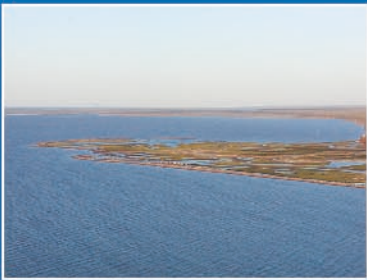
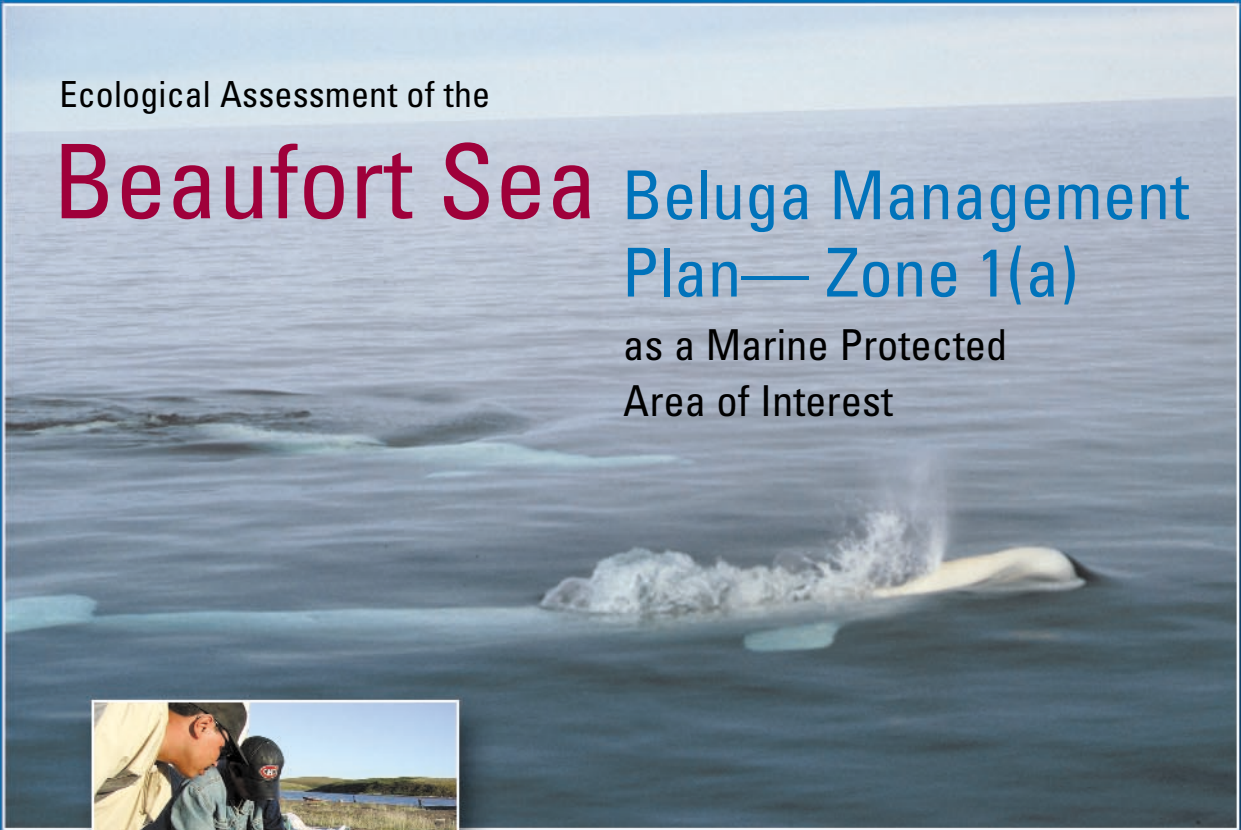


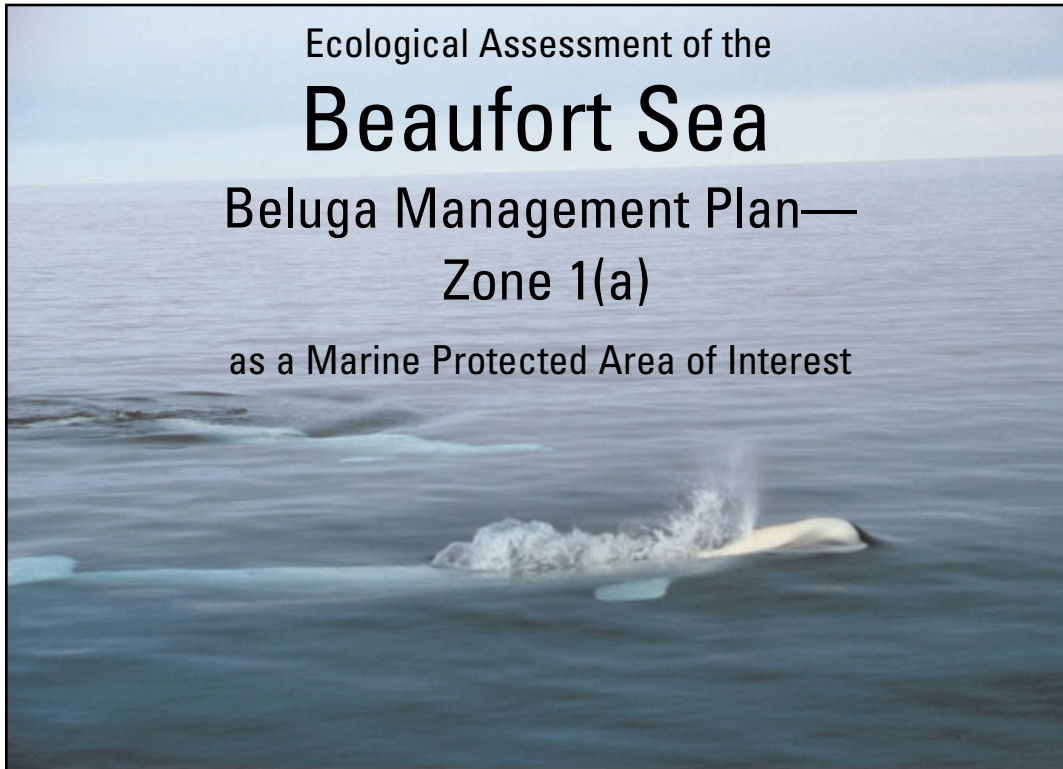
Ecological Assessment of the

Beaufort Sea Beluga Management Plan— Zone 1(a)

as a Marine Protected
Area of Interest



BEAUFORT SEA INTEGRATED MANAGEMENT
PLANNING INITIATIVE WORKING GROUP



Ecological Assessment of the
Beaufort Sea
Beluga Management Plan—
Zone 1(a)
as a Marine Protected Area of Interest

Prepared for the
BEAUFORT SEA INTEGRATED MANAGEMENT PLANNING
INITIATIVE (BSIMPI) WORKING GROUP, July 2003, by

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COVER PHOTO CREDITS—*Top Centre*: Beluga and Calf. (Based on photo from Department of Fisheries archives). The following are based on photos by Pete Cott, Department of Fisheries, 2002. *Left Top*: Fish sampling conducted by Frank Dillon and Forrest Day. *Left Middle*: Starry Flounder, *Left Bottom*: Shingle Point

Graphic Design by Jill Hart

The land, the animals, the waters, the whales, and the fish were very important to our ancestors and still are to us. Even during negotiations for our land claim-settlement, our elders told us that the land and waters had looked after them for centuries and would look after us for many more if we looked after our environment.

Billy Day (2002:1)

Inuvialuit elder and member of the Beaufort Sea Integrated Management Planning Initiative Working Group



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List of Acronyms

AICPP	Aklavik Inuvialuit Community Conservation Plan
AMAP	Arctic Monitoring and Assessment Programme
AOI	Area Of Interest
BSBMP	Beaufort Sea Beluga Management Plan
BSIMPI	Beaufort Sea Integrated Management Planning Initiative
CAPP	Canadian Association of Petroleum Producers
CC	Community Corporation
CCP	Community Conservation Plan
Cd	Cadmium
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CWS	Canadian Wildlife Service
DFO	Department of Fisheries and Oceans
DIAND	Department of Indian Affairs and Northern Development
EC	Environment Canada
EMAN	Ecological Monitoring and Assessment Network
FJMC	Fisheries Joint Management Committee
GRRB	Gwich'in Renewable Resources Board
GSC	Geological Survey of Canada
Hg	Mercury
HTC	Hunters and Trappers Committee
IFA	Inuvialuit Final Agreement
IFMP	Integrated Fisheries Management Plan
IFMPC	Integrated Fisheries Management Plan for Coney
ICRC	Inuvialuit Cultural Resource Centre
IGC	Inuvialuit Game Council
IICPP	Inuvik Inuvialuit Community Conservation Plan
IRC	Inuvialuit Regional Corporation
IRRCMP	Inuvialuit Renewable Resource Conservation and Management Plan
ISR	Inuvialuit Settlement Region
MPA	Marine Protected Area
NRC	Natural Resources Canada
NWA	National Wildlife Areas
NWT	Northwest Territories
POP	Persistent Organic Pollutants
SDL	Significant Discovery Licences
SMC	Senior Management Committee
TBT	Tributyltin
TCPP	Tuktoyaktuk Community Conservation Plan
WG	Working Group
WMAC	Wildlife Management Advisory Council

Preamble

This introductory piece provides background for the three assessment reports prepared to assist in the evaluation of establishing a Marine Protected Area (MPA) in the Mackenzie Delta-Beaufort Sea Region. It is comprised of six sections as follows:

- 1. *The Regional Context:*** focuses on the estuarine environment and the beluga which summer in the area.
- 2. *Management Planning Processes:*** reviews economic development interests and their relationship to beluga management interests in the context of *The Western Arctic Claim*, *The Inuvialuit Final Agreement (IFA)* and *The Beaufort Sea Beluga Management Plan (BSBMP)*.
- 3. *Integrated Management:*** discusses the relationship of economic development interests to beluga management interests from the perspective of management options available under the *Oceans Act*.
- 4. *Economic Development and Beluga Management:*** summarizes beluga management in the context of hydrocarbon exploration interests.
- 5. *Evaluating the BSBMP Zone 1(a) Area as a Potential MPA:*** reviews legislative criteria used to evaluate proposed MPAs, the purpose of the three assessment reports and how they will be used to evaluate the proposed area against these criteria.
- 6. *Outcome***



Beluga whales. (Lois Harwood/Department of Fisheries)



1. THE REGIONAL CONTEXT

The Inuvialuit Settlement Region (ISR) lies in the Canadian Western Arctic region. Created with the signing of the Inuvialuit Final Agreement in 1984, the ISR covers 906,430 km². It includes four distinct geographic regions: the Beaufort Sea, the Mackenzie River Delta, the Yukon North Slope, and the Arctic islands. The Mackenzie Delta includes lakes, wetlands and river channels covering about 35,000 km². The population of the region is about 10,000 people.

The marine environment of the ISR includes a permanently ice-covered region, a seasonally ice-covered region, and a coastal area influenced by the mixing of saltwater and freshwater from the Mackenzie River. The continental shelf of the Beaufort Sea is quite narrow, nowhere exceeding 150 km offshore. The average depth on the shelf is less than 65 m, and ranges from around 10 m in the Mackenzie Delta to 600 m around Amundsen Gulf. The shelf seas and ice edges provide food for top predators. Since time immemorial Inuvialuit have relied and thrived on the rich and abundant variety of marine resources. The Beaufort Sea marine region has a large population of polar bear, ringed and bearded seals, the largest summer feeding population of bowhead whales, and perhaps the world's largest summering stock of beluga whales.

The beluga that move into ISR waters every summer form part of a larger population that winters in the Bering and/or the East Siberian Sea. Each spring the population separates into several stocks that migrate to summering areas ranging from Bristol Bay on the Alaskan West Coast to the eastern Beaufort Sea. The beluga move widely throughout the Beaufort Sea, ranging into Amundsen Gulf and into Viscount Melville Sound far to the north. Scientists have observed that individual beluga return to the Mackenzie Delta estuary in successive years. Their unique tolerance for freshwater is thought to indicate an important physiological dependence on particular sites. Both hunters and scientists have observed beluga rubbing themselves on sandbars to remove dead skin. The warmer waters of the estuary accelerate the rate at which the moult occurs. Some hunters have observed beluga feeding and calving in these areas.

2. MANAGEMENT PLANNING PROCESSES

The Mackenzie Delta-Beaufort Sea region is rich in non-renewable hydrocarbon resources. During the 1960s and 1970s the Inuvialuit sought to find ways to balance industry and conservation interests. In 1977, the Report of the Mackenzie Valley Pipeline Commission recommended that comprehensive land use planning be undertaken to address resource use conflicts identified during the Commission's hearings. The Commission also recommended that part of the area of West Mackenzie Bay should become a beluga sanctuary.

In 1983 the Task Force on Northern Conservation was established to provide advice to the Department of Indian Affairs and Northern Development (DIAND) on the development and implementation of a comprehensive conservation policy for northern Canada. One year later it tabled recommendations emphasizing



Preamble

the need for marine conservation management and planning initiatives, and the need for a comprehensive network of land and/or water areas subject to special protection, taking into account local knowledge and uses of the area. The IFA signed in the following year provided legislative support to those recommendations.

The three goals of the IFA are:

- a) to preserve Inuvialuit cultural identity and values within a changing northern society;
- b) to enable Inuvialuit to be equal and meaningful participants in the northern and national economy and society; and
- c) to protect and preserve the Arctic wildlife, environment and biological productivity.

