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Proceedings of the Regional Science Peer Review on the Biophysical and Ecological Overview of the Southampton Island Ecologically and Biologically Significant Area

Meeting dates: December 5–6, 2018
Location: Winnipeg, MB

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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 2011, Fisheries and Oceans Canada (DFO) identified Ecologically and Biologically Significant Areas (EBSAs) in the Canadian Arctic including in the Eastern Arctic Biogeographic Region. Since then the Government of Canada has agreed to a suite of international biodiversity conservation goals and targets, including the conservation of 10% of coastal and marine areas by 2020. The designation of new Marine Protected Areas (MPAs) in Canadian waters has been identified as one part of the national strategy to meet these targets. A regional site selection process was initiated in the Central and Arctic Region and the Southampton Island EBSA has been proposed as an Area of Interest (AOI) for potential MPA development and recommendation for MPA designation. A regional science advisory meeting was held December 5–6, 2018 at the Freshwater Institute in Winnipeg, MB. The purpose of the meeting was to prepare and conduct a review of the Ecosystem Overview Report for Southampton Island EBSA, identify science based conservation priorities, and provide advice on the formulation of conservation objectives for this area

Participants at the meeting included experts from DFO Science, Oceans Management and Fisheries Management, Environment and Climate Change Canada, University of Manitoba, Laval University, McGill University, Coral Harbour Hunters and Trappers Organization, Government of Nunavut and Nunavut Tunngavik Inc. These proceedings summarize the meeting discussions. Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

INTRODUCTION

The Government of Canada has agreed to a suite of international biodiversity conservation goals and targets (the Convention on Biological Diversity 2011-2020 Strategic Plan for Biodiversity's Aichi Targets) and adopted complementary domestic 2020 Biodiversity Goals and Targets for Canada. Both international and domestic targets (Aichi Target 11 and Canada's Target 1) call for the conservation of 10% of coastal and marine areas by 2020. The designation of new Marine Protected Areas (MPAs) in Canadian waters has been identified as one part of the national strategy to meet these targets. Under the *Oceans Act*, Fisheries and Oceans Canada (DFO) is authorized to provide protection to areas of the oceans and coasts through the establishment of MPAs, where the identification of an Area of Interest (AOI) is the first step in this process.

A regional site selection process is underway and the Southampton Island Ecologically and Biologically Significant Area (EBSA) has been proposed as an Area of Interest (AOI) for potential MPA development and recommendation for designation. The Southampton Island EBSA was first identified as an EBSA in 2011 (DFO 2011). The main features of this EBSA include:

- Summer and winter use by the Hudson Bay-Davis Strait stock of Atlantic Walrus;
- Important spring and fall migration routes for Beluga, Narwhal and Eastern Canada-West Greenland Bowhead;
- Southampton, Coats and Mansel islands are considered important Polar Bear denning areas and summer refuge habitats for the Foxe Basin Polar Bear subpopulation;
- Important nesting areas for seabirds which feed on aggregations of marine fish in the area (e.g., Capelin, Arctic Cod), and;
- Largest single colony of Common Eider in Nunavut occurs in East Bay.

Further to this, DFO's Oceans Program has been engaging communities and Inuit organizations regarding support for the proposed AOI.

Once an area is selected as an AOI, detailed information on the key biophysical and ecological features of the area is required, especially as it pertains to potential conservation priorities (i.e., features of the EBSA) and their linkages to other key ecosystem components and processes. A review of key biophysical and ecological information within the Southampton Island EBSA may further inform ecological significance of the area and highlight conservation priorities based on the results of the review. Furthermore, the biophysical and ecological overview will assist in formulating conservation objectives, delineating a future MPA boundary (and MPA zoning, if required), and completing an ecological risk analysis to inform the development of the regulatory approach for the proposed MPA. The information contained within will also inform subsequent advice on monitoring protocols and strategies, identification of information gaps requiring further research, and the development of a management plan for the area.

DFO's Oceans Program has requested that DFO Science prepare and conduct a review of the Ecosystem Overview Report for Southampton Island EBSA, identify science-based conservation priorities, and provide advice on the formulation of conservation objectives for this area. In order to provide this information, a regional peer-review meeting was held in Winnipeg, MB, from December 5–6, 2018. The objectives of the review are described in the Terms of Reference (Appendix 1). Meeting participants included staff from DFO Science, Fisheries Management and Oceans Management, the University of Manitoba, Université Laval, Nunavut Tunngavik Incorporated (NTI; Wildlife and Environment Department), McGill University, and Government of Nunavut (GN), a local community member from the Aiviit Hunters and Trappers

Organization (HTO) in Coral Harbour and an English-Inuktitut interpreter from Rankin Inlet (Appendix 2). The meeting followed the agenda outlined in Appendix 3. This proceedings report summarizes the relevant discussions from the meeting and the suggested revisions to the associated working paper (Loewen et al. 2020). This Proceedings report summarizes the relevant discussions and presents the key conclusions reached at the meeting. Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

OPENING DISCUSSION

The Chair welcomed the participants of the meeting and discussed housekeeping items. Participants were asked to introduce themselves and provide a brief description of their background and area of expertise for participating in this review. The Chair emphasized the role of the English-Inuktitut interpretation and the importance of ensuring all participants understood the discussions and conclusions. The Chair explained the Canadian Science Advisory Secretariat (CSAS) process and placed an emphasis on the role of Science in the decision-making process (i.e., management application). The Chair then reviewed and received participant approval of the wording for the Terms of Reference (ToR) and agenda. The Chair gave an overview of the presenters who would be speaking over the course of the meeting, as well as how each of these presentations related to the ToR. A draft version of the Ecological and Biophysical overview report for the Southampton Island proposed Area of Interest (AOI) was circulated to participants in advance of the meeting. This draft overview report formed the basis of the peer review and provided context for the discussions forming the scientific advice. Participants were encouraged to ask questions and contribute knowledge and expertise towards developing a consensus on the conclusions, recommendations, and advice.

