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Proceedings of the Regional Assessment of Stressors, Impacts and Pathways of Effects for the Darnley Bay Area of Interest for Marine Protected Area Designation

February 6-7, 2013

Winnipeg, Manitoba

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Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings may include research recommendations, uncertainties, and the rationale for decisions made during the meeting. Proceedings may also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

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SUMMARY

In late 2010, Fisheries and Oceans Canada (DFO) Science sector identified an Area of Interest (AOI) in Darnley Bay which met the criteria for marine protection under the *Oceans Act.* Science sector provided advice on boundary of key areas and identified conservation objectives (DFO 2011). The Anuniaqvia Niqiqyuam AOI (ANAOI) Steering Committee decided on the final areas and boundaries and included a portion of the Cape Parry Offshore Marine Feeding Habitat in the ANAOI.

As a precursor to the Regulatory Impact Analysis Statement (RIAS), DFO Oceans Programs requested DFO Science sector evaluate a Pathway of Effect (PoE) based approach to understand the activities and associated stressors that have the potential to affect valued ecosystem components (VECs) in the ANAOI. Specifically, meeting participants reviewed and evaluated each of the following for completeness and appropriateness: activities (drivers) that may impact the VECs identified in the AOI; stressors resulting from these activities; and potential pathways by which the drivers and stressors affect VECs. Meeting participants were from DFO Science sector and Oceans Programs, Fisheries Joint Management Committee, the Canadian Museum of Nature and academia. Participants from Environment Canada were not present at the meeting but provided input separately.

This Proceedings report summarizes the relevant discussions and presents the key conclusions reached at the meeting. A Science Advisory Report and supporting Research Document, resulting from this meeting, are published on the DFO Canadian Science Advisory Secretariat Website.

Compte rendu de l'évaluation des agents de stress, des impacts et des séquences des effets dans la zone d'intérêt de la baie Darnley dans le cadre de la désignation des zones de protection marine

SOMMAIRE

À la fin de 2010, le Secteur des sciences de Pêches et Océans Canada (MPO) a délimité dans la baie Darnley une zone d'intérêt (ZI) répondant aux critères de protection marine aux termes de la Loi sur les océans. Le Secteur des sciences a formulé un avis sur les limites géographiques des zones clés et a établi des objectifs de conservation (MPO 2011). Le comité directeur de la ZI Anuniaqvia Niqiqyuam (ZIAN) a établi les zones et les limites définitives, qui englobent aussi une partie de l'habitat marin nourricier situé au large du cap Parry.

En tant que précurseurs du Résumé de l'étude d'impact de la réglementation (REIR), les programmes des océans du MPO ont demandé au Secteur des sciences du MPO d'évaluer une approche basée sur la séquence des effets (SE) pour connaître les activités et les agents de stress connexes susceptibles de nuire aux composantes valorisées de l'écosystème (CVE) de la ZIAN. En particulier, les participants ont examiné et évalué l'état d'achèvement et le caractère approprié de chacun des aspects suivants : les activités (facteurs) qui peuvent avoir un impact sur les CVE définies pour la ZIAN, les agents de stress découlant de ces activités et les séquences des effets potentielles de l'impact des facteurs et des agents de stress sur les CVE. Les participants à la réunion représentaient le Secteur des sciences du MPO et les programmes des océans, ainsi que le Comité mixte de gestion de la pêche, le Musée canadien de la nature et le milieu universitaire. Aucun représentant d'Environnement Canada n'a assisté à la réunion, mais on a pu compter sur la participation de ce ministère en dehors de ce cadre.

Le présent compte rendu résume les discussions tenues et expose les révisions à apporter aux documents de recherche connexes. L’Avis scientifique et le document de recherche à l’appui découlant de la présente réunion de consultation scientifique seront publiés sur le site Web du Secrétariat canadien de consultation scientifique du MPO.

INTRODUCTION

DFO, under the authority of the *Oceans Act* (1997), is authorized to establish a national system of marine protected areas (MPAs) to conserve and protect Canada's marine resources. The National Framework for Establishing and Managing MPAs (DFO 1999) describes the four major steps for establishing an MPA as:

- Select the Area of Interest (AOI);
- Conduct an overview and assessment of the AOI;
- Develop regulatory intent and documents; and
- Manage the MPA.