The Inuvialuit Regional Corporation (IRC) was given responsibility for the management of the compensation and benefits received by the Inuvialuit pursuant to this Agreement. The Inuvialuit Game Council (IGC) was given responsibility to represent the collective Inuvialuit interest in wildlife. The Fisheries Joint Management Committee (FJMC) was given the responsibility to assist Canada and the Inuvialuit in administering the rights and obligations relating to fisheries under this Agreement and to assist the Minister of Fisheries and Oceans of Canada in carrying out his responsibilities for the management of fisheries. The Wildlife Management Advisory Council (NWT) with representation from Canada, the Government of the Northwest Territories and the Inuvialuit, was created to give advice to the appropriate minister on request, on all matters relating to wildlife policy and the management, regulation and administration of wildlife habitat and harvesting in the Western Arctic Region.

In 1988, the Inuvialuit Renewable Resource Conservation and Management Plan (IRRRCMP) was prepared by the WMAC (NWT) and the FJMC. This plan lays out a long-term strategy for the conservation and management of fish and wildlife in the ISR. At this time, efforts initiated earlier by the Department of Fisheries and Oceans (DFO) toward the development of a beluga management plan were still underway. When the BSBMP was completed three years later, responsibility for the Plan was transferred to the FJMC. Parties to the Plan include the FJMC, the six community Hunters and Trappers Committees (HTCs) and DFO. Consistent with the themes and goals of the IRRRCMP, the purpose of this plan is to ensure the responsible and effective, long-term management of the beluga resource by the Inuvialuit and DFO.

In order to accommodate the needs of both the industrial and the subsistence economies, authors of the plan classified the estuarine and marine waters into four management zones. The first is a protected area zone [Zones 1(a) and (b)], which places strict limits on the types of activities allowed. Zones two and three allow for development that will not adversely affect the beluga or their habitat. Zone four is used to classify international waters and beluga management issues here are an international responsibility.



3. INTEGRATED MANAGEMENT

Management issues addressed under the BSBMP include the following: oil, gas and mining exploration, production and related development including dredging, drilling, seismic and sounding surveys, island/camp maintenance, vessel movements, helicopter and fixed-wing flights, and ice-breaking, shipping routes, port development, possible future commercial fisheries development, contaminant levels in marine waters and mammals, a developing tourism industry, a myriad of regulators, transboundary issues, subsistence hunting practices and traditional values closely related to the beluga harvest, and climate change.

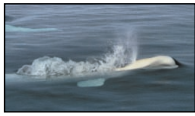
With the passage of the *Oceans Act* in 1997, Canada became one of the first countries in the world to make a legislative commitment to a comprehensive approach for the protection and development of oceans and coastal waters. To reinforce this approach, the *Oceans Act* calls for wide application of the precautionary approach to the conservation, management and exploitation of marine resources. It also recognizes the significant opportunities offered by the oceans and their resources for economic diversification and the generation of wealth for the benefit of all Canadians, particularly those in coastal communities. To achieve these commitments, the *Act* calls on the Minister of Fisheries and Oceans to lead and facilitate the development of plans for integrated management.

The concept of integrated management as it is being applied across Canada involves the comprehensive planning and management of human activities to minimize conflict among users. It is a collaborative approach that cannot be forced on anyone. It is a flexible and transparent planning process that respects existing divisions of constitutional and departmental authority, and does not abrogate or derogate from any existing Aboriginal or treaty rights.

In 1999 the IRC, the IGC, the FJMC, DFO, and industry represented by the Canadian Association of Petroleum Producers (CAPP) agreed to collaborate on the development of integrated management planning for marine and coastal areas in the ISR. This agreement is called the Beaufort Sea Integrated Management Planning Initiative (BSIMPI). The BSIMPI Senior Management Committee (SMC) is composed of the interest groups which formed the Initiative. This Committee seeks to guide the development of a management planning process for ocean-related activities in the Beaufort Sea. One of its first actions was to form a Working Group (WG) to implement effective collaboration on ocean management efforts. Representation on the WG reflects that of the SMC, with the addition of a member from DIAND.

4. ECONOMIC DEVELOPMENT AND BELUGA MANAGEMENT

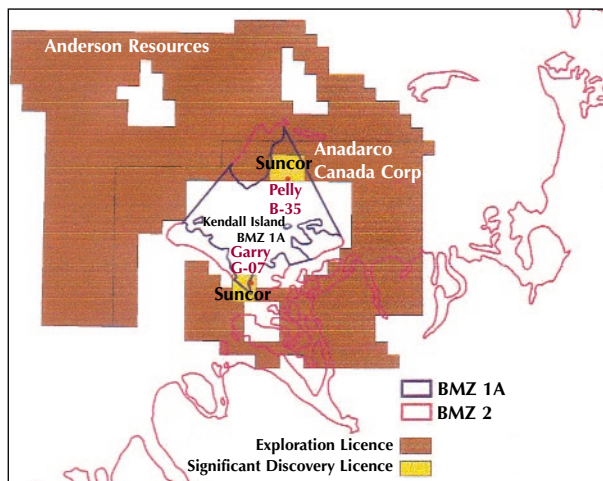
There is significant potential for offshore oil and gas production in the Beaufort Sea—Mackenzie Delta region. There are currently eleven Exploration Licences, one Production Licence, and thirty-two Significant Discovery Licences in the ISR offshore area. The area covered by these licences is 10,096 km².



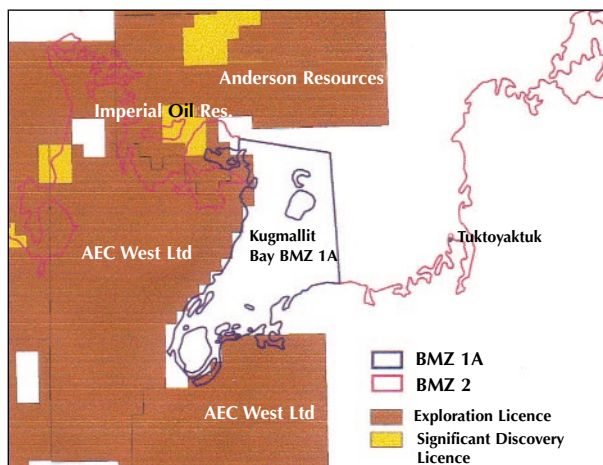
Preamble

The extent of the three areas in the Zone 1(a) being considered for a Marine Protected Area is as follows: Mackenzie Bay at 1,160 km²; the Kendall Island area at 193 km²; and Kugmallit Bay at 363 km². The total area of the three is 1,716 km². They are identical with the areas zoned as 1(a) in the BSBMP.

Exploration and Significant Discovery Licences (SDLs) overlap with the Kendall Island and Kugmallit Bay Zone 1(a) areas. In the Kendall Island area, three companies are affected. A small portion of Anderson Resources 903 km² Exploration Licence (issued 2000, expiry 2009) falls within the Zone 1(a) area, as does a larger portion of Anadarko Canada Corps 679 km² Exploration Licence (issued 2000, expiry 2009).



Suncor Energy Inc. has two SDLs that fall within the Zone 1(a) area. The two licences represent 29 km² out of a total 47 km² of Suncor's SDLs in the Mackenzie Delta (issued 1998). The licenced area near Pelly Island contains an historic abandoned gas well (Pelly B-35) on an Artificial Island. Another gas well, Garry G-07 also noted as historic, occurs in the second SDL area falling within the Kendall Island Zone 1(a) area.



Oil and gas interests in the Kugmallit Bay Zone 1(a) area are found to overlap along the edge of the zone. For the most part, Exploration Licences held by Anderson Resources (issued 2000, expiry 2009) and AEC West Ltd. (issued 1997, expiry 2006) are affected, however, this may be due to the scale of mapping and the use of grid and section numbers to delineate licence areas. Imperial Oil Resources SDL (issued 1990) also overlaps with the northwest corner of the Kugmallit Bay Zone 1(a) area.¹

Exploration and development of hydrocarbon resources in the Mackenzie Delta—Beaufort Sea will lead to a large increase in ship movement and barge traffic through the region. During periods of intense activity in previous decades it was not uncommon to see an average of 100 vessels of all types in Kugmallit Bay at any given time—including barges, platforms, and supply vessels. Dredging activity will increase. The shorebases that will be built to support offshore activities are known to produce localized impacts on the marine environment. For example, Tuktoyaktuk Harbour and McKinley Bay acted as staging areas for offshore drilling that was carried out in the Beaufort



Sea during the 1970s and 1980s. Studies have shown that some of the highest hydrocarbon concentrations in the Arctic occur in Tuktoyaktuk Harbour and McKinley Bay. These hydrocarbons appear to originate primarily from chronic fuel spills and runoff from work-yards.²

Beluga summering in the Beaufort Sea travel through areas where oil and gas production and transportation activities are proposed for the future. They concentrate in areas where mining (gravel removal), deep water port development, and shipping could affect water regimes, water quality and food availability. Such activities could affect beluga either directly (underwater noise, oil spills) or indirectly (changes in stability or integrity of ice, timing of breakup, chronic hydrocarbon contamination of food species).

Considering the magnitude of possible development scenarios, members of the FJMC and Inuvialuit beneficiaries expressed concern regarding the absence of legally enforceable mechanisms available under the BSBMP. Another management concern is the lack of scientific knowledge that could be used to assess the relative sensitivity of marine mammals and their habitat to disturbance by various activities in the Zone 1(a) areas. A related concern that has been raised pertains to the maze of legislation and regulation which currently governs management decision-making processes in the region. Industry and others have requested simplification of the regulatory process.

It was in this environment of opportunity for major economic development, a very complex regulatory structure, and the desire to protect traditional land values that the SMC was formed. SMC members acknowledged during their first meetings that addressing both the conservation and development interests in the BSBMP Zone 1(a) areas was a high priority. The question they posed was whether the three Zone 1(a) areas should be protected under a single regulation through the establishment of a Marine Protected Area.

Conducting an evaluation of the merits of establishing an MPA in the Zone 1(a) areas, and providing recommendations to the SMC was the first major task assigned to the Working Group. It began its work early in 2001.

5. EVALUATING THE BSBMP ZONE 1(A) AREAS AS A POTENTIAL MPA

Section 35 (1) of the *Oceans Act* defines an MPA as an area of the sea...(that) has been designated for special protection for one or more of the following reasons:

- a) the conservation and protection of commercial and non-commercial fishery resources, including marine mammals, and their habitats;
- b) the conservation and protection of endangered or threatened marine species, and their habitats;
- c) the conservation and protection of unique habitats;
- d) the conservation and protection of marine areas of high biodiversity or biological productivity; and,
- e) the conservation and protection of any other marine resource or habitat as is necessary to fulfill the mandate of the Minister of Fisheries and Oceans.



Preamble

As specified in the *National Framework for Establishing and Managing Marine Protected Areas*, the BSIMPI Working Group initiated assessments of the ecological, social, and cultural environment of the proposed MPA, as well as of the technical merits of the proposal. The purpose of these assessments is to provide information needed to evaluate the proposed MPA against the stated criteria for an MPA. They are described below.

1. The Ecological Assessment assesses:

- whether the proposed MPA complies with the reasons for MPAs stated in the *Oceans Act*; and,
- the ecological merits of the proposal and their relative significance.

2. The Social and Economic Assessment addresses:

- how the establishment of an MPA will affect human activities in and around the proposed MPA; and,
- how the social and economic benefits of the MPA can be enhanced or the costs reduced.

3. The Technical Assessment provides information for administrative and management purposes including:

- whether the proposed MPA is feasible from a management and technical perspective;
- a review of appropriate boundaries of the proposed MPA; and,
- whether there is public and stakeholder support.

6. OUTCOME

Draft copies of the three assessment reports were reviewed by the BSIMPI WG in January 2002. All three reports were revised in accordance with the advice received and were subsequently discussed at a joint meeting of the BSIMPI WG and the FJMC in March 2002 in Edmonton. These discussions led to the recommendation to be taken to the SMC that the three Zone 1(a) areas be protected under regulation through the establishment of a Marine Protected Area. The rationale supporting the recommendation was also formulated at this meeting.

Footnotes:

1. The Oil and Gas Rights data were downloaded from http://www.aincinac.gc.ca/oil/act/Lan/dig/index_e.html. Measurements for lease areas in the data were provided as Hectares. However, the projection parameters used to calculate the area were not provided. In order to provide a comparison of the relative areas under consideration, new area measurements were calculated using the Lambert Conformal Conic Projection; Spheroid Clarke 1866; Central Meridian = -135; Reference Latitude = 49; Standard Parallel 1 = 77; Standard Parallel 2 = 49; False Easting = 0; False Northing = 0.

2. AMAP, 1998. AMAP Assessment Report: Arctic Pollution Issues. Arctic Monitoring and Assessment Programme (AMAP), Oslo, Norway. xii+859 pp.

1.0

Introduction



Canada's *Oceans Act* directs that integrated management should be undertaken to ensure the sustainable use and health of marine ecosystems. One aspect of this broad objective is the development of an effective planning process. Such a process will identify social, cultural, environmental and economic values, thus providing a solid basis for the development of management plans. Under the guidance of the Senior Management Committee (SMC) of the Beaufort Sea Integrated Management Planning Initiative (BSIMPI), a Working Group (WG) was formed to implement effective collaboration on Oceans management initiatives.

The first major task assigned to the WG was to evaluate a proposal for the establishment of a pilot Marine Protected Area (MPA) in the Inuvialuit Settlement Region (ISR). The primary objectives of this proposed MPA would be to conserve and protect important subsistence beluga whale (*Delphinapterus leucas*) and anadromous fisheries.

The area selected for consideration as an MPA (Figure 1) was consistent with the areas zoned as Zone 1(a) in the Beaufort Sea Beluga Management Plan (BSBMP). The BSBMP was developed and implemented to ensure sustainable beluga management in a manner reflective of the Inuvialuit Final Agreement (IFA). Of the five zones defined by the BSBMP, Zone 1(a) is the most protected.

