim to Victoria was May 7 to July 8, 2012
[2] Female size restriction refers to size of females which must be released, in addition to the minimum legal size and the restriction on berried females

Figure 11: table take from the lobster stock assessment in 2013 reviewing the 2012 management measures (DFO 2013)

Major Lobster Management Measures in 2018
Mesures majeures de gestion en 2018

Lobster Fishing Area	Minimum carapace (mm)	Window /maximum size females	Maximum number of traps	Minimum number of traps per line*	Maximum hoop size (mm)	Escape mechanism / Mécanisme d'échappement	
						Length between 127 mm and less than 254 mm	Length equal to or greater than 254 mm
Zone de pêche de homard	Taille minimale de carapace (mm)	Fenêtre / taille maximale femelle (mm)	Nombre maximal de casiers	Nombre minimal de casiers par ligne	Taille maximale du cerceau	Longueur entre 127 mm et moins de 254 mm	Longueur de 254 mm et plus
23A	**77**	115-129	300	s/o / n/a	152	44 mm	43 mm
23B	**77**	115-129	300	s/o / n/a	152		
23C	**77**	115-129	300	Portion de/of 23C 3 casiers / 3 traps	152		
23D	**77**	115-129	300	Portion de/of 23D 3 casiers / 3 traps	152		
24[1]	**73**	**115**	300	**6 traps per line**	s/o n/a	42 mm	41 mm
25	**77**	115	240- PEI / Î.-P.-E. 250- NB / N.-B. 225- NS / N.É.	s/o / n/a	152	44 mm	43 mm
26A-1	**73** 74 (2020)	115-129	280 GN.-É. 272 Î.-P.-E.	Portion de/of 26A1 (GNS/GN.-É.) : 5 casiers / 5 traps Portion de/of 26A1 (PEI/Î.-P.-É.) : 6 casiers / 6 traps	s/o / n/a	42 mm	41 mm
26A-2	76	115-129	255 & 275	6 casiers / 6 traps	152	43 mm	42 mm
26A-3	76	115-129	250	2 casiers / 2 traps	s/o / n/a		
26B south/sud	**81.7** 82.5 (2019)	s/o n/a	250	s/o / n/a	s/o / n/a	44 mm	44 mm
26B north/nord	82.5	s/o n/a	250	5 casiers / 5 traps	152		

Figure 12: table of the 2018 management measures presented by DFO at the Southern Gulf Advisory meeting in Moncton in December 2018.

There is a high exploitation rate in the lobster fishery leaving the fishery dependent on strong larval recruits (DFO 2013). This is the reason the harvesters protect egg bearing females and it is also partially the reason for increasing the carapace size in some regions, larger females result in more eggs in the water and the guarantee every female will spawn at least once (rather than 50%) prior to being harvested.

It should also be noted that conditions like water temperature can impact the distribution of lobster and and their catches (DFO 2013). This is extremely important to the fishers in the area of the outfall considering the temperature being released will be well above the average for the given time of year (27 degrees Celsius in the winter and 36 degrees Celsius in the summer).

Recommendation 18: In Appendix R of Northern Pulp's environmental assessment it is recommended that more research be completed on the effect of the effluent on lobster in each life stage, although this was omitted from the executive summary written for the environmental assessment. Considering the effort harvesters contribute to understanding the eco-system they rely on and the changes the harvesters are implementing, voluntarily, to ensure they maintain a sustainable fishery in the future the same efforts should be made by Northern Pulp to ensure a sustainable fishery. At this point there has been no field trials, no lab test; absolutely zero work completed by Northern Pulp to prove to harvesters that they

will not be jeopardizing all the hard work going in to protect their lobster fishery. Considering lobster in the Gulf were worth $445 million in 2016, this warrants real science to be completed, not just literature searches based on 40 year old research.

Issue 19: "Scallop Buffer Zones SFA 22 and 24 are part of a system of Scallop Buffer Zones in SFA 21, 22, and 24 that covers a total area of 5,835 km^2 (DFO 2017). Scallop Buffer Zones were established to protect juvenile American lobster as they are known to contain lobster nursery habitat (DFO 2017). Scallop Buffer Zone SFA 22 is in the western Northumberland Strait, approximately 85 km to the west of the marine PFA. Scallop Buffer Zone SFA 24 is in the eastern Northumberland Strait and the effluent pipeline will cross through the Scallop Buffer Zone SFA 24 close to shore (Figure 8.12-10) in Caribou Harbour near Jessies Cove. The location of the outfall is outside this buffer zone" (page 384).

Figure 13 was shared in section 8.12.2.7 of the NPNS's environmental assessment. This image is inaccurate. According to Variation Order GVO-2017-087 (DFO 2017), "A one (1) nautical mile buffer zone will be closed until further notice from the nearest point of land in the counties of Cumberland, Colchester, Pictou and Antigonish and one (1) nautical mile from the nearest point of land around Pictou Island, situated in the Northumberland Strait." The outfall location would be within the scallop buffer zone is the zone was shown in his entirety. These scallop buffer zones are considered marine refuges by DFO and count toward the Marine Protected Area goal of 10% protection of coastal waters in Canada by 2020.