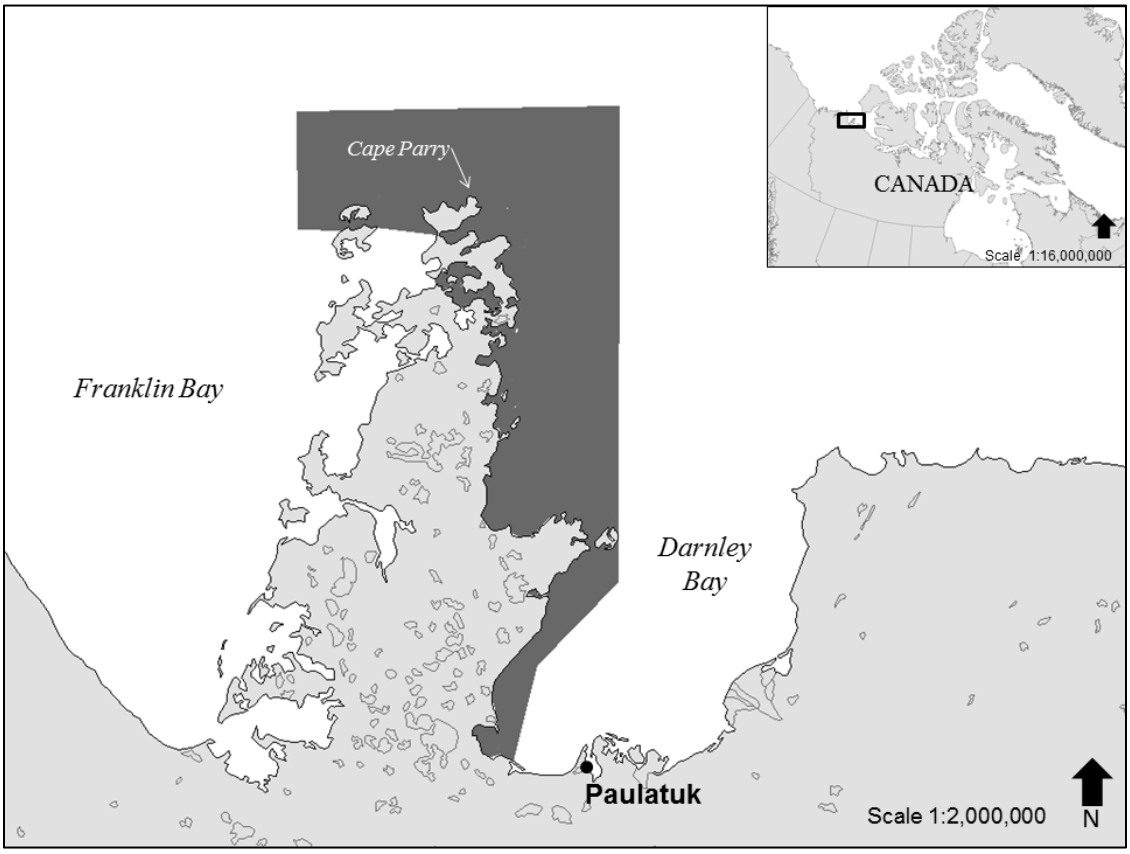

Figure 1. The Anuniaqvia Niqiqyuam Area of Interest (ANAOI), Northwest Territories, is identified by the dark shaded area.

In 2006, DFO Science sector conducted an exercise in which ecologically and biologically significant areas (EBSAs) within the Beaufort Sea Large Ocean Management Area (LOMA) were identified (Paulic et al. 2009). The identification of EBSAs is a tool used to call attention to areas that have particular ecological or biological significance to facilitate a greater than usual degree of risk aversion (DFO 2004). In the LOMA, twenty EBSAs, including two in Darnley Bay, were identified through a series of science and community workshops (Paulic et al. 2011) using a comprehensive set of nationally accepted criteria (DFO 2004).

In 2009, the Darnley Bay AOI was selected by the DFO Oceans Program and a site selection committee for consideration as an MPA: the AOI included portions of the Pearce Point EBSA

and Hornaday River EBSA. Darnley Bay is situated in the Canadian Western Arctic region within the Beaufort Sea LOMA and the Inuvialuit Settlement Region (ISR).

In late 2010, DFO Science sector identified and prioritized areas in Darnley Bay which met the criteria for marine protection under the *Oceans Act*, provided advice on boundaries for those areas and identified one or more conservation objectives for each (DFO 2011). The ANAOI Steering Committee decided to include a portion of the Cape Parry Offshore Marine Feeding Habitat priority area within the AOI based on Science sector advice. The conservation objective that was developed by DFO Science sector for this area is:

> *"to maintain the integrity of the marine environment offshore of the Cape Parry Migratory Bird Sanctuary (MBS) so that it is productive and allows for high trophic level feeding by ensuring that the Cape Parry polynyas and associated sea-ice habitat, and the role of key prey species (e.g., Arctic Cod), are not disrupted by human activities."*

The ANAOI steering committee developed the boundary for the ANAOI, including a portion of the Cape Parry Offshore Marine Feeding Habitat as well as the east side of the Parry Peninsula (Figure 1). The conservation objectives for this area were developed by the Community of Paulatuk and Steering Committee members and were based on Traditional and Local Knowledge (Kavik-AXYS Inc. 2012) focus. The Traditional Knowledge (TK) conservation objectives developed for this area is:

> *"To maintain the habitat to support populations of key species (beluga, char, ringed and bearded seals)"*

DFO Oceans Programs requested that DFO Science sector identify, evaluate and prioritize activities and associated stressors that have the potential to affect VECs in the ANAOI using a PoE approach. The advice provided will subsequently be used to develop and draft the RIAS. A structured approach to assessing the potential risk to ecosystem components from human activities and their associated stressors is required to further refine MPA management. The approach is based on a risk assessment framework developed by the Pacific Region (DFO 2012). The key elements of the risk-based assessment framework are:

- identification of the key features or properties of the system (VECs, including species, habitats and community/ecosystem properties;
- identification of the activities and stressors that have the potential to affect these VECs using PoE models; and,
- assessing the risk of harm to each VEC from each activity and associated stressors using appropriate criteria and scoring methods.