The process for evaluating the merits of an area proposed for consideration as an MPA under the *Oceans Act* is outlined in the *National Framework for Establishing and Managing Marine Protected Areas*. Part of the evaluation process includes the completion of three assessments:

- (1) an Ecological Assessment;
- (2) a Socio-economic Assessment; and,
- (3) a Technical Assessment.

According to the *National Framework*, the Ecological Assessment addresses the following questions:

- Does the proposed MPA comply with the reasons for MPAs stated in the *Oceans Act*?
- What are the ecological merits of the proposal?
- How significant are these?



1.0 Introduction

In addition to ecological knowledge, the assessment should include a list of human activities that may need to be controlled, any restoration needs for the area, and the potential for recovery of natural ecosystem functions, if applicable. Accordingly, these topics form the basis of this report.

The report has been organized to reflect the “Checklist for Area of Interest (AOI) Information”, as it pertains to the ecological assessment, contained in Appendix 1 of the *National Framework for Establishing and Managing Marine Protected Areas*. The “checklisted” information presented in this report is organized as follows:

Section 2: provides environmental and ecological information that describes features of the AOI. It identifies special features, and describes biological and ecological attributes, significant species present and the ‘environmental status’ of the AOI. Much of the information presented in this section is extracted and condensed from North/South Consultants Inc. and Inuvialuit Cultural Resource Centre (2003) and from additional material presented in the Appendix. Inuvialuit traditional knowledge has been integrated into the above information from the few documented sources that are available.

Section 3: identifies the ecological merits and significance of the AOI and provides a rationale for designation as an MPA under the *Oceans Act*.

Section 4: describes how the AOI meets the purposes for MPA designation under the *Oceans Act*.

Section 5: describes how the AOI meets the purposes of other marine protection area legislation.

Section 6: identifies alternatives to designation as an MPA under the *Oceans Act*, and provides a summary table for comparison of the alternative mechanisms.

Section 7: describes existing management initiatives and suggests possible considerations in regard to MPA management objectives, monitoring, and research.

Finally, **Appendix 1** contains more detailed information that was compiled to complete the ecological assessment task using “draft criteria for MPA assessment” provided by DFO.

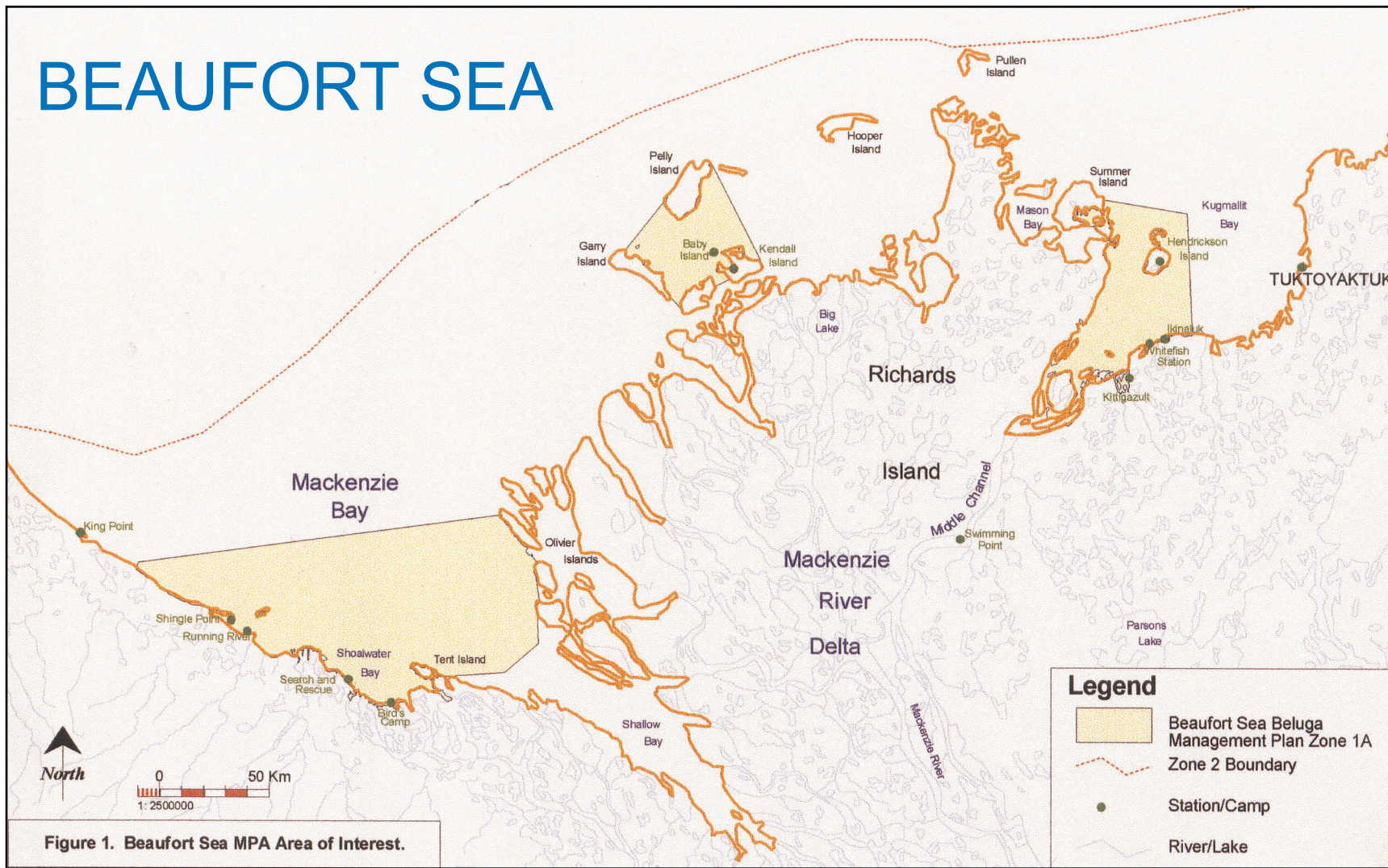
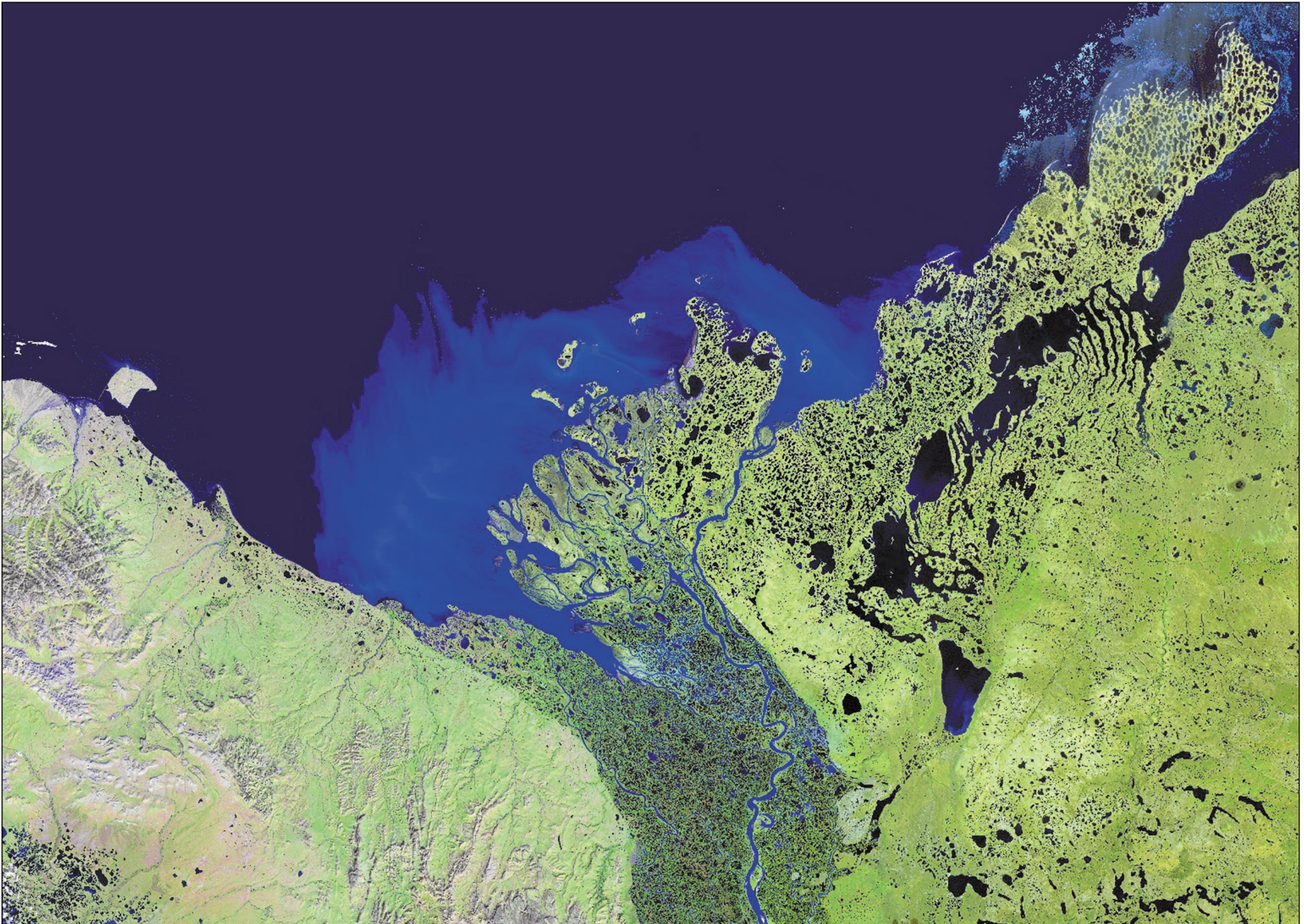


Figure 1. The proposed MPA for the southeastern Beaufort Sea.



Landsat image of the Mackenzie Delta and Estuary. This mosaic was created by Environment Canada—Canadian Wildlife Service, with cooperation of Fisheries and Oceans Canada, Parks Canada and the Western Arctic Handbook Project. Data source: Landsat TM 5 and Landsat 7. Date of Production January 2001

2.0

Environmental and Ecological Information



2.1 PHYSICAL AND CHEMICAL SETTING

The AOI for consideration as an MPA coincides with BSBMP Zone 1(a) and lies within the nearshore region of the Mackenzie River estuary. The Mackenzie River freshwater plume influences the distribution of biota, including phytoplankton, fish, and higher trophic level species. In particular, the plume is significant for production, as it provides a rich supply of nutrients in an otherwise relatively nutrient-poor ecosystem (the Mackenzie River is the largest North American river that flows into the Arctic and is the most significant source of nutrients in the southern Beaufort Sea). It plays a major role in defining the physical and chemical conditions of the coastal environment, through its substantive supply of freshwater, sediments, carbon, nutrients, and heat. The Mackenzie River estuary provides highly significant habitat for coastal waterfowl and seabirds and serves as a migratory corridor for anadromous fishes. Relative to the remaining areas of the Mackenzie Estuary, the AOI is generally more shallow, more turbid, and of a lower salinity. All three areas of the AOI are located at major outflows of the Mackenzie River.

The coastline of the southern Beaufort Sea (including that of the AOI) retreats rapidly, resulting in unstable and dynamic shoreline habitats. Coastal erosion is significant due to its role in supplying sediments to the Beaufort Sea. However, the Mackenzie River contributes the greatest portion of sediments to the Beaufort Sea. Re-suspension of sediments as a result of wind and/or storms in late summer (i.e., during the open water season) in the shallow environment of the AOI and wind-driven coastal upwelling are important mechanisms of nutrient replenishment.

The chemical composition of surface water and the ice regime in the Estuary is cyclic, changing seasonally as a function of temperature, solar radiation, ice formation and melting, variations in water circulation patterns, and discharge from the Mackenzie River.

All of these characteristics are fundamental to the creation and maintenance of critical habitat and ecological processes in the area as a whole, including the AOI.



2.2 SPECIAL FEATURES

The three areas comprising the AOI (Shallow Bay to the west [or 'west Mackenzie Bay'], the central Kendall Island area, and Hendrickson Island/western Kugmallit Bay area to the east) contain a number of unique and/or otherwise critical features which are significant to biota and/or to the physical, chemical, and/or biological processes in the AOI or adjacent areas. However, it is noted that with the possible exceptions of beluga and coastal waterfowl and seabird habitat, the AOI is not unique in itself. Rather, the AOI comprises a significant portion of the most nearshore portion of the Mackenzie River estuary, which itself is a unique environment both within the Beaufort Sea and the Arctic as a whole.

Variability and Ecosystem Processes

The AOI is in a region exposed to relatively wide fluctuations (i.e., variability) in the physical and chemical environments, which subsequently results in high seasonal, and oftentimes, annual variability in species distribution, abundance, and composition, communities, and ecosystem processes (e.g., production processes).

Variability in the physical and chemical environments is due to seasonal fluctuations in light and temperature, both of which may directly affect species distribution and abundance. Seasonal variations in light and temperature may also dramatically affect species composition, abundance, and even presence in the AOI. Wind is also highly significant as an erosion-driver and in the dispersal and transport of suspended sediments, due to its influence on mixing and dispersion of the Mackenzie Plume, and in influencing the location of ice. The most important factor that influences the chemical and physical conditions in the AOI is the Mackenzie River. Discharge and concentrations of nutrients, carbon, suspended mineral sediments, contaminants, and water temperature in the Mackenzie River play a vital role in defining conditions in the AOI.

Parameters and conditions in the physico-chemical environment that fluctuate substantively in the AOI include:

- discharge of the Mackenzie River;
- nutrient concentrations due to ice melt, upwellings, remineralization, and areas of rapid nutrient depletion;
- salinity (i.e., ice brine pump, vertical stratification, wind, Mackenzie River discharge);
- ice conditions (thickness, freeze-up and break-up times, location, leads, ice edges);
- temperature;
- light; and,
- wind.