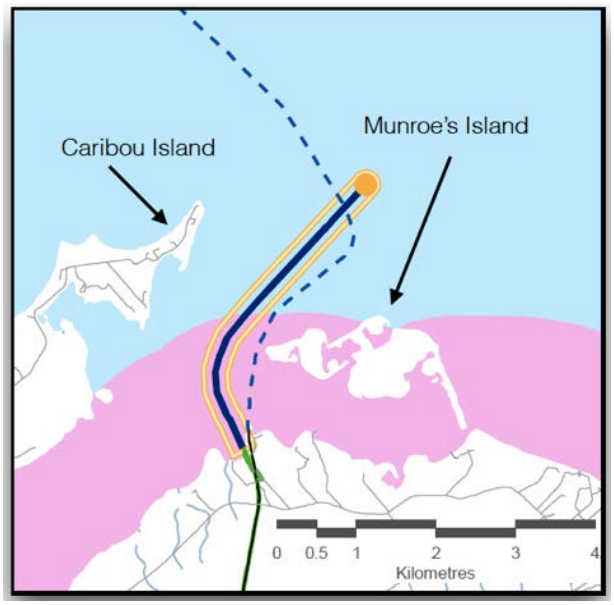

Figure 13: Outfall location and scallop buffer zone as shown, inaccurately, by Northern pulp in the Environmental Assessment

Recommendation 19: Ideally there would be no change or alteration to the scallop buffer zone. It is in place to protect juvenile lobster habitat and that protection zone should be honored.

Sincerely

Prince Edward Island Fishermen's Association, President

Maritime Fishermen's Union, President

Gulf Nova Scotia Fleet Planning Board, President

Andrea Paul
Pictou Landing First Nation, Chief

REFERENCES

AMEC Earth & Environment. 2007. Northumberland Strait Ecosystem Overview Report. Submitted to Fisheries and Oceans Canada Gulf fisheries Centre, Moncton, New Brunswick.

Chassé, J., Lambert, N., Comeau, M., Larouche, P., Galbraith, P., and Pettipas, R. 2013 Physical Environment Conditions in the southern Gulf of St. Lawrence. DFO, GFC-IML-BIO.

Chassé, J. and Miller, R.J. 2010. Lobster Larval Transport in the Southern Gulf of St. Lawrence. Fish. Oceanogr. 19:5, 319-338.

Claret, Mariona & Galbraith, Eric & Palter, Jaime & Bianchi, Daniele & Fennel, Katja & Gilbert, Denis & Dunne, J. (2018). Rapid coastal deoxygenation due to ocean circulation shift in the northwest Atlantic. Nature Climate Change. 8. 10.1038/s41558-018-0263-1.

DFO. 2005. The Gulf of St. Lawrence, A Unique Ecosystem. The Stage for the Gulf of St. Lawrence Integrated Management (GOSLIM). Oceans and Science Branch, Fisheries and Oceans Canada. Cat. No. FS 104-2/2005

DFO. 2011. Assessment of the scallop fishery (Placopecten magellanicus) of the southern gulf of St. Lawrence. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2011/039.

DFO. 2013. American lobster, *Homarus americanus*, stock status in the southern Gulf of St. Lawrence: LFA 23, 24, 25, 26a and 26b. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2013/029.

DFO 2016. 2016 Value of Atlantic Coast Commercial Landings, by Region (thousand dollars). http://www.dfo-mpo.gc.ca/stats/commercial/land-debarq/sea-maritimes/s2016aveng.
htm (Date modified: 2018-03-06)

DFO 2016. 2015 lobster stocks assessment in the Gaspé, Quebec area (LFAS 19, 20 and 21). Canadian Science Advisory Secretariat Science Advisory Report 2016/43.

DFO 2016. 2015 lobster stocks assessment on the North Shore (LFAS 15, 16 and 18) and at Anticosti Island (LFA 17), Quebec area. Canadian Science Advisory Secretariat Science Advisory Report 2016/44.

DFO 2016. 2015 lobster stock assessment in the Magdalen Islands (LFA 22), Quebec area. Canadian Science Advisory Secretariat Science Advisory Report 2016/45.

DFO 2016. Update of the stock status indicators for the American lobster (Homarus americanus)
stocks in the southern Gulf of St. Lawrence Canadian Science Advisory Secretariat Science Advisory Report 2016/51

DFO. 2017. Assessment of the Atlantic Mackerel Stock for the Northwest Atlantic (Subareas 3 and 4) in 2016. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2017/034.