The purpose of the meeting, as described in the Terms of Reference (Appendix 1), was to complete the scoping phase of the framework (second item in the list above) for this AOI by identifying human activities (drivers), their associated stressors, and develop PoE models to illustrate potential pathways by which the drivers and stressors affect VECs.

Meeting participants are listed in Appendix 2.

Presentation: Background on ANAOI

Presented by: Leah Brown, DFO Oceans Programs

The AOI's official name is Anuniaqvia Niqiqyuam which means Nelson Green's traditional hunting area.

The PoE model exercise currently underway is intended to identify activities and their potential impacts on meeting the AOI conservation objectives and facilitate the development of the

Regulatory Intent. Specifically the PoEs will help identify which activities can be exempt from prohibition, and which activities must be prohibited.

The science advice generated during the 2011 Canadian Science Advisory Secretariat (CSAS) process to identify conservation objectives and boundary delineation for the Darnley Bay AOI was summarized for presentation at Paulatuk community consultation meetings as well as the ANAOI steering committee meetings. The outcome of the community and steering committee meetings was a recommendation to maintain the AOI boundary only on the east side of Parry Peninsula while avoiding the community of Paulatuk and the Hornaday River area.

Discussion

Meeting participants asked why the Paulatuk/Hornaday River areas, identified as the "Darnley Bay Nearshore Migration and Feeding Corridor" were not included since they had been recommended as the zone requiring the highest priority for protection in order to achieve the conservation objectives (DFO 2011). The community and steering committee wanted to avoid restrictions or possible prevention of future development activities within any zone designated as an MPA (port development in Paulatuk was highlighted specifically). Meeting participants asked why the east side of Darnley Bay was eliminated from consideration altogether. The community did not want the zone designated as an MPA split or developed into two separate areas as this would not support the Traditional Knowledge (TK) conservation objectives.

The area selected by the community and steering committee was only a section of the "Darnley Bay Nearshore Migration and Feeding Corridor". Scientists acknowledge the lack of scientific information available for this area so a workshop was held with the traditional and local knowledge holders from the community of Paulatuk who provided ecological information about the area and identified the conservation objectives (Kavik-AXYS Inc., 2012).

During the community and steering committee meetings, decisions were also made to revise the outer limit of the ANAOI boundary to extend15 km offshore. The Cape Parry Offshore Marine Feeding Habitat identified by DFO science had a recommended boundary extending 30 km offshore. Meeting participants asked for the rationale for this decision. The community did not want to restrict shipping to the community, which can occur approximately 20 km offshore.

Wise Bay and Summers Harbour were not included in the ANAOI boundary, due to the high potential for future development (likely overwintering fuel caches and/or barges). It was noted by meeting participants that excluding Wise Bay and Argo Bay also may exclude kelp beds which were identified as unique and potentially key habitats (DFO 2011).

The community approved the boundary delineation for the ANAOI based on the Traditional and Local Knowledge of species in the region. Meeting participants commented that although tagging studies have been sporadic and were conducted some time ago, and that annual migrations can vary, previous studies have shown the marine mammal use of the Darnley Bay area is transient. Some meeting participants felt caution is still recommended as it is not well known why marine mammals (whales and seals) visit Darnley Bay.

No known petroleum potential exists within the ANAOI and mining interests are essentially restricted to on-land activities. However, a very small corner of a lease does extend into the proposed AOI and thus the effects of mining activities are included in the PoE exercise.

Designating MPAs within Canada is for the most part science-based, and MPAs are generally based on the scientific knowledge of a feature or region (i.e., the area is unique or there is something specific to protect). To date in the Arctic, MPAs have focused on community interest and needs.

Presentation: Background Information on Darnley Bay

Presented by: Chandra Chambers, North-South Consulting

Key biological and physical features of the Darnley Bay Ecosystem, summarized from the Ecosystem Overview Assessment Report (DFO 2011) and other literature reviews were presented.

Pathways of Effects (PoE) modelling is a method of graphically presenting the predicted relationships between human activities (drivers) and the impacts (stressors) they produce on the ecosystem and ecosystem components. Understanding these relationships is necessary for the mitigation of effects. Understanding cumulative effects and using risk characterization and assessment helps managers to decide if certain activities should be allowed to proceed.

A series of PoE models were developed for the Anuniaqvia Niqiqyuam Area of Interest (ANAOI) in the Beaufort Sea to determine which activities may have a negative impact on valued ecosystem components (VEC). The purpose of this assessment is to develop models that will assist in the decision making process for regulations within the AOI.

Available literature relating to socio-economic and cultural uses of the area was used to determine which activities were occurring in the AOI.

DISCUSSION

The meeting participants agreed to a method for evaluating the activities/drivers, the stressors, the pathways and the linkages to the VECs. It was agreed that this method would:

- provide the Oceans Programs participants with the material necessary for their upcoming meetings,
- be relevant for developing the RIAS, and
- be feasible in the 2-day meeting timeframe provided.