Due to the variance in the physico-chemical environment, biota and ecosystem processes also vary substantively in the AOI. Examples of high variability that are known to occur with respect to biota include: benthic communities;



2.0 Environmental and Ecological Information

abundance of ringed and bearded seal; energy transfer pathways, dominance of various food chain components; and, primary production.

Freshwater Feature

The AOI is within an area that, during the period of open water, remains a largely freshwater environment. Depending on wind direction, speed and duration, coastal upwellings can occur which may disrupt the continuity of the freshwater band that develops along the coast. The existence and extent of the freshwater band is a major factor influencing the extent of coastal movements of anadromous fish species with low salinity tolerance.

During the period of landfast ice cover, the estuary (including the AOI) has been described as a sub-ice (or sub-sea) lake; the 'lake' is formed in winter when freshwater from the Mackenzie River pools under land fast ice. This area provides over-wintering habitat for many anadromous fish.

2.3 BIODIVERSITY, PRODUCTIVITY, AND BIOMASS

The AOI supports a variety of species including a number of marine mammals (including polar bear, *Ursus maritimus*), fishes, coastal waterfowl, seabirds, invertebrates, and algae. Epontic (ice-algae) communities also develop annually within the AOI, but by comparison with areas further offshore, are sparse.

Biodiversity

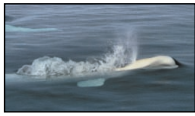
Benthic invertebrate and zooplankton diversity is low in the AOI. Generally, fewer than 20 invertebrate species might be found in bottom samples from the shallow-water environment that is typical of the AOI. Ice scour, low and variable salinity, and sediment deposition and re-suspension are the main factors contributing to the low species diversity in the shallow-water zone. By comparison, samples from further offshore might be expected to yield from 20 to 80 species. The embayment on the eastern shore of Richards Island that is partially contained within the Kugmallit Bay portion of the AOI supports a higher diversity of benthic invertebrate taxa.

Fewer than 10 of the more than 50 fish species present in the coastal regions of the southeastern Beaufort Sea are commonly present in the AOI. Only species tolerant of low-salinity water (freshwater, anadromous, and euryhaline marine species) are generally present. Periodic incursions of marine species typically occur as a result of coastal upwellings that may occur when winds originate from the south and east.

Conversely, the AOI supports a large number and high diversity of coastal waterfowl and seabirds. Over 130 bird species have been identified in the Mackenzie Delta (MDBSRLUPC 1991).

Herring and Ciscoes. (Pete Cott, Department of Fisheries, 2002)





Productivity

In general, nearshore production in the southeastern Beaufort Sea is greater relative to more distant offshore locations. However, the AOI is characterized by low biological productivity due to the light-limiting effects of the turbid Mackenzie River that inhibits primary production. The precise location of the Mackenzie River plume will determine the distribution of primary productivity (i.e., productivity is generally higher at the edge of the plume).

Biomass

Despite low rates of primary production in the very nearshore areas, the AOI (or its outer periphery) may support patches of relatively high abundances of zooplankton, which can occur at the estuary 'front'. The location of the 'front' depends on prevailing wind speed and direction and the consequent interaction between warmer freshwater and the colder marine water. The zooplankton aggregations that result (notably *Limnocalanus macrurus*) provide energy to bowhead whale and plankton-feeding fish species.

Key Indicator Species of Productivity and Biomass

Key indicator species of productivity and biomass that are represented in the AOI include the copepod *Limnocalanus macrurus* and aggregations of bowhead, beluga, ringed seal, coastal waterfowl and seabirds, and anadromous fish.

2.4 SIGNIFICANT SPECIES PRESENT, THEIR STATUS, AND ECOLOGICAL REQUIREMENTS

The AOI supports a number of species that are ecologically and/or socially significant including a number of marine mammals such as beluga whale, bowhead whale (*Balaena mysticetus*), ringed seal (*Phoca hispida*), polar bear and bearded seal (*Erignathus barbatus*), fish, and seabirds and coastal waterfowl.

2.4.1 Beluga

The eastern Beaufort Sea beluga stock, the protection of which is one of the primary objectives of designation of MPA status, is believed to be stable. The AOI includes three beluga concentration areas in the southeastern Beaufort Sea that are important for socializing, moulting, and for energetics (i.e., thermal advantage). It is reported by Inuvialuit hunters that beluga feed in the AOI and they are also reported to feed in adjacent offshore areas ('intermittent-use areas'). Inuvialuit also report that beluga calve in the Estuary. Specifically, beluga concentrate in the AOI during the July/August period. The three areas of the AOI tend to be warmer, more turbid, less saline, and shallower than the rest of the Estuary.

The AOI is presumably of considerable importance to beluga because they return to these areas each summer despite significant hunting pressures. The eastern Beaufort Sea beluga stock is one of the largest in Canada and is not considered endangered or threatened.



2.4.2 Bowhead Whale

The western Arctic population of bowhead whale, which comprises more than 90% of the world's population, is considered endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (COSEWIC 2001). Bowhead feed along the periphery of the AOI and one of the main feeding areas for this stock is located along the Yukon coast from Kay Point to Shingle Point. Precise locations of feeding areas are dependent upon the distribution of zooplankton. Because the AOI is generally shallow, bowhead do not extensively inhabit the area.

2.4.3 Polar Bear

The AOI provides occasional habitat for the southern Beaufort Sea polar bear population, which inhabit the mainland coast from Baillie Island into Alaska. Polar bear mate on the ice and make limited use of maternity dens on small islands on the outer periphery of Mackenzie Delta. As the AOI also provides marginal ringed seal maternity lair habitat (much of the AOI is too shallow to provide seal lair habitat), it may also play a role in providing food for polar bear.

Polar bear are listed as a species of special concern by COSEWIC (COSEWIC 2001). However, the AOI does not provide unique habitat for this species and the estuary and coastal region as a whole supports polar bear feeding, over-wintering, and denning.



Polar bears. (Photographer unknown/Resources Wildlife and Economic Development/GNWT)

2.4.4 Fish

A number of important subsistence fish species inhabit the AOI. Fish species' use of the AOI is dependent on the season.



2.0 Environmental and Ecological Information

Open Water Season

The AOI provides feeding and coastal migratory habitat for young-of-the-year and juvenile broad whitefish (*Coregonus nasus*), lake whitefish (*Coregonus clupeaformis*), Arctic cisco (*Coregonus autumnalis*), least cisco (*Coregonus sardinella*), and coney (inconnu) (*Stenodus leucichthys*). Adults of these species are generally not present during the summer months. By this time most adults have moved into freshwater where they will spawn in the fall.

Pacific herring (*Clupea harengus pallasii*) occasionally occur in the shallow turbid waters of the AOI, but, within the AOI, are more likely to be found in the Richards Island coastal embayment, part of which is within the Kugmallit Bay portion of the AOI.

Yukon coastal waters of the Shallow Bay portion of the AOI support the only known populations of the northern form of anadromous Dolly Varden (*Salvelinus malma malma*). Dolly Varden use Niakunak and Shallow bays as a summer feeding habitat.

Ice-Cover Season

Pacific herring are likely to overwinter and spawn in the Richards Island coastal embayment, part of which is within the Kugmallit Bay portion of the AOI.

Portions of the AOI provide critical over-wintering habitat for lake and broad whitefish, least and Arctic cisco, and inconnu. The over-wintering capacity of the AOI in general is not well documented, but Kugmallit Bay is a known (and likely important) site.

2.4.5 Coastal Waterfowl and Seabirds

The AOI provides moulting, brooding, brood rearing, feeding, and staging habitat, and serves as a migration route for numerous coastal waterfowl and seabirds. The central portion of the AOI is adjacent to the Kendall Island Migratory Bird Sanctuary, established in 1961 to protect staging and breeding grounds for a number of water birds, particularly the Lesser Snow Goose (*Chen caerulescens caerulescens*). This sanctuary is used by more than 100 species of birds.

In addition, several species of birds known to use the AOI are endangered (Eskimo curlew (*Numenius borealis*)), of special concern (ivory gull (*Pagophila eburnea*)), or threatened (Ross' Gull (*Rhodostethia rosea*)).

The ivory gull, which visits the AOI, occurring most often near ice-edges, was listed as a species of special concern by COSEWIC in 1992 (COSEWIC 2001).

The Eskimo curlew, which may also be present (i.e., Kendall Island Bird Sanctuary) in the AOI, was listed as endangered by COSEWIC in 2000 (COSEWIC 2001) (first listed as endangered by COSEWIC in 1978, Gratto-Trevor 2001). The Kendall Island Bird Sanctuary is also believed to contain 'probable breeding habitat', although no confirmed nests have been found in more than 110 years (CWS 2001). There has recently been at least one



2.0 Environmental and Ecological Information

unconfirmed sighting of this species in the Kendall Island Bird Sanctuary (1985) (NPWRC 2002). Current population estimates range from 23 to 100 birds and it is believed that Eskimo curlews may persist in very small numbers (Gratto-Trevor 2001).

Ross' Gull, considered to be 'threatened' by COSEWIC as of 2001 (COSEWIC 2001), may be an occasional/seasonal visitor.

2.5 ENVIRONMENTAL STATUS AND KNOWN STRESSORS OR THREATS

In general, the AOI is not degraded. However, the southern Beaufort Sea, in general, is subject to a number of anthropogenic stressors and pressures most notably:

- Harvesting;
- Oil and gas exploration and development;
- Shipping;
- Tourism;
- Climate change; and,
- Contaminants (point and non-point sources).

Available information indicates that harvesting of the major species does not appear to have degraded the local populations of marine mammals and fish. The eastern Beaufort Sea beluga stock is reportedly stable and is not being overexploited by current levels of harvest. Similarly, stocks of inconnu and Dolly Varden (for which stock status reports are available) are also believed to be stable and sustainable at current harvesting rates.

In general, the Beaufort Sea is facing increasing development pressures due to increased human habitation and access to the north and due to industrial activities. Recent increases in gas exploration and development activity in the region appears indicative of increasing development of gas (and possibly oil) resources in the southeastern Beaufort Sea and Mackenzie Delta. The areas are currently not affected by mining but could potentially be threatened by granular material exploration and extraction. Possible future increase in mining activities in upstream parts of the Mackenzie River valley also pose a potential source of impact.

Increases in air and water-borne traffic that would result from a larger tourism industry and greater requirement for vessel and aircraft support for oil and gas development pose a potential threat to certain wildlife populations that inhabit the AOI (e.g., birds and marine mammals). The severity of the threat would depend upon species' response to this type of disturbance.

Seismic exploration also has potential to disturb or harm marine mammals and fish that inhabit the AOI, depending on the season and energy source used.

Distant anthropogenic activities (i.e., activities far from the AOI and even the southern Beaufort Sea area) may affect the AOI through alterations to the Mackenzie River. The Mackenzie River is considered relatively pristine with



2.0 Environmental and Ecological Information

respect to eutrophication and anthropogenic nutrient loading. Any shifts in nutrient supply (i.e., nutrient enrichment), could alter the productivity and the algal community structure in the southern Beaufort Sea. Furthermore, upstream alterations to the thermal and/or water regime (e.g., hydroelectric development) of the Mackenzie River and/or increased loadings of contaminants could affect the AOI.

Climate change, and to a lesser extent accumulation of contaminants, is likely the most significant threat to the integrity of the Beaufort Sea, including the AOI. There is growing evidence that climate change will probably be most severe at high latitudes, and particularly severe within the Beaufort Sea and Mackenzie Delta. A warmer climate in the Beaufort Sea region is predicted to affect local marine coastal ecosystems through processes such as thawing permafrost, reduction of the extent and thickness of sea ice, rising sea level, increased coastal erosion, and habitat alteration. Stock reductions or collapse may occur if alterations in thermal regimes and/or suspended sediment levels due to erosion affect critical spawning or over-wintering habitats.

Climate change and its effects on the AOI (and the Beaufort Sea in general) can not be managed through designation of an MPA and effects that have occurred to date, as well as those that will continue to develop, can not be remediated.

Research to date has indicated that the Beaufort Sea contains relatively low levels of cadmium (Cd) and some organic contaminants but relatively high levels of other organic contaminants and metals, such as mercury (Hg). Specifically, some organochlorines and Cd are lower in the Beaufort Sea than in other regions of the Canadian Arctic. Conversely, levels of mercury are higher in the Beaufort Sea than in the eastern Arctic, although this disparity is believed to be due to differences in biogeochemistry and geology and not due to higher inputs of mercury in the west. In general, concentrations of Hg in marine mammals, including beluga whale, are higher in the western Arctic, including the Beaufort Sea, while concentrations of Cd are lower than the eastern Arctic. Concentrations of Hg in tissues of beluga whale from the Mackenzie Delta have also exceeded the federal consumption limit of 0.5µg/g for decades.

Local sources of contamination (e.g., tributyltin (TBT) from ships, hydrocarbons from oil/gas development) could be reduced or managed in the AOI through designation of an MPA. However, designation of an MPA would not be adequate to prevent on-going accumulation of contaminants due to non-localized sources; due to long-range atmospheric transport processes, a suite of contaminants are present in Arctic air, snow, water, and biota. Therefore, contaminants are present in all components of the Beaufort Sea, including the AOI. Like effects of climate change, introduction of contaminants from non-point sources, including long-range atmospheric and hydrological (i.e., sea ice and water) transport, cannot be managed through designation of an MPA.

3.0

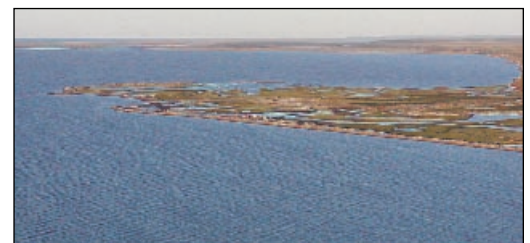
Ecological Merits and Significance of the AOI

At any time during the open water season, the three Zone 1(a) areas (which coincide with the AOI) provide a substantial portion of critical shallow, warmer, fresher water habitat for the Beaufort Sea beluga whale population. Therefore, regulation of activities in the AOI would assist to ensure that a significant non-commercial fishery resource, the beluga whale and their habitat, would be conserved and protected.