DFO. 2018. Stock Assessment of Atlantic Halibut of the Gulf of St. Lawrence (4RST) in 2016. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2017/052.

DFO. 2018. Assessment of the southern Gulf of St. Lawrence (NAFO Div. 4T) spring and fall spawner components of Atlantic herring (*Clupea harengus*) with advice for the 2018 and 2019 fisheries. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2018/029.

DFO. 2019. Aquatic Species at Risk – White Hake. Southern Gulf of St. Lawrence population. https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/public/Cd%2DWhiteHake2pops%2Dv00%2D2019Feb%2DEng%2Epdf

Fisheries and Oceans Canada (DFO). 2005. The Gulf of St. Lawrence – A Unique Ecosystem. Gulf of St. Lawrence Integrated Management. Cat. No. FS 104-2.

Galbraith, P.S., Chassé, J., Gilbert, D., Larouche, P., Caverhill, C., Lefaivre, D., Brickman, D., Pettigrew, B., Devine, L., and Lafleur, C. 2014. Physical Oceanographic Conditions in the Gulf of St. Lawrence in 2013. DFO Can. Sci. Advis. Sec. Res. Doc. 2014/062. vi + 84 p.

Hannah M. Murphy, Jonathan A. D. Fisher, Arnault Le Bris, Mathieu Desgagnés, Martin Castonguay, Timothy Loher & Dominique Robert (2017) Characterization of Depth Distributions, Temperature Associations, and Seasonal Migrations of Atlantic Halibut in the Gulf of St. Lawrence using Pop-Up Satellite Archival Tags,Marine and Coastal Fisheries, 9:1, 1-356, DOI: 10.1080/19425120.2017.1327905

Hanson, J.M. and Comeau, M. 2017. Progress on the Ecosystem Research Initiative for the Northumberland Strait since October 2012. Can. Manuscr. Rep. Fish. Aquat. Sci. 3145: ix + 29

Encyclopedia Britannica: Scientific Model - https://www.britannica.com/science/scientific-modeling.

APPENDIX A. Ongoing Research Efforts by Industry

This section is designed to show the effort being made by the industry associations to improve the health of the oceans and eco-systems. It is not enough to maintain the current status of the ocean. The majority of current harvesters come from a long line of harvesters and the outlook for the future of the industry remains the same. Soon, the children of current harvesters will take over gear with visions of their own children doing the same.

It is not enough to consider the effects of the effluent on the ocean environment in one month or one year. Fishing has been going on for hundreds of years and should continue for 100 more. To ensure this is possible industry groups now work directly with the Department of Fisheries and Oceans (DFO) to come up with new management plans, help DFO collected required data for stock assessments and various research and help develop rebuilding plans for stocks. Below are a few of the projects industry works on with DFO to improve the health of our oceans:

Halibut Longline survey – Collaborative research with DFO. Collected data from this study feeds the Atlantic Halibut Stock Assessment.

Scallop survey – Collaborative research with DFO. This project is being completed to gain insight into changes seen in the scallops physiology.

Lobster/crab study – Rock crab is an integral part of the lobster's diet, unfortunately we don't know enough about the current rock crab biomass to ensure there will continue to be enough food for the lobster as their population grows. The project titled: "Effects of exploitation patterns and fluctuations in lobster (*Homarus americanus*) and rock crab (*Cancer irroratus*) abundances on lobster diet and condition in the Gulf of St. Lawrence; is the predator-prey interaction at risk?"; has been drafted and we are currently exploring funding opportunities to move forward. The project, if we are successful with funding, will be a collaboration between the Prince Edward Island Fishermen's Association, DFO and the Province of PEI.

Bio-collectors – This is a study that has been ongoing in the Gulf region for 10 years now and is a collaboration between the Prince Edward Island Fishermen's Association, DFO and the Province of PEI. This project gives us a look at the number of lobster settling in sites around Prince Edward Island at stage 4 to gather information on trends of higher or lower settlement annually. The hope of this project is to find a correlation between lobster settlement and lobster landings in the future. The collectors also provide an opportunity to collect data on some other species as well, including rock crab, mud crab, cunner and other fish species.

Lobster Node – This is an industry lead, pan-Atlantic group bringing DFO, industry and acedemia together to try to answer questions from the industry, specifically on lobster.

Bait Alternatives – foraging fish are normally used as bait in the lobster industry. These stocks are declining and fishers are, pre-emptively, looking for other sources of bait while they sit on working groups to come up with a plan to rebuild the stocks.

Temperature Probes in the Northumberland Strait – This is at the request of harvesters who are seeing bottom water temperature changes in the Northumberland Strait and they are curious if certain species will vacate the vicinity due to unsuitable habitat. This will be monitoring 10 locations in the Northumberland Strait for 6 months a year.

Acoustic Herring and variable mesh nets – Collaborative with DFO. This has been ongoing for many years to better understand the biomass of herring. The data is used to feed the stock assessment.