PRESENTATIONS

EASTERN ARCTIC MARINE PROTECTED AREA PROCESS

Presenter: Charlotte Sharkey, DFO-Oceans Management

Descriptions of the MPA designation process and the Southampton Island AOI selection process were provided and the rationale for requesting science advice was outlined.

SCIENCE CONTRIBUTION TO THE MPA PROCESS AND THE RESEARCH DOCUMENT

Presenter: Tracey Loewen, DFO-Science; Eastern Arctic Marine Conservation Target (MCT) Biologist

A review of the contributions of DFO Science to the MPA process was provided. The development process for the working paper allowed for a thorough approach to information gathering for each section. A literature review was completed via contract and DFO Science added the ecological significance, vulnerabilities, and knowledge gaps sections. The working paper was then sent out for review to 12-15 experts and their feedback was incorporated into the document or noted for discussion by meeting participants at the meeting. The major changes that occurred during this review process included the addition of zooplankton and phytoplankton species, the identification that the seabird section needed restructuring, and the addition of the Walrus Traditional Knowledge workshop information. The species lists were removed from the Appendix of the working paper and will be published as a DFO Data Report.

WORKING PAPER PRESENTATION – LITERATURE REVIEW SECTION

Presenter: Tracey Loewen, DFO-Science; Eastern Arctic MCT Biologist

An overview of the literature review was provided and the information on ecological significance was highlighted. The Southampton Island EBSA appears more productive than previously suggested due to the information provided on primary production and benthic communities in the area. Kelp appear to be widespread in areas of high currents. There are unique species of zooplankton in the Southampton Island EBSA compared to other adjoining areas. It is also a marine mammal migration corridor for beluga, bowhead and narwhal, and provides important habitats for these species in addition to walrus and polar bear. There are also two colonies of thick-billed murres in the area, which represents approximately 2% of their Canadian population. Other migratory birds also use the area.

DISCUSSION

Meeting participants discussed the salmonid species present in the area. The presence of Brook Char (*Salvelinus fontinalis*) was identified by traditional knowledge reports. Presence data for fish species from in and around the EBSA were included in the working paper to account for potential fish movements into and out of the EBSA.

There was also discussion about the uncertainty regarding the importance of this area for bowhead calving and foraging. While older aged bowhead individuals use the area, the larger proportion of the population is in Foxe Basin. The use of this area for calves and nursing bowhead was identified as a knowledge gap. There was local observations (i.e., local knowledge) of bowhead arriving earlier in the spring, and also increasing observations of bowhead in the area suggesting changes in the timing of bowhead presence, and an increase in the number of individual whales. Community members from Coral Harbour can now see bowhead from the shoreline at the floe edge (i.e., pre-ice breakup), which was noted as a major change. Walrus are also common but are occasionally hunted in spring. Other local knowledge holders would be able to provide additional information about changes near their communities. Local knowledge of an increasing number of polar bears in the area has led community members to regularly suggest the presence of a dog or bear monitor for bear protection when studying whales.

Bearded and ringed seals were noted as year-round residents.

The working paper was summarized by meeting participants as being comprehensive but noted some missing pieces. It was speculated that these missing pieces may have been omitted because they were missed or because the data were not available. The importance of highlighting both what is known and what is not known was identified and discussed, as this process drives the kinds of research that are necessary to support the Oceans Program and any future MPA. The intent was to encourage a report be as complete as possible to highlight ongoing research, identify information gaps, and raise awareness of areas and topics that require further efforts.

The oceanographic conditions, nutrient dynamics, carbon dynamics, and exchanges were identified as data gaps by participants as there are only minimal data currently available (e.g., only one previous ocean data collection in 1967). The data from recent cruises will provide a modern snapshot of the area. In addition, there were also data collected recently from Naujaat and Chesterfield Inlet in winter; however, these data are not yet available. Information about the water column and the relationship of those processes to the physical aspects of the ecosystem are important to include, if available, or to highlight as a data gap.

An assessment of the benthic substrate was also identified as a data gap by meeting participants. This information, if available, would contribute to an assessment of the biological community associated with different substrate types (e.g., kelp need hard surfaces whereas other species burrow into soft substrates) and should be included both in the text and also in associated maps in the working paper. There was discussion about the presence of large kelp beds on the south side of Southampton Island to the maximum depth of the species (i.e., about 40 m). There have been oceanographic research cruises; however, the data are not in an organized format and only provide pieces of information, all of which are from deeper water (e.g., greater than 50 m). There was also a recent study to map the substrate in Hudson Bay, which included five stations in the EBSA. The substrate hotspot map (Pelletier 1986) is of limited use because it only provides a general overview of the substrate in the area.

There was discussion from meeting participants regarding the under-representation of marine fish biodiversity in the EBSA and the use of biased assessment methods. The current estimate of 42-44 species of marine fishes present is based on very old information using scientific surveys that are biased by the nature of the substrate in the area and the type of gear used. As there are different communities of fishes associated with different substrate types, different substrate types require different sampling methods in order to accurately represent species diversity. For example, soft-bottomed areas are easily sampled whereas kelp areas require scuba work rather than using passive gear. There was discussion of a recent news report of a Greenland shark in the area; however, whether that represents a shift in the community structure (i.e., species new to the area) or an occurrence of a fish that is present but not previously documented is unknown. Local observations were provided of increased observations of marine mammal species (i.e., seals) after one Greenland shark was caught in a fishing net. It was discussed that marine fish biodiversity in this area is underestimated, the documentation of rare species is missing, the significance of the presence of new species is not well understood, and our current understanding is based on old information.