The AOI also represents important summer feeding, migratory, and over-wintering habitat for a number of anadromous and euryhaline fish species which rely on the inner, fresher, shallow-water portion of the Mackenzie River estuary. This extensive habitat is a unique estuarine feature of the Canadian arctic coast (the single largest freshwater input to the Canadian portion of the Arctic Ocean).

Useful comparison of the relative merits of each of the three areas of the AOI is confounded by the seasonally and annually variable nature of their physical and chemical characteristics that, in turn, affect their relative importance as critical habitat at any point in time. In general, however, it would appear that the western area is more likely to provide conditions that result in denser aggregations of zooplankton in the open water season, and consequently may provide a more abundant food supply. It is also closer to marine water, and depths in excess of 5 m are present in this area; hence the area may be more used by fish and mammals that also use the marine environment (e.g., bowhead whale). On the other hand, Kugmallit Bay appears to provide more certain over-wintering habitat for anadromous fish species and supports similar beluga concentrations in summer as does the western area. The central portion is the shallowest of the areas, but is also closer to deeper, more brackish waters. Its overwintering potential may be more limited owing to its shallow depth.

Shingle Point, 2002. (Pete Cott/
Department of Fisheries)





3.1 CONSIDERATION OF DESIGNATION OF MPA STATUS UNDER THE *OCEANS ACT*

3.1.1 Certainty of Protection in the Local Context

Designation of MPA status to the AOI under the *Oceans Act* would provide legislated protection from threats and stresses of local origin to beluga whale and fishes and their habitat, while accommodating regional and local interests. Specifically, the designation of the AOI as an MPA would provide a mechanism for limiting and/or managing any activities that currently occur or could potentially occur in the area in the future (i.e., within the boundaries of the AOI). These activities would include oil and gas development, transport industry activities (i.e., shipping, ice roads, air transportation), mining, harvesting, tourism, and any potential local development (e.g., infrastructure such as harbours).

Designation under the *Act* would respect existing objectives and management guidelines, while providing a mechanism for conservation and protection of fisheries resources and their habitats (designated reasons for creation of an MPA). Creation of an MPA under the *Oceans Act* would also provide greater certainty that the objectives associated with the MPA and the BSBMP could be achieved.

3.1.2 Integrity and Adequate Size of the AOI

As indicated in the previous section (3.1.1), the size of the AOI is adequate to manage local activities that may exert stress upon the local ecosystem and biota while they reside in the area (i.e., beluga habitat in the MPA).

However, the designation of MPA status would not be adequate to address potential stress arising from activities outside the MPA boundaries or threats due to non-localized processes and activities. Specifically, designation of an MPA would not provide a mechanism for managing or mitigating effects to the ecosystem, including beluga whale, due to stressors such as climate change and accumulation of contaminants due to long-range, non-point source introduction.

With respect to beluga whale, and other migratory species, it is further recognized that provision of marine protected status in the AOI does not address stressors that are exerted on the population outside of the AOI. Therefore, management of the eastern Beaufort Sea beluga stock, as opposed to management of the congregation areas in the AOI, would be required through inter-jurisdictional and international initiatives to provide protection to this stock in a more comprehensive manner. The same argument applies to other biota that are not permanent residents of the AOI (i.e., migratory species).

Due to the dynamic and complex nature of the Beaufort Sea in general, it is also acknowledged that conditions outside the AOI boundaries may have profound effects on conditions within the AOI. Furthermore, the three areas within the AOI are not discretely bounded and are in fact continuous with the Estuary and Beaufort Sea.

4.0

Meeting Purposes of MPAS Under the *Oceans Act*

Section 35 (1) of the *Oceans Act* states that:

A marine protected area is an area of the sea that forms part of the internal waters of Canada, the territorial sea of Canada or the exclusive economic zone of Canada and has been designated under this section for special protection for one or more of the following reasons:

- (a) the conservation and protection of commercial and non-commercial fishery resources, including marine mammals, and their habitats;*
- (b) the conservation and protection of endangered or threatened marine species, and their habitats;*
- (c) the conservation and protection of unique habitats;*
- (d) the conservation and protection of marine areas of high biodiversity or biological productivity; and,*
- (e) the conservation and protection of any other marine resource or habitat as is necessary to fulfil the mandate of the Minister.*

Designation of the AOI as an MPA, would, to a greater or lesser extent, serve the combined purposes as described in Section 35(1) as follows:

a) Conservation and protection of commercial and non-commercial fishery resources including marine mammals and their habitats

Conservation and protection of beluga whale through regulation of activities in the AOI would assist to ensure that BSBMP objectives are met.

Conservation and protection of anadromous fish species through regulation of activities in the AOI would assist to ensure that Community Conservation Plans (CCPs) and other management initiatives, including fishery management plan, objectives are met (e.g., Integrated Fisheries Management Plan for Coney (IFMPC) in the Gwich'in Settlement Area, Inuvialuit Settlement Region, and Sahtu Settlement Area, NT, 2000–2005).



b) Conservation and protection of endangered or threatened marine species, and their habitats

Several endangered, threatened, and special concern species (COSEWIC 2001) utilize habitat in, or at, the periphery of the AOI. These include: bowhead whale and Eskimo curlew (endangered); Ross's gull (threatened); and, polar bear and ivory gull (special concern). Conservation and protection regulations that could be implemented in the AOI may provide additional protection to these species, especially in circumstances where local activities may affect the quality of critical habitat (e.g., Eskimo curlew).

c) Conservation and protection of unique habitats

The AOI encompasses a significant portion of a unique coastal, estuarine ecosystem in Canada. Features of the ecosystem could be conserved and protected to the extent that regulation of activities within the bounds of the AOI would maintain these features.

d) Conservation and protection of marine areas of high biodiversity or biological productivity

Aquatic biodiversity within the AOI is not exceptional. However, a diverse assemblage of avifauna utilize portions, or the periphery, of the AOI (e.g., Kendall Island Migratory Bird Sanctuary). Biological productivity in the AOI is considered low by comparison with offshore areas peripheral to the AOI, and with other arctic marine coastal areas. Physical oceanographic/hydrographic characteristics associated with the outer periphery of the AOI, (coastal upwellings and temperature/salinity fronts) tend to result in often large, dense aggregations of zooplankton, which provide important food for plankton-consuming marine mammals (e.g., bowhead whale) and fishes.

e) Conservation and protection of any other marine resource or habitat as is necessary to fulfill the mandate of the Minister

MPA designation could provide *de facto* fish and fish habitat management and protection as per the *Fisheries Act*.

5.0

Meeting Purposes of Other Marine Protection Legislation

For greater certainty, nothing in the Acts (or Bill C-10) described in this section, abrogate or derogate from any existing aboriginal or treaty rights of the aboriginal peoples of Canada described under section 35 of the *Constitution Act, 1982*.

Bill C-10:

An act respecting the National Marine Conservation Areas of Canada which would be administered by Parks Canada reporting to the Minister of Culture and Heritage. This act is intended to provide a representative sampling of the various marine environments found in Canada's oceans and the Great Lakes. Marine conservation areas would be managed for sustainable use and there would be a focus on recreation, tourism, education, and research. At present, three representative areas in the Beaufort Sea region have been identified: Cape Bathurst Polynya, Yukon North Slope, and Western Banks Island.

The AOI would provide a representation of a portion of an arctic marine ecosystem that is unique within Canada, and would provide a “representative sampling” of a marine environment not found elsewhere in Canada. The appropriateness of the area to provide a focus on recreation and tourism would need to be reconciled with the conservation objectives for Zone 1(a) waters as described in the BSBMP.

Canada Wildlife Act:

National Wildlife Areas (NWA) may be set aside for purposes of wildlife research, conservation, and public education. NWAs may be established out to the 12-nautical mile limit. Within NWAs, hunting, possession of firearms, camping, lighting a fire, operation of a conveyance, conducting a commercial or industrial activity, and disturbance or removal of soil, sand, or gravel are, among other things, prohibited, unless done so by permit or posted notice issued by the Minister. Permits may be issued to individuals on an annual basis. The restriction of rights to hunt and possess firearms (as described in the legislation) and to otherwise carry out traditional harvesting pursuits would not apply to the Inuvialuit.



5.0 Meeting Purposes of Other Marine Protection Legislation

Creation of an NWA would prohibit all activities described above except by annual permit issued under the authority of the Minister. This would limit the scope for management of commercial, industrial etc. activities to one of prohibition, except as may be permitted by the Minister on an annual basis. This suggests less opportunity to develop a “tailor-made”, “integrated management” approach to conservation and protection, for the area.

Migratory Birds Convention Act:

Migratory Bird Sanctuaries may be established to protect migratory birds and their nests and through issuance of permits, to control and manage activities in those areas that are likely to be harmful to migratory birds or the eggs, nests or habitat of migratory birds within a sanctuary.

At present there is one Migratory Bird Sanctuary in the region (Kendall Island Migratory Bird Sanctuary) that overlaps with part of the AOI. Jurisdictional coordination would be required were a new MPA created under any of the possible means (*Oceans Act, Canada Wildlife Act, or Bill C-10*).

With the possible exception of the central portion of the AOI that overlaps with the Kendall Island Bird Sanctuary, the AOI (which is entirely aquatic) would not appear to substantively serve the reasons for creation of a Migratory Bird Sanctuary, which is to protect migratory birds and their nests.



Green-winged teal. (Dave Menke/U.S. Fish and Wildlife Service)

6.0

Alternatives to Protection Under *Oceans Act* MPA Designation

6.1 PROTECTION MECHANISMS PRESENTLY IN PLACE

There are currently no legislated protection measures in place, except for the Kendall Island Migratory Bird Sanctuary, which overlap with a portion of the AOI.

The AOI coincides with Beluga Management Zone 1(a) created under the BSBMP for conservation and protection of beluga stocks. Within Zone 1(a) strict limits are placed on the types of activities allowed. Parties to the BSBMP include the FJMC, the six community Hunters and Trappers Committees (HTCs), and the Department of Fisheries and Oceans (DFO). Consistent with the themes and goals of the Inuvialuit Renewable Resource Conservation and Management Plan (IRRCMP), the purpose of this plan is to ensure the responsible and effective, long-term management of the beluga resource by the Inuvialuit and DFO.

6.2 ALTERNATIVES TO *OCEANS ACT* MPA DESIGNATION

Other legislation exists (Section 5.0) which could provide conservation and protection status to the area. Creation of protected areas under Bill C-10 or the *Canada Wildlife Act* are generally more suited to serving a broader national interest (representative ecosystems, research and education, etc.) than might be achieved through an MPA under the *Oceans Act*, which can more readily accommodate regional and local management interests.

Creation of a Migratory Bird Sanctuary under the *Migratory Birds Convention Act* would have a limited scope for protection of marine resources and for managing activities beyond those required to protect migratory birds and their nests. Furthermore, creation of a bird sanctuary would not provide the means for developing the more comprehensive management plans that would likely be required for conservation and protection of resources within an MPA.

Essentially, none of the other means of providing protection and conservation status appear to be as appropriate in this circumstance as creation of an MPA under the *Oceans Act*. This is largely due to the requirement that an MPA that coincides with Beluga Management Zone 1(a), would, in large part, want to



6.0 Alternatives to Protection Under *Oceans Act* MPA Designation

respect the objectives and management guidelines that are currently in place or are contemplated. Conservation and protection of fisheries resources and their habitats is a stipulated reason for creation of an MPA. Consequently, there is greater certainty that the combined objectives of the MPA and the Beluga Management Plan can be achieved.

6.3 OTHER REGULATIONS OR CONSERVATION MEASURES

A number of provisions of the *Fisheries Act* and regulations under the *Act* are currently being used, and could be employed in the future to protect fisheries resources and habitat in the AOI. These include: Northwest Territories (NWT) Fishery Regulations; Marine Mammal Protection Regulations (Part 2—Cetacean Protection Regulations), sections of the *Fisheries Act* respecting use of explosives, destruction of fish, harmful alteration, disruption and destruction of fish habitat, and deposit of deleterious substances. These protection measures are applied on a case-by-case basis.

Additionally, the *Arctic Waters Pollution Prevention Act* has provisions for limiting or preventing the deposit of materials into Canadian Arctic waters.

6.4 SUMMARY COMPARISON OF PROTECTION MECHANISMS

The following table provides a summary comparison of the mechanisms that have been considered to achieve the conservation and protection objectives for the AOI.

Objective	CONSERVATION & PROTECTION MECHANISM				
	<i>Oceans Act</i> MPA	Bill C-10	WMA	MBS	Existing Legislation & Management
Beluga Conservation	Yes	Yes	Yes	No	Case-by-case
Protect Fish Habitat	Yes	Yes	Yes	Partial	through permitting
Biological Integrity	Yes	Yes	Yes	Partial	and monitoring.
Regional-based Management	Yes	No	No	Partial	Yes

7.0

Possible Management Strategies and Regulations Inside the MPA

If designation of the AOI as an MPA occurs, management planning will proceed by working with other federal agencies, provincial agencies, local governments, Aboriginal communities and organizations, non-government stakeholders, and the public. As indicated in the *National Framework for Establishing and Managing Marine Protected Areas*, the formal process of developing a management plan for a candidate MPA begins after the AOI evaluation has been completed. As such, a detailed management plan was not developed at this stage. Rather, the following provides some general guidance that may assist in future development of management plans, should the area be assigned MPA status. A brief overview of existing management initiatives in the ISR is also included, for consideration in the potential development of future management plans under MPA status.