Rather than working with the flowchart format, the material was tabulated for ease of discussion and note taking during the meeting. The main points to address were to:

- identify all possible activities/drivers
- identify all possible stressors
- identify all effects of the stressors on VECs

It was agreed that the participants would first discuss the drivers and stressors beginning with those presented in the working paper in plenary (with all participants present) and identify any additional drivers and stressors. Then an assessment of the stressor-effects pathways for the "Port Construction" driver was undertaken by the group as a whole. After the participants were comfortable with the exercise, they were divided into two groups and each was assigned half the PoEs assessment for the remaining drivers.

OVERARCHING PRINCIPLES

Risk Assessment

The Pacific Region's risk assessment framework continues from the scoping phase (identifying VECs, activities, stressors and PoE models) to risk assessment phases. The first of these identifies the interactions between activities/stressors and VECs and leads into rating the significance of the stressors based on likelihood and impact. It was decided in advance not to conduct a risk assessment of activities at this meeting due in part to the time available to

prepare and the expertise available to attend. However, an informal risk assessment was inherent when discussing and determining particular drivers or stressors for the PoE models. The emphasis of the meeting was therefore to illustrate “possible” drivers, stressors and pathways.

Geographic Scale

The meeting participants agreed to consider and discuss drivers, stressors and effects within the vicinity of the ANAOI (i.e. regardless of their location within or outside of the proposed MPA) in case the effect may in some way impact either the VECs directly or the habitat that brings VECs to the AOI (habitat and ecosystem quality) or indirectly through prey species.

In order to define the relevance of scale for the driver-stressor-effect relationships, each effect was described and noted in the discussion as being close to the location of the AOI (localized effect) or apart from the location of the AOI (widespread effect). This is captured in the discussion section as well as the final flowcharts for each PoE model.

Consideration of additional VECs

Meeting participants discussed drivers, stressors and effects on the five VECs that were presented in the working paper (Arctic Char, Beluga, ringed seals, bearded seals and productivity). The TK conservation objective defined by the Paulatuk Working Group was a high-level objective that listed Beluga, char, ringed and bearded seals as VECs but still allowed the ANAOI steering committee the flexibility to add additional VECs at a later date.

Conservation objectives

It was agreed by meeting participants to interpret the TK conservation objective, *“…to protect the natural presence of key species…”,* to mean protecting not only abundance but also the habitat (including prey) that allows sustainability, or that allows species to populate or use the area.

Valued Ecosystem Component terminology

In the working paper, the “Productivity” VEC was interpreted as being primary productivity. It was meant to be considered a broader ecosystem category (DFO 2011) to represent for example marine mammal and marine bird food chains and predator-prey relationships. After some discussion, meeting participants agreed that the term “ecosystem integrity and trophic links” would be a more appropriate term for this VEC.

VALIDATING DRIVERS

Meeting participants found it relevant to list all potential drivers in full, including those that are human-induced and can generally be regulated or controlled, and those that cannot be directly regulated or controlled at the ANAOI level. These latter ones were termed pervasive or background drivers.

Meeting participants agreed that cumulative impacts and multiple driver scenarios would not be illustrated in the PoE models.

Participants discussed whether all potential drivers were listed, if some should be combined or eliminated. Four new drivers were identified as background drivers that have potential influence on the ecosystem, such as amplification of the effects by stressors identified in the models, and thus should be kept in mind as influencing factors. These may play a larger role when

considering a risk assessment exercise but specific PoE models would not be developed for them. They included the following:

- Climate Variability and Change
- Contaminant Transport
- Arctic Ocean Acidification
- Invasive/Colonizing/Vagrant Species

The following 11 drivers were identified and PoE models developed:

- Commercial Fishing
- Dredging
- Infrastructure Development
- Mining
- Port Construction and Operation
- Recreational Fishing
- Scientific Research Activities
- Seismic Surveys
- Shipping
- Subsistence Hunting/Fishing
- Tourism

It was agreed that the potential for aquaculture is limited and so was not included in discussions.

VALIDATING STRESSORS

Participants validated relevant stressors associated with each of the activities or drivers. Meeting participants agreed that the pathway from a stressor may affect the species directly, its habitat or broader ecosystem processes. Therefore, it was noted if the effect impacted a species (its quality, quantity or sustainability) or its habitat. Whether the effect is localized or could affect VECs distant from the AOI was also noted.

The stressors associated with each identified driver are presented in the results (PoE models) and specific notes are captured below within the discussion of the PoE for each driver.

PATHWAYS OF EFFECTS MODELING

Commercial Fishing

There is currently no commercial fishing in this area, though commercial fishing elsewhere in the Beaufort Sea (including Alaska) could impact this area.

Seven stressors were identified and discussed: Biota Removal; Contaminants; Habitat Alteration and Destruction; Invasive Species; Gear Loss; Noise; and Ship Strikes.

Biota Removal

Decreased abundance of target species (from injury and mortality); changes in population structure (age/size); decreased abundance of non-target species (from injury and mortality).

These effects would impact ecosystem integrity and trophic links and habitat VECs and could impact the char VEC if the commercial fishery were directed towards this species as well as

other targeted or by-catch species. Effects would be primarily local to the fishing area, but could be widespread depending on the species caught and its migratory behaviour.