Local knowledge was also provided regarding observations of new species in the area, which highlighted a need for monitoring for new species in the area. Humpback and minke whales have also recently been observed in Hudson Bay. There was discussion that the best way for large areas in the Canadian Arctic to be monitored for new species is to rely on the observations of local people. This information gives scientists the opportunity to better understand potential shifts in community structure through observations of changing species biodiversity and associated ecological information. There was encouragement that one of the outcomes of the AOI process could be the development of a monitoring program. There is also an opportunity to document Inuit Qaujimajatuqangit (IQ) in a future workshop and there is potential to work with the HTOs to document this local knowledge regarding biodiversity change on an on-going basis.

The meeting participants suggested that the research document could list recent and new research projects that will produce new data for the area. A new section will be added to the research document to accommodate this suggestion and will rely on meeting participants to provide a list of relevant projects.

Information related to the presence of Arctic Char was discussed. This information was listed as a data deficiency as there was little published information about char in the area. Arctic Char are normally found in the nearshore environments (anadromous use the rivers to overwinter in the lakes); however, there are exceptions and they can also be found offshore or even landlocked. It is important to highlight for this summary, that Arctic Char are more coastal than offshore.

WORKING PAPER PRESENTATION – ECOLOGICAL SIGNIFICANCE

Presenter: Tracey Loewen, DFO-Science; Eastern Arctic MCT Biologist

Migration Corridor

A summary of the ecological significance of the migration corridor for beluga, bowhead, and narwhal was presented. The importance of understanding why this area is of ecological importance through the identification of physical drivers was emphasized as this allows for the development of hypotheses regarding how this migration corridor may change due to the impact of different stressors (e.g., climate, vessel traffic).

Participants discussed Frozen Strait and identified the persistence of ice and the presence of sea mounts in this location as potentially important drivers. The highly variable depths in Frozen Strait may provide the potential for mixing across depths and also the movement of water from Foxe Basin. This would provide additional nutrients and increase production, which would pass through the food web. Hudson Strait was discussed as a choke point, animals choose to migrate through the Southampton Island area because it was suitable (including offshore areas and the floe edges). The area also provides food availability. There was a discussion about the value in identifying the seasonality of the area for each species. The need to map the migration corridors for each species was identified by participants.

Marine Mammal Seasonal Residents (narwhal, beluga, bowhead) Feeding

Walrus was identified as a year-round resident species and the section will be restructured to reflect this.

The area was discussed as important for feeding by beluga, narwhal and bowhead. For bowhead, the area is important as post-calving habitat for feeding in the Roes Welcome Sound polynya.

The Southampton Island EBSA is used by narwhal but participants discussed that it is not a core or key area for this species. Narwhal likely calve prior to entering the EBSA and their summer core area, in and around Repulse Bay, however the extent to which calving occurs within the area was not clarified during this discussion. The Repulse Bay EBSA was identified as important calving and nursing habitat for narwhal, in a previous DFO (2011) report. The area near Naujaat, specifically, was discussed as an important region for narwhal to avoid predators as the physical conditions in this area provide a refuge for their calves. Local knowledge noted that there were few narwhal calving and nursing areas observed near Coral Harbour compared to Naujaat.

The difficulty for several communities to reach their narwhal quotas recently was discussed. Local knowledge highlighted the use of the area for shipping, challenging weather conditions, and the inability of harvesters to go hunting were all identified as potential reasons for the lower harvests. An aerial survey for narwhal was completed last summer so there may be evidence of changes in narwhal and beluga abundance from previous years, however this has not yet been assessed by DFO (e.g., population abundance calculations, stock assessment). Fewer whales may also represent a shift in distribution.

East Bay was identified from local knowledge as being important as a beluga calving area. Beluga were also observed nursing in the East Bay area. Additional information about the importance of the area for calving and nursing may be identified in a future IQ workshop.

The movements of beluga, narwhal, and bowhead were discussed. Some beluga move through the Southampton Island EBSA to summer in western Hudson Bay, Foxe Basin, and the Gulf of

Boothia, while some remain in East Bay during summer. It was identified that more animals use the Southampton Island EBSA as a migration corridor, whereas a smaller number of animals remain in the EBSA during summer. The same pattern was noted for narwhal; however, narwhal are more aggregated in summer areas outside the EBSA (Naujaat). Beluga coming from Hudson Strait to their summer region in western Hudson Bay will travel along the coast. The movement of beluga may be driven by the timing of ice breakup as shorelines may be breaking up earlier than does Hudson Bay. The movement of bowhead is likely also sea-ice associated as they follow the sea ice to go to Foxe Basin and Gulf of Boothia. Few whales are remain in the area during summer.

A participant provided local knowledge about the impacts of climate change in the area. The formation of ice has changed and the ice in spring is thinner. Community members historically could use the ice in spring and fall but now they cannot use the ice in June and October because ice breaks up earlier and forms later. Climate change has also caused changes in the weather.

Seabirds and Prey

Local knowledge was provided about the importance of Coats Island, East Bay, and the area between Coats Island and Southampton Island as important habitat for staging, resting and foraging for seabirds. Several different species of seabirds were identified as using Coats Island. Local knowledge was provided regarding the impact of shipping activity on species in the area between Coats Island and Southampton Island, including Walrus Island. The shipping activity may be impacting the food availability for seabirds, the abundance of species in the area, and the use of the walrus haulouts on Coats and Walrus Island. Local observations were provided by a participant, stating that fewer walrus using the haulouts. Local knowledge was discussed regarding an increasing number of polar bears and the importance of this increase was noted due to the resulting impacts on seabirds and mammals. Some of the polar bears are aggressive, which is dangerous for humans.