7.1 EXISTING MANAGEMENT INITIATIVES AND SPECIAL DESIGNATED LANDS IN THE ISR

There are a number of management organizations and committees in the Inuvialuit Settlement Region, through which numerous management plans, including the BSBMP, have been developed. The Fisheries Joint Management Committee (FJMC) assists the Government of Canada and the Inuvialuit in managing marine mammals and fisheries in the ISR. CCPs have been developed for Aklavik, Inuvik, Olokhaktomiut, Paulatuk, Sachs Harbour, and Tuktoyaktuk (all available at the FJMC web-site: <http://www.fjmc.ca/>). Under these CCPs, fisheries and wildlife are managed, although the plans are not legally binding. Additional management plans include the IRRCMP, the Yukon North Slope Wildlife Conservation and Management Plan, and the Regional Land Use Plan for the Mackenzie Delta Beaufort Sea Region.

Many species-specific management plans have been developed for the ISR. For example, the CCPs include specific conservation measures for polar bear, beluga whale, bowhead whale, seals, and numerous fish species.

Perhaps the most significant management consideration is the BSBMP. The area selected for consideration as an MPA is consistent with the areas zoned as Zone 1(a) in the BSBMP (FJMC 2001). The BSBMP was developed and



7.0 Possible Management Strategies and Regulations Inside the MPA

implemented to ensure sustainable beluga management in a manner reflective of the Inuvialuit Final Agreement. Of the five zones defined by the BSBMP, Zone 1(a) is the most protected. Additional management initiatives include the HTC Beluga Bylaws and the Inuvialuit Inupiat Beaufort Sea Beluga Whale Agreement (2000). It is also of interest that prior to the development and adoption of the BSBMP, the Inuvialuit Regional Corporation (IRC) had proposed a Beluga Whale Marine National Park for Kugmallit Bay (IICCP 2000).

Polar bear management plans/initiatives in the ISR include the Management Agreement for Polar Bears in Southern Beaufort Population (1991), the Inuvik Quota 3, and the Inuvialuit–Inupiat Polar Bear Management Agreement in the Southern Beaufort Sea (1991 and 2000). Within the ISR, the AOI falls within the South Beaufort Polar Bear Management Zone (IICCP 2000).

Bowhead whale are managed under the Bowhead Whale Management Strategy: DFO, FJMC, Aklavik HTC (Draft 1991) (cited in IICCP 2000).

Detailed integrated fisheries management plans (IFMPs) have been developed for inconnu and Dolly Varden in the AOI. Inconnu are managed in the southern Beaufort Sea through Integrated Fisheries Management Plan for Coney (i.e., inconnu) (IFMPC), co-developed by DFO, the FJMC, the Inuvialuit Game Council (IGC), the Gwich'in Renewable Resources Board (GRRB), and the Sahtu Renewable Resources Board. Dolly Varden from the Rat River stock(s) are managed through the Rat River Char Fishing Plan (Aklavik RRC et al. 2000). The plan is a community-based initiative first begun in 1995. An additional management plan, the West Side Char Fishing/Management Plan, was initiated in 2000 to manage stocks used by Aklavik (IICPP 2000).

CCPs for Aklavik, Tuktoyaktuk, and Inuvik include conservation plans for 12 fish species including: Arctic char; Arctic cisco; Arctic grayling; blue or Pacific herring; broad whitefish; burbot or loche; coney or inconnu; Dolly Varden; jackfish or northern pike; lake trout; lake whitefish or crooked backs; and, least cisco or big-eyed herring. Detailed IFMPs for other fish species in the ISR are planned for development; an IFMP is currently being developed for broad whitefish (IICCP 2000).

Numerous sites that overlap with the AOI have been identified by various interested parties including government agencies (i.e., Canadian Wildlife Service (CWS), DFO) and the Communities of Aklavik, Inuvik, and Tuktoyaktuk as 'special designated lands' (Inuvik Inuvialuit Community Conservation Plan 2000). Areas of importance have been assigned to a category(s), according to their importance and significance to the Inuvialuit and/or federal government initiatives. Categories, which successively increase in significance, are as follows:

Category A: "Lands and waters where there are no known significant and sensitive cultural or renewable resources. Lands and waters shall be managed according to current regulatory practices."



Category B: “Lands and waters where there are cultural or renewable resources of some significance and sensitivity but where terms and conditions associated with permits and leases shall assure the conservation of these resources.”

Category C: “Lands and waters where cultural or renewable resources are of particular significance and sensitivity during specific times of the year. These lands and waters shall be managed so as to eliminate, to the greatest extent possible, potential damage and disruption.”

Category D: “Lands and waters where cultural or renewable resources are of particular significance and sensitivity throughout the year. As with Category C, these areas shall be managed so as to eliminate, to the greatest extent possible, potential damage and disruption.”

Category E: “Lands and waters where cultural or renewable resources are of extreme significance and sensitivity. There shall be no development on these areas. These lands and waters shall be managed to eliminate, to the greatest extent possible, potential damage and disruption. This category recommends the highest degree of protection in this document.”

In general, the AOI falls within a zone that has been designated a ‘Category E’ area of importance, the most significant category, by the Inuvialuit. Specific sites of importance that have been identified in the ISR that overlap with the AOI include (letters following the Site numbers indicate the Management Category):

- Site No. 706D: Kendall Island Bird Sanctuary;
- Site No. 711E: Beluga Management Plan Zone 1(a);
- Site No. 712C: Beluga Management Plan Zone 2;
- Site No. 714CDE: Kugmallit Bay;
- Site No. 715C: Mackenzie River Delta Key Migratory Bird Habitat;
- Site No. 716CE: Mackenzie Bay and Shallow Bay;
- Site No. 717B: Garry and Pelly Islands;
- Site No. 718D: Central Mackenzie Estuary;
- Site No. 719C: Inner Mackenzie Delta;
- Site No. 725D: Eastern North Slope and East of Babbage River; and,
- Site No. 729D: Kitigaaryuit.

Three of these Sites have been assigned the most significant Management Category (Category E): the Beluga Management Plan Zone 1(a); Kugmallit Bay (the portion of the Bay that coincides with the Beluga Management Plan Zone 1(a)); and, Mackenzie Bay and Shallow Bay (the portion of the Bay that coincides with the Beluga Management Plan Zone 1(a)).

In general, the AOI, also defined as the boundaries of Beluga Management Plan Zone 1(a), has been identified as significant by DFO, the FJMC, and Inuvik,



7.0 Possible Management Strategies and Regulations Inside the MPA

Tuktoyaktuk, and Aklavik Community WGs due to its importance as habitat for beluga whale (concentration areas in summer for possible calving, calf rearing, moulting and/or socializing) and waterfowl, subsistence harvesting (particularly beluga), overwintering habitat for anadromous coregonids, feeding and nursery area for young fish, and as an important traditional fishing area (IICCP 2000).

In addition, the North Slope Wildlife Conservation and Management Plan has designated the area known as “Work Boat Passage/Shallow Bay”, which extends from Herschel Island to the Mackenzie River Delta (i.e., Mackenzie/Shallow Bay area) as “deserving of special protection.” (IICCP 2000)

7.2 SUGGESTED MANAGEMENT OBJECTIVES

Management objectives for the MPA should, to the extent possible and desirable considering the broader mandate of the Minister of Fisheries and Oceans, embrace those of the BSBMP that are specific to Beluga Management Zone 1(a).

Management objectives should also incorporate those that are espoused in any of the integrated fisheries management plans for the area, especially in the context of managing sustainable fisheries.

Objectives that limit (prevent, control by permit and regulation) activities in the AOI that have the potential to interfere with the over-arching objective of fisheries and habitat conservation and protection, should be defined. These may lead to regulations for the MPA which would limit the timing, duration, intensity, and location of acceptable activities. The acceptability of certain activities that may interfere with fisheries management objectives should be determined in consultation with local resource users.

7.3 SUGGESTED MONITORING AND RESEARCH

It is evident that the more significant potential stressors on the AOI and the resources present do, or may, originate from beyond the boundaries of the AOI. These stressors include: climate change, long range transport of atmospheric pollutants, long range transport of water-borne contaminants and nutrients (ocean circulation, Mackenzie River), and hydrology changes associated with potential upstream hydroelectric development. As well, fishery stocks and the eastern Beaufort beluga population are harvested outside the AOI and are also, because of their migratory nature, potentially exposed to contaminants outside the AOI.

“State of the environment” monitoring (tissue contaminant residues, water quality, sediment chemistry, etc.) would assist to document potential causal mechanisms for changes occurring in the ecosystem of the AOI. However, no effective management response to environmental stress associated with these types of parameters would be possible. Adjustments to harvest management plans may be necessary in light of data gathered from monitoring.



7.0 Possible Management Strategies and Regulations Inside the MPA

Monitoring of indicators of change resulting from locally controllable activities (i.e., activities within the AOI) should be undertaken or continued. This would include monitoring for potential impacts of oil and gas development activities adjacent to the AOI (e.g., disturbance and harmful effects from seismic surveys, contaminant monitoring). Monitoring harvest of beluga and fish (i.e., harvest statistics), traffic in the AOI, and land use activities in or near the AOI should also be continued or considered.



Fish sampling conducted by Frank Dillon and Forrest Day, 2002. (Pete Cott/ Department of Fisheries, 2002)



APPENDIX 1:

Detailed Ecological Assessment of the AOI using Draft MPA Evaluation Criteria





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1.0

Conservation and Protection of Fisheries Resources: Fish

CRITERIA

Designation of the Area of Interest (AOI) enhances the resource available for the commercial fishery and the viability of commercial populations and genetic stocks through conservation and protection of important species and communities, critical species life stages, functionally critical habitats, ecosystem components, and environmental support systems.

Designation supplements existing management efforts, providing conservation and protection not achievable through other fisheries management tools.

EVALUATION

There are no commercial fishing activities in the AOI. However, the AOI provides important over-wintering habitat for a number of important fish species that are harvested in the general area and includes a number of important fishing sites.

The most important fish species harvested in the southern Beaufort Sea/Mackenzie Estuary include:

- broad whitefish (*Coregonus nasus*);
- lake whitefish (*Coregonus clupeaformis*);
- Pacific herring (*Clupea harengus pallasii*);
- inconnu (*Stenodus leucichthys*);
- Dolly Varden (*Salvelinus malma*);
- Arctic cisco (*Coregonus autumnalis*); and,
- least cisco (*Coregonus sardinella*).

The following evaluation specifically refers to the significance of the AOI with respect to the maintenance of populations of the aforementioned fish species.

1.1 SPAWNING AREAS

The AOI does not support significant spawning concentrations of harvested species. A number of important subsistence fish species spawn in freshwater, inland of the AOI. Of the seven primary harvested fish species, lake whitefish, broad whitefish, Dolly Varden, Arctic cisco, least cisco, and inconnu spawn in

freshwater and over-winter in brackish water (i.e., nearshore locations) (Stewart et al. 1993). Pacific herring spawn under the ice in the Mackenzie Estuary in coastal embayments, some of which may be included in the AOI (Lawrence et al. 1984).

1.2 JUVENILE AND NURSERY AREAS

The AOI supports significant concentrations of juvenile whitefishes, ciscoes, and Pacific herring. Lawrence et al. (1984) reported juvenile broad whitefish from Kugmallit Bay in August; the coastal environment also reportedly supported young-of-the-year broad whitefish. Similarly, larval broad whitefish are carried down the Mackenzie River to the estuary and young-of-the-year then migrate from the low salinity coastal area of the Tuktoyaktuk Peninsula back to freshwater systems (Stewart et al. 1993). Lake whitefish fry and young-of-the-year may reside in the delta and inner estuary (Bond and Erickson 1985); Kugmallit Bay is known to support juvenile, young-of-the-year lake whitefish (Lawrence et al. 1984).

Cisco larvae are transported downstream to the Estuary after hatching in spring, where they over-winter (Stewart et al. 1993). Young-of-the-year Arctic cisco migrate westward along the coast of the Yukon and Alaska, as well as eastward along the Tuktoyaktuk Peninsula (Lawrence et al. 1984).

Juvenile Dolly Varden migrate to estuaries near the mouths of their natal streams to smoltify (Sandstrom 1995). Juvenile Dolly Varden also reside in the coastal environment of the Mackenzie Estuary (see Melnyk 2001).

The Mackenzie Estuary also provides rearing habitat for inconnu (IICCP 2000).

1.3 GENETIC STOCKS

The Mackenzie Bay Zone (i.e., Niakunak and Shallow bays) of the AOI supports the only known populations of the northern form of Dolly Varden (*Salvelinus malma*) (Reist 2001). Anadromous Dolly Varden use Niakunak and Shallow bays as a summer feeding habitat. Distinct genetic stocks of Dolly Varden are represented in Area 1 of the AOI. Specifically, at least four distinct stocks may be found in Area 1: (1) Big Fish River; (2) Rat River; (3) Babbage River; and, (4) Firth River stocks (a fifth stock may exist in a tributary of the Firth River) (DFO 2001). Within the Rat River, all Dolly Varden are believed to be anadromous but may be comprised of more than one stock.

1.4 CRITICAL HABITATS

The AOI provides critical over-wintering habitat for a variety of fish species. Specifically, the presence of a substantive freshwater surface layer, overlying or displacing saline water, in the bays provides suitable over-wintering habitat for fish species intolerant of high salinities (i.e., lake whitefish, broad whitefish, inconnu) (e.g., Stewart et al. 1993). In addition, rivers and streams provide important habitat for anadromous fish stocks (Craig 1984).

The large volume of fresh to brackish water that encompasses the three areas of the AOI facilitates movement between coastal lagoons and embayments used for foraging and nursery areas.

Anadromous Dolly Varden also migrate along the coast between offshore feeding areas and freshwater environments (DFO 2001). Dolly Varden migrate from inland rivers and streams to the coastal environment in summer for feeding.