Contaminants

Antifoulants

There is a new body of research on antifoulants, which are chemicals used to keep ship hulls clear of algae and barnacles. The chemicals used are toxic and can bioaccumulate in the environment. Their effects on organisms can include: immunosuppression, poisoning, liver/renal lesions, and cancer.

Antifoulants can affect all organisms from invertebrates to fish and marine mammals (e.g., by disrupting reproduction). The effects would be localized but could be propagated up the food chain.

Hydrocarbons

Exposure could cause changes to the nervous system, physiological changes, thermoregulatory effects, changes in hormone levels, cancer, decreased immunity to pathogens, and changes in water quality.

There is little if any potential for oil development in the area, however a damaged ship could result in a fuel spill, therefore, small and medium sized fuel spills that could occur due to vessel damage were considered.

Hydrocarbon exposure can affect all VECs and is typically localized to the site of the spill, assuming effective containment measures. Fouling, which is the coating of oily substances on the feathers on birds, could occur but would be related to the type of hydrocarbon and size of the spill.

Waste

Waste includes sewage and garbage. It is possible that pathogens could be introduced (e.g. *Escherichia coli*), species could consume or become tangled in garbage (e.g., plastic bags), and therefore sub-effects include disease, injury or mortality, and changes to water quality.

Small vessels under 100 Gross Tonnes (most yachts and pleasure vessels) do not fall under Arctic Waters Pollution Prevention Regulations, so are allowed to release sewage while underway into the ocean. We expect the effects due to sewage and garbage would be localized and could affect all VECs, as well as seabirds and polar bears, but note that research is needed to determine specific effects.

Gear Loss

Injury and Mortality

Lost gear can “ghost fish” and results in increased injury and mortality to fishes, marine mammals or invertebrates (e.g., corals) that get caught or entangled in this gear.

All VECs could be impacted but specific effects depend on the type of gear lost. This effect could be local or widespread depending on the species and its migratory behaviour, as well as the location of the lost gear.

Habitat Alteration and Destruction

Seafloor changes

Changes to the seafloor result from physical damage caused by gear interactions with benthic habitats (e.g., bottom trawling). Sub-effects include sedimentation, changes in species present,

dispersion of communities, extirpation, and decreased spawning potential. Effects could be both local or widespread. Ecosystem integrity and trophic links and habitat VECs would be impacted by both changes to the seafloor and changes to the water column while the char VEC would be affected primarily by changes to the water column.

Water Column Changes

An increase in suspended sediment or altered sediment regime could result in: physiological changes to fish (e.g., gill irritation) and filter feeding invertebrates; changes in water quality; and changes in migratory and foraging patterns.

These are localized to the site of the activity and affect Ecosystem Integrity and Trophic Links, char and Habitat VECs as well as benthic fishes and invertebrate species. There is published evidence that supports the effect of suspended sediment on the fish gills.

Invasive Species

Disease

Invasive species can bring diseases that could affect the health of marine mammals and fishes.

Ecosystem Changes

Invasive species can disrupt the ecosystem resulting in changes in ecosystem dynamics, collapse of native species, increased competition for native species, and dispersal or relocation of native species.

Invasive species can be introduced through shipping activities (including tour boats). Hull fouling and ballast can be the transportation vectors. Ecosystem integrity and trophic links are affected, as is the habitat for marine mammals and fishes. Effects of invasive species could be localized or widespread.

Noise

Noise can influence species' behaviour and lead to changes in marine mammal communication, changes in migration patterns (avoidance behaviour), changes in access to habitat, decreased foraging efficiency, stress, avoidance/displacement, increased energetic demands, decreased group cohesion and increased predation.

The VECs that could be affected are marine mammals and marine birds, and the effect would be localized to the area around the noise.

Ship Strikes

It was noted that Beluga are much more likely to avoid vessels than larger whales (e.g., Bowhead Whale). Ship strikes can cause injury or mortality. Effects can be both local (in the AOI) and widespread (outside the AOI).

Dredging

Four stressors were identified and discussed: Contaminants; Habitat Alteration and Destruction; Invasive Species; and Noise.

Contaminants

Heavy Metals

Heavy metals can lead to bioaccumulation, poisoning, liver/renal failure, and neurotoxicity.

Hydrocarbons

Refer to details under Commercial Fishing.

Habitat Alteration and Destruction

Effects include the following:

Seafloor changes

Seafloor changes can lead to: sedimentation; changes in species present; dispersion of communities; extirpation; and decreased spawning potential due to the destruction of eggs or spawning habitat.

Evidence exists to support changes in species' presence due to habitat alternations. The effects listed above are typically localized to the site of the dredging (or where dredged material is placed) or immediately downstream and could impact ecosystem integrity and trophic links and habitat VECs as well as benthic fishes and invertebrate species.

Water column changes

Refer to details under Commercial Fishing.

Invasive Species

Disease

Refer to details under Commercial Fishing.

Ecosystem changes

Species can become attached to dredging equipment and can be introduced to new areas when the equipment is moved.

Refer to details under Commercial Fishing.

Noise

Behaviour Changes

Refer to details under Commercial Fishing.

The difference between noise from dredging and commercial fishing is that noise from dredging is localized to the site of the activity and ongoing while the activity is occurring, whereas a ship's noise at any given location is transitory as the ship moves past.