Offshore feeding information for seabirds was identified as a data gap. The connection between offshore feeding habitats and shipping traffic was discussed as potentially a major stressor that would need to be addressed if bird foraging areas and timing of feeding overlapped with shipping routes. Feeding distance from the colony is an important piece of information and will be updated in the report for each species from the primary literature. Home ranges include short foraging trips and there is recent tagging data for thick billed murres. The feeding radius from walrus haulout sites could also be similarly identified for walrus. Diet information for the seabird species is also important. For instance, eider duck prey includes blue mussels.

The importance of including all factors contributing to chick survival was emphasized. The energy content of prey is only one such factor.

Physical drivers were discussed and were separated from determinants, which are items that determine the importance of the area to seabirds or for other mammals. Physical drivers, including oceanographic conditions and primary production, were identified as data gaps and need to be emphasized. Determinants could be physical drivers, production drivers, or forage base prey items that are available. There is a wide spectrum of determinants.

The presence of seabirds in the East Bay area was identified as the primary rationale for the importance of this particular area within the AOI. The background reasons why the birds are present can be used to better delineate the conservation objectives and identify needs for management. These physical or general drivers can be identified by beginning with presence and then rationalizing the reasons for their presence including physical oceanographic

conditions and biological oceanographic conditions that contribute to habitat and food availability (e.g., currents and productivity).

Resident Marine Mammals and Prey

Agreement from participants that bearded and ringed seals were also year-round residents. The Southampton Island EBSA is highly productive for seals and this likely reflects the productivity of the area.

The key life history periods for seals in this area were identified as pupping in winter and molting in spring. Sub-adult seals also use the Roes Welcome Sound polynya in winter. Pupping typically uses land-fast ice and nearby food resources are important. The Roes Welcome Sound polynya was identified as a key reason for ringed seal abundance. As Roes Welcome Sound is deeper, it is less clear why the area is important for bearded seal, a benthic feeder. Roes Welcome Sound was identified as having the largest concentration of ringed seals in this EBSA.

The location of key foraging habitats for walrus was identified as a data gap. Local knowledge in some communities has mapped walrus feeding areas. Local knowledge identified that walrus diet included clams and mussels from the seabed. However, walrus can more easily dig in shallow habitats but can also access deeper habitats by remaining underwater for 20 to 30 minutes. Significant community concern from Coral Harbour was identified regarding the increased boat activity at Walrus Island. A lack of communication between vessels accessing Walrus Island and the community of Coral Harbour was identified as an issue.

Species richness for epifauna was predicted for the Hudson Bay Complex (including East Bay and Roes Welcome Sound polynya). This model, which creates the probability of occurrence for benthic invertebrates, was developed using 18 historical data sets (Atkinson et al. 1989, Cusson et al. 2007), and also 14 samples recently collected from the Hudson Bay Complex. It was suggested that the map of predicted species richness should also include the sample sites to facilitate interpretation as it is difficult to extrapolate the information to the AOI.

Polar bear habitat use was summarized for Southampton Island. Almost any part of the island can be used for maternity denning habitat (which tend to be on higher ground). There is a north-south migration as bears move up and down the island as ice forms and retreats. This movement is seen in collar data gathered by satellites and is also supported by local observations. Local knowledge holders also observe movements of bears across frozen polynyas.

Local knowledge was provided regarding the presence of fewer large male polar bears. Male polar bears are being targeted by hunters and this was discussed as a potential cause for this observed decrease. The decline in male polar bears may have an impact on reproduction because they are more successful. It was suggested that harvest ratios should be equal between males and females.

Migratory Arctic Char

Participants discussed whether Arctic Char was warranted as a species of ecological significance. Although not necessarily ecologically unique (although the char populations might be), they are certainly ecologically significant, and the same goes for ringed seals. Arctic Char was identified as a representative species for the coastal area, and the prey of char (e.g., Capelin, sandlance, Arctic Cod) are also good indicators of this coastal environment. The absence of feeding studies for char in this area was noted as a data gap. However, char generally eat in the upper water column. Therefore, any interface or interchange that would concentrate planktonic food would also concentrate char. Char were also described as

opportunistic feeders and their associations with rivers and nearshore freshened areas indicate areas where food also concentrates. If those areas do not have sufficient food, char will move elsewhere and most likely to areas further along the coast or offshore areas that are freshened rather than wholly marine areas. Observed shifts in fish communities indicate larger ecosystem level changes and also perhaps changes in water currents. The need for local knowledge to identify the significance of char as a subsistence resource was identified and should be included in future discussions. There is potential for increased fishing pressure due to increased tourism in the area. Also, there is potential for interaction of char, the nearshore marine environment, tourists using the area, and the follow-on effects of this on the availability of char as a subsistence resource. If Arctic Char are included as an ecologically significant species, there may be associated management implications and obligations.

Kelp was identified as important to the coastal ecosystem. The extent of kelp forests and their role in the ecosystem was identified as a data gap. Thick billed murres forage in kelp off Coats Island and bring back primarily two species of fish (*Gymnelus viridis* and *Stichaeus punctatus*). The presence and extent of sea grass/eel grass beds was identified as a data gap and is related to the lack of information about benthic substrates in the area. Sea grasses need salty clear water at depths of 4m or less with finer grain silty sandy mud in order to establish roots. The composition of benthic substrates around Southampton Island is unknown, and the prevalence of hard substrate, which is unsuitable for sea grasses, may be a factor limiting their presence. Alternatively, hard substrates may provide anchor sites for kelp. There is a general lack of information about macroalgae in the area.