Lake and broad whitefish and Pacific herring feed and over-winter in the Mackenzie Delta and nearshore along the Tuktoyaktuk Peninsula (Freeman and Stevenson 1995, reviewed in Stewart et al. 1993). All three species are also present in Kugmallit Bay in mid-May (Chiperzak et al. 1991).

Inconnu feed and over-winter on the western coast of the Beaufort Sea to Shingle Point (the Mackenzie Bay Zone) and Kugmallit Bay (DFO 1998, see Melnyk 2001).

Over-wintering in one or more of the areas comprising the AOI is known to occur for the following species:

- Pacific herring: inner Shallow Bay/Niakunak Bay and Kugmallit Bay (IICCP 2000);
- inconnu: Kugmallit Bay and west Mackenzie Bay (Lawrence et al. 1984, Sekerak et al. 1992, DFO 1998);
- Arctic cisco: Kugmallit Bay and inner Shallow Bay/Niakunak Bay;
- lake whitefish: Kugmallit Bay and areas of the inner estuary (Lawrence et al. 1984); and,
- broad whitefish: coast of Tuktoyaktuk Peninsula (Stewart et al. 1993).

1.5 MANAGEMENT AND RESEARCH ISSUES

Fisheries management issues raised by the Inuvialuit (Byers 1993) include concerns that:

- local management of fisheries can break down when the availability of lands and waters are reduced due to technological intrusions
- advances in the technologies used by subsistence harvesters can increase the catch rate
- pressure on fish populations increases as the population of harvesters or those they are harvesting for increases
- commercialization of fisheries can lead to over harvesting (Berkes 1981 in Byers 1993).

There are a number of management organizations and committees in the Inuvialuit Settlement Region through which numerous management plans have been developed. Community Conservation Plans (CCPs) have been developed for Aklavik (AICCP 2000), Inuvik (IICCP 2000), and Tuktoyaktuk (TCPP 2000), among others (all available at the FJMC web-site: <http://www.fjmc.ca/>). Under these CCPs, fisheries are managed. Additional management plans include the Inuvialuit Renewable Resources Conservation

and Management Plan, the Yukon North Slope Wildlife Conservation and Management Plan, and the Regional Land Use Plan for the Mackenzie Delta Beaufort Sea Region.

Detailed integrated fisheries management plans (IFMPs) have been developed for inconnu and Dolly Varden in the AOI. Inconnu are managed in the southern Beaufort Sea through Integrated Fisheries Management Plan for Coney (i.e., inconnu) (IFMPC), co-developed by the Department of Fisheries and Oceans (DFO), the Fisheries Joint Management Committee (FJMC), the Inuvialuit Game Council, the Gwich'in Renewable Resources Board (GRRB), and the Sahtu Renewable Resources Board. Dolly Varden from the Rat River stock(s) are managed through the Rat River Char Fishing Plan (Aklavik RRC et al. 2000). The plan is a community-based initiative first begun in 1995. An additional management plan, the West Side Char Fishing/Management Plan, was initiated in 2000 to manage stocks used by Aklavik (IICCP 2000).

CCPs for Aklavik, Tuktoyaktuk, and Inuvik include conservation plans for 12 fish species including: Arctic char; Arctic cisco; Arctic Grayling; blue or Pacific herring; broad whitefish; burbot or loche; coney or inconnu; Dolly Varden; jackfish or northern pike; lake trout; lake whitefish or crooked backs; and, least cisco or big-eyed herring. Detailed IFMPs for other fish species in the ISR are planned for development; an IFMP is currently being developed for broad whitefish (IICCP 2000).

The only research that has focussed on Inuvialuit traditional knowledge of coastal marine resources within the AOI was on the broad whitefish (Freeman and Stevenson 1995, Freeman 1997). A study of the Big Fish River char fishery dealt in part with char inhabiting the coastal areas in the western part of the AOI (Byers 1993). The potential for future research is vast. The priorities and scope of future traditional knowledge research will need to be addressed by Inuvialuit.



Dolly Varden at the Big Fish River. (Photographer unknown/FJMC-DFO-0618)

2.0

Conservation And Protection Of Fisheries Resources: Marine Mammals

CRITERIA

Designation of the AOI enhances the viability of important marine mammal populations, genetic stocks, and aggregations through conservation and protection of important species and communities, critical species life stages, essential habitats and ecosystem components, and environmental support systems.

EVALUATION

2.1 REGIONAL CONCENTRATIONS

The AOI supports regional concentrations of:

- Beluga whale (*Delphinapterus leucas*);
- Bowhead whale (*Balaena mysticetus*);
- Ringed seal (*Phoca hispida*);
- Bearded seal (*Erignathus barbatus*); and,
- Polar bear (*Ursus maritimus*).

2.2 HARVESTING ACTIVITIES

The AOI supports aggregations of beluga whale (*Delphinapterus leucas*) and bowhead whale, both of which, although primarily beluga, are harvested by Inuvialuit (Harwood 2000, Reeves and Mitchell 1985). Beluga harvests are significant to the local communities from both a nutritional and a cultural/traditional perspective (Byers and Roberts 1995, Harwood 2000). In addition, there is local harvest of ringed seal, polar bear, and bearded seal in the area.

2.2.1 Beluga Whale

Inuvialuit living in the vicinity of the Mackenzie Estuary have long relied on the beluga whale as a source of muktuk, oil, meat and other resources. There are a number of ancient village sites at the mouth of the East Channel of the Mackenzie River with middens full of beluga bones. This, along with Inuvialuit oral history, relates the importance of beluga whales to Inuvialuit subsistence in the past (Day 2002, Friesen and Arnold 1995, Hart and Inuvialuit Cultural

2.0 Conservation And Protection Of Fisheries Resources: Marine Mammals

Resource Centre 2003, McGhee 1974). Today, traditional whaling camps are maintained along the Beaufort Sea coastline and within the Mackenzie Delta in the three areas of beluga concentration, which correspond to the three areas of the AOI. Hunting occurs when beluga are concentrated in the Mackenzie Estuary, usually during July (Byers and Roberts 1995, Norton and Harwood 1986).

Beluga whaling camps are located in all three of the areas represented in the AOI. Camps include Shingle Point, Running River, West Whitefish Station, Bird Camp, Kendall Island, Hendrickson Island, Ikinaluk (Ikinaaluk), East Whitefish, Kittigazuit (*Kitigaaryuit*), and Tuktoyaktuk (*Tuktuuyaqtuuq*) (Harwood, pers. comm.) (Figure 1).



Excavating beluga remains at the old village of Kuukpak. (Charles Arnold/Prince of Wales Northern Heritage Centre)



Butchering a beluga whale at East Whitefish Station. (Photographer unknown/FJMC-DFO-1241)

2.2.2 Bowhead Whale

Historically the bowhead was hunted by Inuvialuit living in coastal areas near deep water and with sufficient food for the whales. The whales provided an abundant supply of meat and muktuk, and only two or three whales were needed for the winter (Hart and Inuvialuit Cultural Resource Centre 2003, Morrison 1988, Harwood and Smith 2002). Commercial whaling for bowheads occurred between 1849 and 1914, and little subsistence harvest by Inuvialuit people occurred during or after this era (Bockstoce 1986 in Harwood and Smith 2002). Inuvialuit from Aklavik harvested a bowhead in 1991 and 1996 at Shingle Point (Freeman et al. 1992). Subsistence harvest by Inupiat people has continued, and the current quota is 65 animals struck on an annual basis.

2.2.3 Ringed Seal

Ringed seal have been important to Inuvialuit as a source of blubber, meat, and skins, but were not relied upon as much as the beluga whale by those living adjacent to the Mackenzie Estuary (Hart and Inuvialuit Cultural Resource Centre 2003). Some Inuvialuit hunt seals during summer and fall in the Finger Lakes area, Kugmallit Bay, Liverpool Bay, Wood Bay, and along the north side of the Tuktoyaktuk Peninsula (Tuktoyaktuk Community Conservation Plan 2000). Winter seal hunting occurs along shear zone leads north of the mainland coast.

2.2.4 Polar Bear

Historically, polar bears were hunted for their meat and skins. The skin and meat is still used, and some Inuvialuit obtain part of their income through outfitting for sport hunters. Polar bear are harvested during winter and early spring along shear zone leads north of the mainland coast (TCCP 2000).

2.2.5 Bearded Seal

Although bearded seal have traditionally been harvested along with ringed seal, they are less abundant and, consequently, are harvested with less frequency



A bearded seal. (Photographer unknown/FJMC-DFO-1185)

than ringed seals. They were once prized for their large size, which provided an ample supply of blubber and meat. Their thick hides were valued for ropes, covers for skin boats, and much more (Hart and Inuvialuit Cultural Resource Centre 2003). Only small numbers of bearded seals have been harvested by hunters from communities within the study area in recent years.

2.3 CRITICAL HABITAT

The AOI provides key habitat for:

- beluga feeding (Orr and Harwood 1998), socializing, moulting (St. Aubin et al. 1990), and calving (Byers and Roberts 1995);
- bowhead feeding: bowhead aggregate on the Yukon coast between Kay and Shingle points (Area 1) in response to the presence and abundance of zooplankton prey (Wong 1999). Bowheads along the Yukon coast appear to be mostly juvenile and yearlings (Cubbage et al. 1984, Davis et al. 1986); and,
- polar bear feeding, over-wintering, and denning (Stirling et al. 1993).

2.3.1 Beluga Whale

The Beaufort Sea beluga stock aggregates in the Mackenzie River estuary in July (Wong 1999) in the AOI. Although available data (surveys conducted in July 1984 and 1992) indicate that the overwhelming majority of the population is distributed offshore in summer, the highest densities of beluga are found in the estuary, most notably in Kugmallit Bay (Harwood et al. 1996, Norton and Harwood 1985). Specifically, beluga concentrate in the AOI, areas which are located near major outflows of the Mackenzie River (Fraker et al. 1978). At the time of aggregation (i.e., July), these areas differ from other areas of the Estuary; the three areas comprising the AOI tend to be warmer, more turbid, less saline, and shallower than the rest of the Estuary (Fraker et al. 1978). The AOI provides a thermal advantage for beluga whale (Fraker 1979), is important for social behaviour (Fraker et al. 1979), appears to play a role in the annual moult (St. Aubin et al. 1990) and for calving (Byers and Roberts 1995).

If the main objective of the designation of the Marine Protected Area (MPA) were the protection of beluga aggregation areas that coincide with important whaling camps, then the suggested boundaries of the AOI may be appropriate. However, the boundaries of the AOI may not be the most ecologically relevant, if the main objective of the designation of the MPA was solely the protection of beluga whale congregation areas. In addition to the three areas comprising the AOI, Harwood et al. (1996) observed high densities of beluga outside of the area contained in the AOI: in west Mackenzie Bay (between the Mackenzie Bay Zone and the Kendall Island Zone of the proposed MPA); in the Estuary north of the Mackenzie Bay Zone; and in the eastern portion of Kugmallit Bay. Similarly, Fraker et al. (1979) observed concentrations of beluga in west Mackenzie Bay and on one occasion, near Pullen Island. On this basis, it may seem more appropriate to extend the areas in accordance with observed beluga distributions. In general, beluga whale concentrations in the Mackenzie Estuary follow the 2 m isobath (Fraker et al. 1979, Harwood et al. 1996).

It is also important to consider that beluga whale aggregations have also been observed outside of the AOI and the Estuary; Harwood et al. (1996) reported offshore aggregations northwest of west Mackenzie Bay, offshore of the Tuktoyaktuk Peninsula, Baillie Islands, and the mouth of the Horton River, offshore of Cape Bathurst in the vicinity of the Buthurst polynya, and the central Amundsen Gulf in July.

2.3.2 Bowhead Whale

The area along the Yukon coast from Kay Point to Shingle Point is one of the main bowhead feeding areas (Wong 1999). Bowhead whale aggregate in the nearshore environment in late summer (Wong 1999).

2.3.3 Ringed Seal

Ringed seal typically concentrate during the open water season along the north coast of Tuktoyaktuk Peninsula, perhaps concentrating in areas with the greatest prey density (Harwood and Stirling 1992).

2.3.4 Polar Bear

The AOI provides important habitat for polar bear feeding, over-wintering, and denning (Stirling et al. 1993).

2.4 MANAGEMENT ISSUES

Marine mammals are managed under the Tuktoyaktuk CCP (TCCP 2000), the Aklavik CPP (AICCP 2000), and the Inuvik CCP (IICCP 2000). Community HTCs, Wildlife Management Committees, and the Inuvialuit Game Council (IGC) also participate in management initiatives for marine mammals in the ISR. The FJMC assists the Government of Canada and the Inuvialuit in managing marine mammals in the ISR. In general, the AOI has been designated a 'Category E' area of importance by the Inuvialuit. The land use Category E specifies: "Lands and waters where cultural or renewable resources are of extreme significance and sensitivity. There shall be no development on these areas. These lands and waters shall be managed to eliminate, to the greatest extent possible, potential damage and disruption. This category recommends the highest degree of protection in this document." (IICCP 2000).

Species-specific marine mammal management plans have been developed for the ISR. The CPPs include specific conservation measures for polar bear, beluga whale, and bowhead whale. Additional management plans for various marine mammal species are discussed below.

The area selected for consideration as an MPA is consistent with the areas zoned as Zone 1(a) in the Beaufort Sea Beluga Management Plan (BSBMP) (FJMC 2001). The BSBMP was developed and implemented to ensure sustainable beluga management in a manner reflective of the Inuvialuit Final Agreement. Of the five zones defined by the BSBMP, Zone 1(a) is the most protected. Additional management plans include the HTC Beluga Bylaws and the Inuvialuit Inupiat Beaufort Sea Beluga Whale Agreement (2000).