Infrastructure Development

This category refers to a suite of activities that include water withdrawal, road construction, gravel mining, increased human presence, increased airstrip use or new construction. It also includes a shipping component. Participants identified three main stressors: Contaminants; Habitat Alteration and Destruction; and Noise.

Contaminants

Waste

Refer to details under Commercial Fishing.

Heavy Metals

Effects can occur downstream and into the ocean if tailing ponds and berms fail. Environmental Impact Statements have documented the occurrence of these events and it is likely that habitat PoE models exist.

Refer to details under Dredging.

Hydrocarbons

Evidence presented during Mackenzie Gas Pipeline EIS would apply, and participants felt it was likely that habitat PoE models exist for these activities.

Refer to details under Dredging.

Habitat Alteration and Destruction

Seafloor changes

Refer to details under Dredging.

Water Column Changes

Refer to details under Dredging.

Ice Cover Changes

Icebreaking activities cause changes in sea ice cover and condition leading to: changes in algae and grazers; changes to marine mammal and bird distribution; and disruption to seal birthing and haulout sites.

Birds follow Canadian Coast Guard (CCG) icebreakers and feed on cod exposed when ice is overturned altering behaviour and feeding habits. Participants provided evidence from direct observations.

Disruption to birthing and haulout sites may occur where shipping routes cross areas where birthing lairs occur and could result in pup mortality.

All of these effects are localized to the shipping routes and impact ecosystem Integrity and trophic links, marine mammals and marine birds.

Noise

Injury

Depending on the type of activity, hearing damage to marine mammals can result.

Effects would be at a local level and impact Beluga and Seal VECs, and other marine mammals as well as fishes.

Behaviour Changes

Refer to details under Commercial Fishing.

Mining

Mining increases the occurrence of other drivers, such as shipping, infrastructure, and port construction/operation. Mining occurs on land but has potential downstream effects that are considered here. Water withdrawals and de-watering may be associated with mining activities but were discussed as potential stressors under the Infrastructure driver.

Airborne contamination is also possible, but the group focussed on leakage from tailings ponds or spills.

Two stressors were identified and discussed: Contaminants; and Habitat Alteration and Destruction.

Contaminants

Heavy Metals

Refer to details under Infrastructure Development.

Hydrocarbons

Refer to details under Infrastructure Development.

Habitat Alteration and Destruction

Refer to details under Dredging

Crushed rock and spoiling that is deposited in the nearshore environment is considered here. These effects are localized to the site of the deposits and affect Ecosystem Integrity/Trophic Links, char and Habitat VECs as well as benthic fishes and invertebrate species.

Port Construction/Operation

Six stressors were identified and discussed: Artificial Lighting; Ballast Water; Contaminants; Habitat Alteration and Destruction; Noise; and Ship Strikes.

Artificial Lighting

Behaviour Changes

Polar bears, foxes and birds are attracted to the light and this could increase their vulnerability. Environmental Impact Assessments for Dome Petroleum (1980s) contain supporting evidence.

Ballast Water

Ecosystem Changes

Ballast water introduction can result in: nutrient introduction; changes in temperature and salinity; introduction of water treatment chemicals.

Invasive Species

Introduction of invasive species can occur through ballast water dumping. This vector is also considered under the Shipping driver and Invasive Species stressor. Ballast water is typically dumped when ships in ballast entering harbours or ports must release their ballast to take on cargo. This could impact all VECs.

Contaminants

Hydrocarbons

Refer to details under Commercial Fishing.

Atmospheric Emissions

Changes to sea ice results from deposition of particulates (soot, black carbon) that settle on sea ice. This can result in changes to the timing of melt. Timing of melt will affect ecosystem integrity and trophic links and habitat VECs.

Habitat Alteration and Destruction

Seafloor Changes

Refer to details under Dredging.

Propeller wash typically occurs at the site of the dock in shallow water when the cargo ship or tug is manoeuvring and results in increased sedimentation.

Water Column Changes

Refer to details under Commercial Fishing.

These effects would occur only locally at the port site during the construction phase. Literature from studies in Prudhoe Bay would be relevant. Effects would impact the ecosystem integrity and trophic links, char and habitat VECs as well as benthic fishes and invertebrate species.

Propeller wash typically occurs at the site of the dock in shallow water when the cargo ship or tug is manoeuvring and results in changes in water quality.

Noise

Injury or Mortality

This refers to the potential use of explosives during port construction.

Habitat PoE models exist for effects of explosives. Literature exists, including recent studies through University of Alberta on injury and lethal effects of blasting on fishes. This could affect all marine mammal and fish species, localized to the vicinity of the port.

Behaviour Changes

In the case of both port construction and operation there is the potential for low level constant noise which could impact species behaviour. Refer to details under Shipping.

Ship Strikes

This refers to ship strikes during port operation.

Injury or Mortality

Refer to details under Commercial Fishing.

Recreational Fishing

Two Stressors were identified and discussed: Biota Removal and Contaminants.

Biota Removal

Effects include the following; decreased abundance of target species; changes in population structure (age/size). Effects would impact the char VEC on a very small local scale.