Local knowledge was provided regarding the movements of char between lakes and the ocean, and the proportion of char that remain in lakes. For migratory char, elders describe only half of the char from the lake go down the river during downstream migrations in spring (the other half rotates to the next year), and reside in the coastal marine waters in the summer. Some fishes migrate but do not go the ocean, rather they may seasonally migrate in freshwaters. Migration studies usually focus on sea-run char (rather than those the seasonally migrate within freshwater) because those fish grow rapidly and could support a commercial fishery. Estimates of the proportion of resident char in a population are lower than 50% for populations on Baffin Island. There was discussion about terminology as scientists refer to resident char as those that do not go to sea at all, whereas local people may refer to resident char as those that remain in the lakes, perhaps to reproduce, but then migrate to the ocean at some point. Previous research suggests that Arctic char populations generally consist of about 30% resident fish. The potential complexities of char migratory patterns, life histories, habitat usages, and poor understanding of the importance of marine habitats and conditions constitute an information gap.

It was agreed that rather than have Arctic char as a stand-alone species of ecological significance, char should be incorporated as a nearshore coastal habitat key ecosystem component, which would include the coastal fish community (including char), kelp, and associated representative biota as well as potential indicators. This distinction would help to separate the nearshore environment from the offshore. The coastal habitat and ecosystem that it supports is unique; char remain an important component of that ecosystem. Generally, each distinct char population is unique because it is locally adapted to a particular habitat and a particular area. The association between substrate type and nearshore community, including fish composition, presence of kelp, and related prey availability for fishes, sea birds and mammals, is highly significant and speaks to the relevance of the nearshore environment as ecologically important. These areas are also somewhat distinct and isolated from the large ocean processes in Hudson Bay.

Roes Welcome Sound Polynya

Participants discussed the presence of other polynyas, floe edge areas, and that Roes Welcome Sound polynya is the northern edge of a flaw lead system that extends southward to Churchill. The Roes Welcome Sound polynya was identified as likely the most important one in this system for making Hudson Bay deep water, which is the forming of dense salty water that sinks. The formation of dense water can break down stratification rapidly, causing mixing. Winds can also affect polynyas thus increasing upwelling. The role of polynyas in a freshening ocean was identified as a data gap as the depth of mixing and the sensitivity of that to freshening in the winter are unknowns. The northern extent of the Roes Welcome Sound polynya also occasionally freezes over (or partially) in winter to form a land bridge; this has happened 7 or 8 times in the past 40 years from satellite photos and people sometimes use it to skidoo to the mainland. Local knowledge was also provided regarding the use of the occasional formation of the ice bridge to hunt caribou on the mainland by residents of Coral Harbour.

Participants discussed and identified physical drivers. The influences of the polynya itself, as well as light, were identified as drivers. Wind was identified as a major physical driver in the area. It was discussed that the wind comes predominantly from one direction (the northwest), which sets up certain areas that are prone for upwelling in the region and draws water down Roes Welcome Sound. This region has high tides. The movement of water across kelp forests provides more nutrients to kelp than what is present in the water column alone. The surface waters in this area are nutrient deficient because phytoplankton have removed much of the nutrients early in the season and because the water comes from the Arctic Ocean which is influenced by low-nutrient ice melt. The winds therefore enhance mixing, which adds nutrients.

Ice algae knowledge was identified as a data gap. Although it is known to be ecologically significant in other areas, and some research was completed in Chesterfield Inlet, little is known regarding ice algae in this area.

Priority Areas

Three priority areas were identified and discussed by participants: East Bay, Evans and Fisher Strait, between Coats Island and Southampton Island, including Walrus Island and Roes Welcome Sound polynya. There was agreement to keep Roes Welcome Sound polynya as a standalone element of ecological significance. The potential significance of other polynyas and flaw leads could be built into the coastal habitat elements of significance and seasonality. Each of these areas is ecologically significant for its own reasons. The migration corridor was discussed as ecologically significant for the whole EBSA area. The eastern boundary of the EBSA was identified as a hard boundary due to the borders for the regions within Nunavut. However, participants discussed the importance of the interconnectedness of these areas and the role of these connections in MPA networks.

Each area of ecological significance was then discussed individually, and reasons for significance were identified.

East Bay

This area was identified as potentially important for beluga. It has the largest eider duck colony in the Hudson Bay Complex. There are movements of polar bear between Native Bay and East Bay, and there is a higher abundance in spring as bears are foraging in East Bay on eider duck eggs. Polar bear have decimated the eider duck colony over the last 5-10 years. The area was identified as a nesting area for Canada geese and snow geese by local knowledge. Oceanographic conditions are also important to East Bay. It is inferred that there is a major outflow from Foxe Basin (flowing southeast) and inflow from Hudson Strait (flowing west from

Davis Strait). This connectivity, however, was identified as a data gap. There are also important connections to other areas. There is potential upwelling in the area due to the intersection of currents. The flow of currents in the area would induce upwelling and bring in nutrients from Hudson Strait. The nearshore habitat may also be significant as ice retreats from shore earlier, which provides shallow subtidal open water habitat for birds. Walrus are present in the area and there are several walrus haulout sites in the area. The benthic species richness model supports the presence of walrus in the area through the association of walrus with potential benthic prey items. Although the forage base for walrus is unknown in this area and is thus a data gap, it is possible to infer that the forage base for eider ducks is similarly important for walrus. While walrus are a year-round resident, seasonal movements of walrus are also important. Local knowledge identified the presence of walrus only in March and April in this area. The amount of benthic activity (i.e., presence of a benthic hot spot) may be related to ice transport from Foxe Channel; however, that relationship between ice transport and benthic activity is not well defined and is identified as a data gap.