Contaminants

Waste

Refer to details under Commercial Fishing.

Hydrocarbons

Fuel spills could be a source of hydrocarbons. That can affect water quality, although in this case it would be localized and likely very small scale.

Refer to details under Commercial Fishing.

Scientific Research Activities

Research may be conducted from CCG icebreakers or smaller local vessels, depending on the objectives. The scale of the research activity could vary dramatically and would have to be considered in any risk assessment.

Seven stressors were identified and discussed: Ballast Water; Contaminants; Habitat Alteration and Destruction; Invasive Species; Noise; Sampling; and Ship Strikes.

Ballast Water

Ecosystem Changes

Refer to details under Port Construction and Operation.

Contaminants

Waste

Refer to details under Commercial Fishing.

Hydrocarbons

Refer to details under Commercial Fishing.

Habitat Alteration and Destruction

Seafloor Changes

Refer to details under Dredging

Ice Cover Changes

Refer to details under Infrastructure Development.

Invasive Species

Disease

Invasive species can bring diseases that could affect the health of marine mammals and fish.

Ecosystem Changes

Refer to details under Commercial Fishing.

Noise

Refer to details under Commercial Fishing.

Sampling

Gear Loss

Refer to details under Commercial Fishing or Subsistence Fishing/Hunting

Biota Removal

Refer to details under Commercial Fishing or Subsistence Fishing/Hunting

Species Disturbance

This refers primarily to tourist behaviour such as feeding or watching animals rather than noise disturbance, which is dealt with under the section on Noise Disturbance. This can include Habituation. This impact is local and can occur with seals, birds and bears. It can also include Displacement. The impact is local and can occur with Beluga, seals and possibly fishes.

Ship Strikes

Injury or Mortality

Refer to details under Commercial Fishing.

Seismic Surveys

Pathways of Effects models for seismic surveys have been developed and are available (Coker et. al. 2010). Drivers and stressors that may be linked to seismic surveys, depending on the type of activity, include Shipping, Noise and Artificial light. However, Noise is the dominant stressor and was the only one discussed by participants.

Noise

Effects include the following:

Behaviour Changes

Refer to details under Commercial Fishing.

Injury

The levels of noise found in seismic surveys can cause hearing damage to marine mammals, could change behaviour and could interfere with communications.

Effects would be at a local level and impact Beluga and Seal VECs, and other marine mammals.

Shipping

Shipping refers to the transportation of goods and includes ship activities, tug and barge operations and icebreaking to escort cargo ships. It is possible that icebreaking, which currently can occur in spring, could occur in the future through the winter as a result of climate change. Tour ships and private yachts were considered under the Tourism driver

It is understood that the effect from “propeller wash” would occur typically at the site of the dock in shallow water when the cargo ship or tug is manoeuvring, therefore propeller wash effects are listed with the driver “Port Construction/Operation”.

Waste (garbage) was discussed as a potential stressor resulting from shipping but is not listed since regulations are in place to prevent this. Waste would only be caused by illegal dumping.

The following six stressors were identified and discussed: Ballast water; Contaminants; Habitat Alteration and Destruction; Invasive Species; Noise; and Ship Strikes.

Ballast Water

Ecosystem Changes

Refer to details under Port Construction and Operation.

Contaminants

Antifoulants

Refer to details under Commercial Fishing.

Hydrocarbons

Refer to details under Commercial Fishing.

Noise

Behaviour Changes

Refer to details under Commercial Fishing.

Habitat Alteration and Destruction

Ice Cover Changes

Refer to details under Infrastructure Development.

Invasive Species

Disease

Refer to details under Commercial Fishing.

Ecosystem Changes

Refer to details under Commercial Fishing.

Ship Strikes

Injury or Mortality

Refer to details under Commercial Fishing.

Subsistence Hunting/Fishing

Four stressors were identified and discussed: Biota Removal; Contaminants; Gear Loss; and Ship Strikes.

Biota Removal

Directed hunting for marine mammals and fishing for anadromous fishes (gillnets 4.5-5.5” mesh) is considered here.

The effects include the following: decreased abundance of target species (injury and mortality) which affects char, Beluga and seal VECs and is more likely to be a localized effect, but could be widespread; changes in population structure (age/size) which affects Beluga and seal VECs and other marine mammals in the short term and would be localized; and decreased abundance of non-target species.

Contaminants

Effects include the following:

Hydrocarbons

Refer to details under Commercial Fishing.

Waste

Refer to details under Commercial Fishing.

This would also include temporary shore-based camps which could produce small amounts of sewage and garbage. Note the occurrence of these effects would be localized, and very small scale.

Gear Loss

Injury or Mortality

Refer to details under Commercial Fishing.

Ship Strikes

Injury or Mortality

It was noted that Beluga are much more likely to avoid even fast vessels used by tourists than would a larger whale (e.g., Bowhead Whale). Effects would occur in areas frequented by tourists.

Tourism

Under the Tourism driver cruise ships and their landing craft (zodiacs) were considered as well as pleasure yachts. Regulations, guidelines, or ethics associated with tourism activities may mitigate the impacts of this activity. Six stressors were identified and discussed: Contaminants; Habitat Alteration and Destruction; Invasive Species; Noise; Ship Strikes; and Species Disturbance.