Southampton Island to Coats Island, Fisher Strait to Evans Strait

This area was identified as important for walrus. There are extensive kelp forests; however, the extent of kelp distribution and associated community is a data gap. There are sea bird colonies in the area including thick billed murres on Coats Island. There are nearshore fishes including anadromous Arctic char in the area. There is also open water along the flaw lead. This area is likely not important for bowhead. The nearshore environment was identified as a subset within this area, which would include kelp and the associated fish community. Participants also discussed that a unique sub-ecosystem may be associated with the kelp forests, which would include marine fishes and marine invertebrates that specialize in such habitats. That would also create the opportunity for foraging for predators including sea birds, seals, and walrus. Referencing a published paper from 2014, kelp beds were discussed as refugia from predators for pteropods and other calcified species. The research document would benefit from a more detailed water depth map and overlying substrate information if that information is available. If that information is not available, it should be identified as a data gap. Potential oceanographic drivers were identified as a data gap for this area; however, the Churchill marine observatory has two moorings currently in place in the area, which will provide more information in a year. Polynyas and flaw leads allow for mixing and may also provide the opportunity for light penetration, which will help kelp beds. Ice formation was discussed and would have an impact on mixing and water circulation. The area is surrounded by deeper waters so upwelling could occur. Bathymetry in the area is also a data gap and participants discussed that Canadian Hydrographic Service may have better information due to vessel traffic. The use of the entire Southampton Island EBSA was discussed as important for polar bear and therefore it was not necessary to make mention of polar bear in each individual area. However, polar bear do use the area and it is an important area for summer movement of polar bear. The geographic limits of the area were discussed and participants agreed that the area includes all waters including nearshore in the area bounded by Fisher and Evans straits.

Roes Welcome Sound and specifically the polynya in the area

This area was identified as important for bowhead, ringed seal, and bearded seal. The formation of the ice bridge and the link between the polynya and the presence of a potential benthic hotspot were discussed as ecologically important for this area. Local knowledge stressed the importance of the polynya for marine animals and provided information about the speed of ice formation influencing the currents in the area. In some ice conditions, the animals can get trapped there. Fast-forming ice results in slower currents. The presence of the marine mammals using these areas to breathe also keep these areas open when the ice forms rapidly. Participants also discussed the importance of the physical aspects of the polynya. As Roes

Welcome Sound polynya is the northern edge of a flaw lead system, the polynya is an important feature for the formation of dense bottom water and as a driver for circulation and mixing. Seasonal use of the area was discussed as the polynya is important in winter and the area is also important in summer for bowhead and seals. Sub-adult seals also use the polynya in winter. The area is likely less important for kelp because the area is deeper. Kelp are hypothesized to occur in areas with clear water that are less than 40 or 50m deep, which are not common in this area. Also, the ice is mobile in Roes Welcome Sound so it would scour shallower areas, which would remove kelp if present. Land fast ice was identified as being present in South Bay. The location of the polynya was discussed. While it needs to be mapped for the report, the text also needs to outline that there is variation in location and spatial extent seasonally and annually. For example, oceanographic features have been used as a proxy to identify ecologically and biologically important areas for Baffin Bay and Davis Strait where there is limited data. There is limited oceanographic data for the Roes Welcome Sound. The available information about flow, for instance, is based on limited information from a current meter located in the area 30 years ago. Oceanographic information for this area was therefore identified as a data gap by participants. Ice dynamics were not persistent or consistent in that area from 2003-2011 based on satellite images. Participants will provide a list of references to provide additional information regarding this area for the report. Anadromous Arctic char are present in the area, and are nearshore and migratory along the west side of Roes Welcome Sound. The details regarding Arctic char in this area were identified as a data gap. Local knowledge from Chesterfield Inlet and Coral Harbour would provide the locations of important fishing areas.

KNOWN AND POTENTIAL ANTHROPOGENIC ACTIVITIES AND STRESSORS

A list of potential stressors was provided for discussion.

DISCUSSION

A significant reorganization of the listed potential stressors was discussed by participants. It was suggested that the stressors be categorized as pervasive and widespread or local and area-specific. Examples of pervasive stressors include climate change and downstream effects, large scale contaminant loading (i.e., from global/transboundary sources), and ocean acidification. Examples of local stressors include shipping, exploitation, local point source pollution, and microplastics. Participants agreed that shifts in species distribution and changes in local abundances due to changing environmental conditions should be included. However, it was noted that shifts in species diets may not manifest as only the appearance of new prey species, but rather could also be a change in relative abundance of usual prey species, which is then reflected in diet. Therefore, changes in species distributions are different from trophic changes. Potential shifts in species distributions include the increased occurrence and abundance of unusual or non-endemic species (e.g., killer whales), and possible decreases in geographic range and abundance of endemic species. These changes may be reflected in predator diets (e.g., a shift from Arctic cod to capelin in seabirds).

Discussion about sea ice focused on the need to identify specific mechanisms relating to observed changes. The potential effects of changes in sea ice on sea ice-associated species such as walrus was identified as a data gap. There was discussion about the definition of projections versus predictions. It was suggested that the information be organized to begin with a broad statement and move to a specific statement.

There was agreement about the polar bear statement. Local knowledge was provided regarding the change in movement and migration of polar bear, which includes increasing their contact with humans and communities. There are also observed increases in the use of dumps for feeding and the resulting impacts on the quality of meat. The increased interaction between

bears and humans is resulting in habituation and the bears are less scared and are more aggressive toward humans. This was identified as an inherent danger for people on the land.

Local knowledge was provided regarding the effect of climate change on snow and ice. The snow is now very soft in the fall, which makes it difficult to go hunting. There are also observed changes in weather patterns.

Participants discussed the impact of permafrost degradation due to climate change on freshwater habitats. Local knowledge was provided regarding the occurrence of rocks now present in a river near Coral Harbour as a result of permafrost degradation and consequent slumping of the riverbank/canyon wall, which is blocking the river and affecting both the fish and the people that are hunting and fishing in the area. The community of Coral Harbour is willing to restore the river but needs assistance identifying funding options. Permafrost degradation can also lead to additional effects such as increased sedimentation and nutrient loading. The extent of impacts of permafrost degradation on freshwater and nearshore marine habitats was identified as a data gap.

Local activities that lead to additional stressors were also discussed by participants. Vessel traffic was discussed as a major concern, and includes shipping as well as local small-scale vessel movements. Concerns included disturbance and potential displacement of the marine mammal species, potential waste water and garbage disposal issues, disturbance due to landings in sensitive areas and subsequent activities on shore, and ice-breaking activities that potentially exacerbate the effects of climate change. Local knowledge identified that vessel traffic can result in disruptions to traditional hunting activities. The increase in soot (i.e., black carbon) and related potential impacts of soot deposition on marine and terrestrial vegetation was also identified as a stressor resulting from increased vessel traffic. Local knowledge also identified that vessels stir up sediments. The need to regulate vessel traffic and notify communities regarding vessels in the area was noted. Other local activities discussed included scientific research activities, the use of drones, potential future activities including oil and gas developments and the associated risk of spills and increase in shipping.

DRAFT WORDING FOR CONSERVATION OBJECTIVES

Within the working paper, the authors prepared some drafted text for the participants to consider as a starting point for the SAR bullet points. Participants discussed the drafted text and provided suggestions to organization and wording. It was noted that the wording included here provides a starting point for Oceans Management to consider. The drafted text will be removed from the working paper for publication.

REVIEW OF SUMMARY BULLETS AND UNCERTAINTIES

A general broad ranging discussion on the working document and SAR followed. The working paper was accepted as the Research Document to support the SAR. The summary bullets will be circulated for comments. It was noted that the CSAS meeting provided the opportunity to identify a basic consensus, and that substantive changes cannot be made and new information cannot be added after the meeting ends. However, future steps in the MPA process, including the planned IQ workshop, will allow for the inclusion of information that was not discussed at the CSAS meeting.

The Chair thanked everyone who participated in person and by phone. The Science Advisory Report (SAR) and Proceedings will be drafted over the next few months and then sent to the participants for their review. The Research Document will be revised and provided to participants for their final review in the next few months.

The meeting was adjourned.

REFERENCES CITED

DFO. 2011. Identification of Ecologically and Biologically Significant Areas (EBSA) in the Canadian Arctic. DFO Can. Sci. Advis. Rep. 2011/055.

Loewen, T. N., Hornby, C.A, Johnson, M., Chambers, C., Dawson, K., MacDonell, D., Bernhardt, W., Gnanapragasam, R., Pierrejean, M. and Choy, E. 2020. Ecological and Biophysical Overview of the Southampton Island Ecologically and Biologically Significant Area in support of the identification of an Area of Interest. DFO Can. Sci. Advis. Sec. Res. Doc. 2020/032. vi + 97 p.

Pelletier B.R. 1986. Seafloor morphology and sediments. *In* Canadian Inland Seas: Oceanography Series 44. Edited by I.P. Martini. Amsterdam Elsevier. pp.143–162.

APPENDIX 1: TERMS OF REFERENCE

Biophysical and ecological overview of the Southampton Island Area of Interest (AOI)

Regional Peer Review – Central and Arctic Region

December 5–6, 2018
Winnipeg, MB

Chairpersons: Jason Stow and Joclyn Paulic

Context

The Government of Canada has agreed to a suite of international biodiversity conservation goals and targets (the Convention on Biological Diversity 2011-2020 Strategic Plan for Biodiversity's Aichi Targets) and adopted complementary domestic 2020 Biodiversity Goals and Targets for Canada. Both international and domestic targets (Aichi Target 11 and Canada's Target 1) call for the conservation of 10% of coastal and marine areas by 2020. The designation of new Marine Protected Areas (MPAs) in Canadian waters has been identified as one part of the national strategy to meet these targets. Under the *Oceans Act*, Fisheries and Oceans Canada (DFO) is authorized to provide protection to areas of the oceans and coasts through the establishment of MPAs, where the identification of an Area of Interest (AOI) is the first step in this process. A regional site selection process is underway and the Southampton Island Ecologically and Biologically Significant Area (EBSA) has been proposed as an Area of Interest (AOI) for potential MPA development and recommendation for designation. The Southampton Island EBSA was first identified as an EBSA in 2011 (DFO 2011). The main features of this EBSA include:

- Summer and winter use by the Hudson Bay-Davis Strait population of Atlantic Walrus;
- Important spring and fall migration routes for Beluga, Narwhal and Eastern Canada-West Greenland Bowhead;
- Southampton, Coats and Mansel islands are considered important Polar Bear denning areas and summer refuge habitats for the Foxe Basin Polar Bear subpopulation;
- Important nesting areas for seabirds which feed on aggregations of marine fish in the area (e.g., Capelin, Arctic Cod); and
- Largest single colony of Common Eider in Nunavut occurs in East Bay.
- Further to this, DFO's Oceans Program has been engaging communities and Inuit organizations regarding support for the proposed AOI.