Contaminants

Hydrocarbons

Refer to details under Commercial Fishing.

Waste

Refer to details under Commercial Fishing.

Habitat Alteration and Destruction

Seafloor Changes

Anchor deployment, when repeated over time, can cause: sedimentation; changes in species present; dispersion of communities; extirpation; and decreased spawning potential.

Ice cover changes were not included here as CCG icebreaking escorts for cruise ships do not occur in this region. Russian nuclear icebreaker/tour ships have the capacity to break ice in the winter, and the effects of this activity may need to be considered in the future. The effects identified here are localized to the site of the anchorage and affect ecosystem integrity and trophic linkages and habitat VECs.

Invasive Species

Disease

Refer to details under Commercial Fishing.

Ecosystem Changes

Refer to details under Commercial Fishing.

Noise

Behaviour Changes

Refer to details under Commercial Fishing.

Tourism would differ only that there may be ethics or regulations about operating quietly in order to approach wildlife. Studies of effects of tourism in areas like Churchill could be relevant if tourism were to increase in the Paulatuk area.

Ship Strikes

Injury or Mortality

Refer to details under Shipping.

Species Disturbance

Refer to details under Scientific Research Activities.

NEXT STEPS

Participants agreed that the working paper should be re-written based on meeting discussions and should include references to support the pathways described during the meeting. The science advisory report would be developed to summarize the conclusions and present the pathways of effects models.

REFERENCES CITED

Coker, G.A., Ming, D.L., and Mandrak, N.E. 2010. Mitigation guide for the protection of fishes and fish habitat to accompany the species at risk recovery potential assessments conducted by Fisheries and Oceans Canada (DFO) in Central and Arctic Region. Version 1.0. Can. Manuscr. Rep. Fish. Aquat. Sci. 2904: vi + 40 p.

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APPENDIX 1. TERMS OF REFERENCE

Regional Peer Review - Central and Arctic Region

February 6-7, 2013
Winnipeg, MB

Chairperson: Margaret Treble

Context

Canada's Oceans Act (1997) authorizes Fisheries and Oceans Canada (DFO) to provide enhanced management to areas of the oceans and coasts which are ecologically or biologically significant (DFO 2004). Under the Health of the Oceans Initiative, DFO Science sector provides advice in support of the identification and development of Marine Protected Areas (MPAs) following the selection of an Area of Interest (AOI). Part of this process includes sound scientific advice to identify and prioritize ecosystem issues and to inform the development of management strategies, action plans, research prioritization and the drafting of the Regulatory Impact Analysis Statement (RIAS).

In late 2010, DFO Science identified and prioritized areas within the Darnley Bay AOI which met the criteria for marine protection under the Oceans Act, provided advice on boundaries for those areas and identified one or more conservation objectives for each (DFO 2011). Based on this advice, the Paulatuk AOI Steering Committee decided to include a portion of the Cape Parry Offshore Marine Feeding Habitat priority area within the AOI. The conservation objective developed for this area is:

"to maintain the integrity of the marine environment offshore of the Cape Parry Migratory Bird Sanctuary (MBS) so that it is productive and allows for high trophic level feeding by ensuring that the Cape Parry polynyas and associated sea-ice habitat, and the role of key prey species (e.g., Arctic Cod), are not disrupted by human activities."

DFO Oceans Program Division has asked, DFO Science to apply a stressor-based approach to identify and prioritize the activities and associated stressors that have the potential to affect valued ecosystem components (VECs) in the Darnley Bay AOI. This will be used to develop and draft the RIAS. A structured approach to assessing the potential risk to ecosystem components from human activities and their associated stressors will be applied based on a framework developed in the Pacific Region (DFO 2012). The framework identifies the key elements of a risk-based assessment framework as:

- The identification of the key features or properties of the system (valued ecosystem components or VECs), including species, habitats and community/ecosystem properties;
- the identification of the activities and stressors that have the potential to affect these VECs using pathways of effects models (POE); and,
- an assessment of the risk of harm to each VEC from each activity and associated stressors using appropriate criteria and scoring methods.

The results will be used to identify which VECs and/or activities and stressors may require enhanced management attention.

Objectives

The intent of the meeting is to complete the scoping phase of the framework for this AOI by identifying human activities (drivers), their associated stressors, and potential pathways of effects on VECs in the AOI and their related uncertainties. The working paper (Pathways of

Effect Models for the Anuniaqvia Niqiqyuam Area of Interest by Browne et al.) is the basis for the review. Specific objectives are to review and evaluate for completeness and appropriateness each of the following:

- activities (drivers) that may impact the VECs identified in the AOI;
- stressors resulting from these activities; and
- potential pathways of effects on VECs.

Expected Publications

- Science Advisory Report
- Proceedings
- Research Document

Participation

- Fisheries and Oceans Canada (DFO) (Ecosystems and Oceans Science, Ecosystems and Fisheries Management sectors)
- Environment Canada (Canadian Wildlife Service)
- Fisheries Joint Management Committee
- Academia
- Other invited experts

APPENDIX 2. LIST OF PARTICIPANTS

Name	Affiliation
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Brown, Leah	DFO Oceans, C&A
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