Once an area is selected as an AOI, detailed information on the key biophysical and ecological features of the area is required, especially as it pertains to potential conservation priorities (i.e., features of the EBSA) and their linkages to other key ecosystem components and processes. A review of key biophysical and ecological information within the Southampton Island EBSA may further inform ecological significance of the area and highlight conservation priorities based on the results of the review. Furthermore, the biophysical and ecological overview will assist in formulating conservation objectives, delineating a future MPA boundary (and zones if required), and completing an ecological risk analysis to inform the development of the regulatory approach for the proposed MPA. The information contained within will also inform subsequent advice on monitoring protocols and strategies, identification of information gaps requiring further research, and the development of a management plan for the area.

DFO's Oceans Program has requested that DFO Science prepare and conduct a review of the Ecosystem Overview Report for Southampton Island EBSA, identify science based conservation priorities and provide advice on the formulation of conservation objectives for this area.

Objectives

The intent of the meeting is to complete the following objectives:

- Conduct a peer-review of the Southampton Island EBSA Ecosystem Overview Report based on current information and scientific research in the area;
- Identify, describe and map, where possible, key biophysical and ecological features within the Southampton Island EBSA (i.e., conservation priorities) and, where applicable, recommend wording for potential conservation objectives for each, that considers the desired and measureable state of the conservation priority;
- Identify known and potential activities and stressors with the potential to affect the key biophysical and ecological features within the study area; and,
- Identify any key uncertainties and knowledge gaps as they pertain to the current understanding of conservation priorities within the study area, and where possible, recommend measures to address these gaps.

Expected Publications

- Science Advisory Report
- Proceedings
- Research Document

Expected Participation

- Fisheries and Oceans Canada (DFO) (Science and Ecosystems and Fisheries Management sectors)
- Government of Nunavut
- Nunavut Wildlife Management Board
- Kivalliq Wildlife Board
- Kivalliq Inuit Association
- Local experts from the communities of Coral Harbour, Chesterfield Inlet and Naujaat
- Environment and Climate Change Canada
- Academia
- Other invited experts

References

DFO. 2011. Identification of Ecologically and Biologically Significant Areas (EBSA) in the Canadian Arctic. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2011/055.

APPENDIX 2: LIST OF MEETING PARTICIPANTS

Participant	Organization
Jason Stow	DFO Science, Central and Arctic Region (Co-chair)
Joclyn Paulic	DFO Science, Central and Arctic Region (Co-chair)
Dave Yurkowski	DFO Science, Central and Arctic Region
C.J. Mundy	University of Manitoba
Jens Ehn	University of Manitoba
ZouZou Kuzyk	University of Manitoba
Ross Tallman	DFO Science, Central and Arctic Region
Jim Reist	DFO Science, Central and Arctic Region
Steve Ferguson	DFO Science, Central and Arctic Region
Monika Pućko,	DFO Science, Central and Arctic Region
Cory Matthews	DFO Science, Central and Arctic Region
Paula Smith	DFO Resource Management, Central and Arctic Region
Marie Pierrejean	Laval University
Paul Pudlat	Coral Harbour Hunters and Trappers Organization
Mary Rose	Interpreter-Rankin Inlet
Charlotte Sharkey	DFO Oceans Management, Central and Arctic Region
Karen Dunmall	DFO Science, Central and Arctic Region (Rapporteur)
Tracey Loewen	DFO Science, Central and Arctic Region
Kyle Elliott	McGill University
Evan Richardson (Day 2)	Environment and Climate Change Canada (ECCC)
Teresa Tufts	Government of Nunavut
Bert Dean	Nunavut Tunngavik Inc.
Erinn Ipsen (Day 1)	DFO Science, Central and Arctic Region

APPENDIX 3: MEETING AGENDA

Biophysical and Ecological Overview of the Southampton Island Area of Interest (AOI)

December 5–6, 2018
Large Seminar Room, Freshwater Institute, Winnipeg, MB
Chairs: Jason Stow and Joclyn Paulic

Day 1 – Wednesday, December 5, 2018

9:00 a.m.	Welcome and Introductions (Chair) - Participant Introduction - Overview of CSAS peer review process - Terms of Reference and Meeting Objectives - Review Agenda
9:30 a.m.	Eastern Arctic Marine Protected Area Process (C. Sharkey)
10:00 a.m.	Overview of Science Contribution to MPA Process (T. Loewen)
10:15 a.m.	**HEALTH BREAK**
10:30 a.m.	Working Paper Presentation – Overview Report (T. Loewen)
11:00 a.m.	Working Paper Presentation – Ecological Significance (T. Loewen)
11:45 a.m.	**Lunch (not provided)**
1:00 p.m.	Identify known and potential anthropogenic activities and stressors - Current observations and potential impacts discussion
1:30 p.m.	Discussion
2:30 p.m.	**HEALTH BREAK**
2:45 p.m.	Draft wording for Conservation objectives (Example conservation objectives[1])
4:00 p.m.	Day 1 Adjourns

Day 2 – Thursday, December 6, 2018

9:00 a.m.	Working Meeting to Summarize Day 1
9:45 a.m.	**HEALTH BREAK**
10:00 a.m.	Recap of Day 1 (Chairs)

[1] DFO. 2011. Identification of Conservation Objectives and Boundary Delineation for the Darnley Bay Area of Interest (AOI). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2011/009.

10:15 a.m. Identification of knowledge gaps, sources of uncertainty

11:45 a.m. LUNCH (NOT PROVIDED)

1:00 p.m. Draft Science Advisory Report (Chairs)

2:45 p.m. HEALTH BREAK

3:00 p.m. Finalize Summary Bullets (Chairs)

4:00 p.m. Meeting Complete – THANK YOU!