Polar bear management plans/initiatives in the ISR include the Management Agreement for Polar Bears in Southern Beaufort Population (1991), the Inuvik Quota 3, and the Inuvialuit—Inupiat Polar Bear Management Agreement in the Southern Beaufort Sea (1991 and 2000). Within the ISR, the AOI falls within the South Beaufort Polar Bear Management Zone (IICCP 2000).

Bowhead whale are managed under the Bowhead Whale Management Strategy: DFO, FJMC, Aklavik HTC (Draft 1991) (cited in IICCP 2000).

2.5 ENDANGERED, THREATENED, OR VULNERABLE POPULATIONS

The western arctic population of bowhead whale was classified as endangered in 1986 (COSEWIC 2001).

Polar bear were listed as a species of ‘special concern’ in 1999 (COSEWIC 2001). A species is defined as of special concern where it exhibits “characteristics that make it particularly sensitive to human activities or natural events” (category formerly described as “vulnerable” from 1990 to 1999 or “rare” prior to 1990).

2.6 IMPORTANT HABITAT CONDITIONS FOR TARGETED MARINE MAMMALS

The AOI contains important habitat conditions for beluga and bowhead whales.

2.6.1 Beluga Habitat

The AOI provides a thermal advantage for beluga whale, is important for social behaviour (Fraker et al. 1979) and appears to play a role in the annual moult (St. Aubin et al. 1990) and calving (Byers and Roberts 1995). The AOI may also be significant in provision of food for beluga whale, as it is reported by hunters. The Kendall Island Zone of the AOI is also believed to serve as a calving ground for approximately 2,000 beluga (Environment Canada 2001).

2.6.2 Bowhead Habitat

The AOI is significant as bowhead habitat because it is characterized by chemical and physical conditions that affect the distribution and abundance of zooplankton. Features such as wind, marine upwellings, turbulence, and the location of the Mackenzie River plume affect zooplankton distribution and thus, bowhead distribution. The area along the Yukon coast from Kay to Shingle Points is one of the main bowhead feeding areas (Wong 1999).

2.7 PROVIDE PROTECTION FROM HUMAN DISTURBANCE

Designating the AOI as an MPA can contribute to the protection of species from anthropogenic activities. This is perhaps most obviously applicable to beluga whale. Because the eastern Beaufort Sea beluga stock concentrates in the Mackenzie River estuary in July, these whales are susceptible to anthropogenic activities, including industry (e.g., oil and gas development), barge and ship

traffic, hunting, and tourism (Harwood 2000). However, it has been suggested that the 'magnitude of the perturbation would have to be significant to have a consequential effect' to beluga (Harwood 2000).

2.8 POTENTIAL FOR SPECIES TO SWITCH TO THE AREA/VITALNESS OF AREA UNDER CERTAIN CONDITIONS

Some species may switch their use of habitat into the AOI if their original habitat were removed or disturbed:

- Ringed seal breed and over-winter in the coastal area on landfast ice (north coast of the Tuktoyaktuk Peninsula from Kugmallit Bay to Banks Island) (Smith 1987). Seals seek coastal areas with suitable ice conditions such as those found along complex shorelines around fjords and islands. Therefore, the location of the landfast ice edge may affect ringed seal distribution and the use of the AOI, specifically Areas 2 and 3.
- Ringed seal typically concentrate in the open water season along the north coast of Tuktoyaktuk Peninsula, perhaps concentrating in areas with the greatest prey density (Harwood and Stirling 1992). If prey (i.e., fish, particularly arctic cod, and invertebrates) become abundant (i.e., shift their distribution) in the AOI, seals may follow.
- Distribution of seal may in turn affect distribution of polar bear.
- The distribution of bowhead whale is dependent upon the location of zooplankton, the distribution of which are, in turn, affected by features such as wind, marine upwellings, turbulence, and the location of the Mackenzie River plume. Were conditions to change thus altering the zooplankton distribution, bowhead feeding areas may shift.

2.9 EXISTING RESEARCH ACTIVITIES/FUTURE RESEARCH OPPORTUNITIES

Some existing and potential future research activities pertaining to marine mammals in the AOI are briefly discussed below.

2.9.1 Beluga Whale

There are a number of research and monitoring activities pertaining to the Beaufort Sea Beluga Management Plan (FJMC 2001). Ongoing research includes the annual harvest monitoring program (initiated in 1977) and studies addressing beluga whale health, reproduction, and contaminant levels (initiated in 2000). A number of focussed research programs were also recently completed (Harwood 2000).

There is also potential for future research opportunities in the AOI, due to the limited understanding regarding the biology/ecology of some marine mammal species and populations in the area. Future research opportunities could address the following data gaps:



2.0 Conservation And Protection Of Fisheries Resources: Marine Mammals

- Verification of aging studies conducted on the Beaufort Sea beluga stock (Harwood 2000);
- Knowledge of beluga breeding biology (Harwood 2000);
- Ecology/biology of bearded seal (little is known of this species);
- Knowledge of bowhead whale reproduction; and,
- Reasons for the observed fluctuation in bearded and ringed seal annual abundance.

One study has been conducted to document Inuvialuit traditional knowledge of the beluga whale. It focussed on cultural and biological aspects of the beluga whale and documented hunting experiences, hunting practices, meat processing and culture, and beluga travel routes, reproduction, behaviour, food, ecological relationships, and populations (Byers and Roberts 1995). However, no one study can get complete information on all of those subjects. Inuvialuit could review the results and determine gaps in the information collected, and set priorities for further traditional knowledge research on the beluga whale.

3.0

Conservation and Protection of Endangered or Threatened Species

CRITERIA

Designation of the AOI enhances the viability of populations or genetic stocks of endangered or threatened species, or reduces the risk of decrease or extinction of a species, through conservation and protection of important species and communities, critical species life stages, essential habitats and ecosystem components, and environmental support systems.

EVALUATION

3.1 ENDANGERED OR THREATENED SPECIES/SPECIES OF CONCERN

3.1.1 Marine Mammals

The AOI supports bowhead whale. The western Arctic population was listed as endangered by COSEWIC in 1986 (COSEWIC 2001).

Polar bear were listed as a species of 'special concern' in 1999 (COSEWIC 2001).

3.1.2 Birds

The ivory gull (*Pagophila eburnean*), which visits the AOI, occurring most often near ice-edges, was listed as a species of special concern by COSEWIC in 1992 (COSEWIC 2001).

The Eskimo curlew, which may also be present (i.e., Kendall Island Bird Sanctuary) in the AOI, was listed as endangered by COSEWIC in 2000 (COSEWIC 2001) (first listed as endangered by COSEWIC in 1978, Gratto-Trevor 2001). The Kendall Island Bird Sanctuary is also believed to contain 'probable breeding habitat', although no confirmed nests have been found in more than 110 years (CWS 2001). According to the CWS (CWS 2001), sightings continue to be reported, including sightings in the NWT; seven possible sightings were reported from 1978 to 2001 in the northern breeding areas (Gratto-Trevor 2001). A pair was reported in the breeding grounds in the NWT by an experienced birder in 1987 (DRWED 1996) and a nest was reported in the southern district of Keewatin in 1992 (Gratto-Trevor 2001). There has also been at least one unconfirmed sighting in the Kendall Island Bird Sanctuary

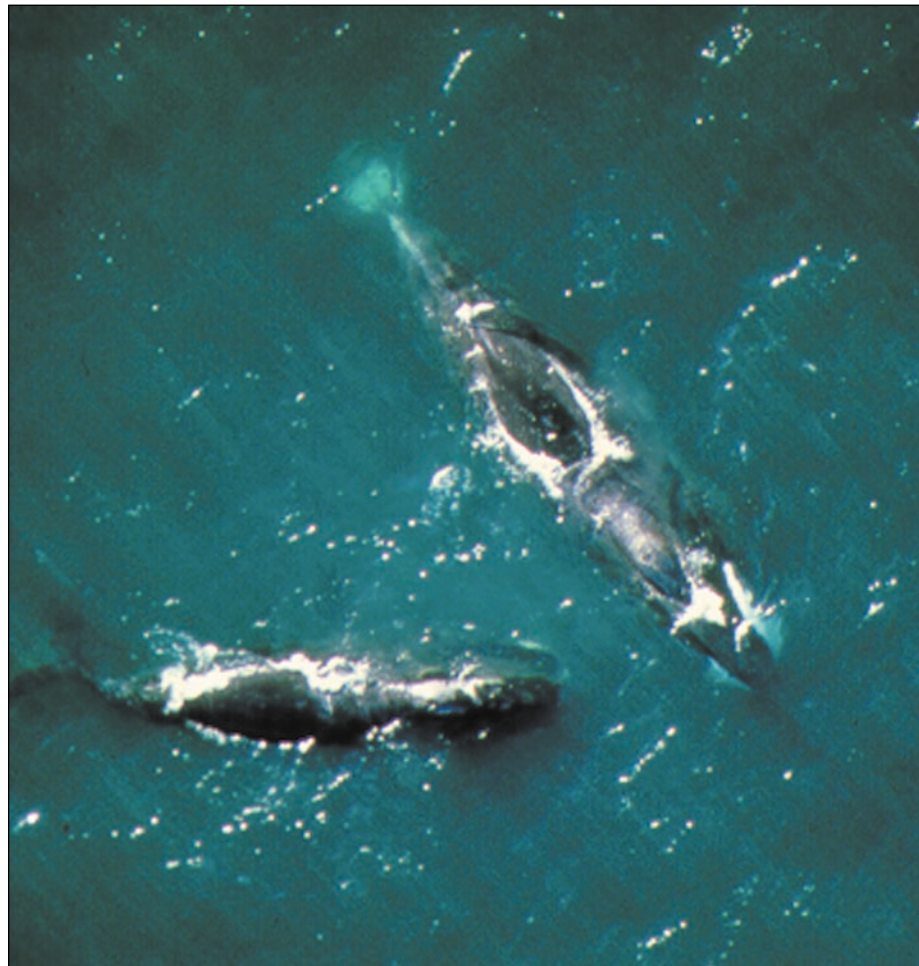
3.0 Conservation and Protection of Endangered or Threatened Species

(1985) (NPWRC 2002). Current population estimates range from 23 to 100 birds and it is believed that Eskimo curlews may persist in very small numbers (Gratto-Trevor 2001).

Ross' Gull (*Rhodostethia rosea*), considered to be 'threatened' by COSEWIC as of 2001 (COSEWIC 2001), may be an occasional/seasonal visitor.

3.2 SUPPORT OF CONCENTRATIONS OF ENDANGERED OR THREATENED SPECIES

The area along the Yukon coast from Kay Point to Shingle Point is one of the main feeding areas for the western Beaufort Sea bowhead stock (Wong 1999). Bowhead aggregate on the Yukon coast between Kay Point and Shingle Point (west Mackenzie Bay area of the AOI), in response to the presence and abundance of zooplankton prey (Wong 1999). Bowheads along the Yukon coast appear to be mostly juvenile and yearlings (Cubbage et al. 1984, Davis et al. 1986).



Bowhead whales. (John Ford/FJMC-DFO-937)

3.3 KEY HABITAT FOR ENDANGERED OR THREATENED SPECIES

The periphery of the AOI provides key feeding opportunities for bowhead. Bowhead concentrate around zooplankton aggregations formed in the Mackenzie Estuary (Wong 1999).

The AOI also provides important habitat for polar bear feeding, over-wintering, and denning (Stirling et al. 1993).

It is believed that the Kendall Island Bird Sanctuary contains 'probable breeding habitat' for the endangered Eskimo curlew (CWS 2001).

3.4 SIGNIFICANT PORTION OF REGIONAL POPULATION

The western Arctic bowhead stock (one of three) comprises more than 90% of the world's population of this species (Marine Mammal Commission 1999). Significant numbers of these bowhead feed along the periphery of the AOI.

3.5 EXISTING OR FUTURE RESEARCH OPPORTUNITIES

See section 7.1 for details regarding current scientific research activities and potential future research opportunities.

3.6 AREA VULNERABLE TO HUMAN DISTURBANCE

The AOI and the Mackenzie Estuary/southeastern Beaufort Sea, in general, are facing increasing pressures due to a variety of anthropogenic stressors including:

- Oil and gas development;
- Mining;
- Increased habitation/population increases;
- Tourism;
- Shipping/transportation activities;
- Infrastructure (e.g., harbours, roads);
- Hydroelectric development (upstream);
- Municipal wastes;
- Climate change; and,
- Long-range transport of contaminants.

Some of these activities/occurrences are already affecting (or have affected) the AOI and/or adjacent areas (e.g., shipping and oil and gas development) while others are projected to become issues in the future (e.g., hydroelectric development and mining). In addition, because the three areas (Niakunak/Shallow Bay, Kendall Island area, and Kugmallit Bay) are located at the mouths of river channels, they are vulnerable to effects of activities that occur upstream of the area.

In general, the Beaufort Sea is facing increasing development pressures due to increased human habitation and access to the north and due to industrial activities. Speculation largely supports the notion of increasing development of

oil and gas resources in the southeastern Beaufort Sea and Mackenzie Delta (Brackman 2001). These areas are currently not affected by mining but could potentially be threatened as mining activities increase in Canada's north.

Distant anthropogenic activities (i.e., activities far from the AOI and even the southern Beaufort Sea area) may affect the AOI through alterations to the Mackenzie River. The Mackenzie River is considered relatively pristine with respect to eutrophication and anthropogenic nutrient loading. Any shifts in nutrient supply (i.e., nutrient enrichment), could alter the productivity and the algal community structure in the southern Beaufort Sea (Justic et al. 1995). Furthermore, upstream alterations to the thermal and/or water regime (e.g., hydroelectric development) of the Mackenzie River and/or increased loadings of contaminants could affect the AOI.

Climate change and long-range transport of contaminants are the most serious threats to the Beaufort Sea and Mackenzie Delta but can not be managed or mitigated through any efforts undertaken in the Arctic itself. Both issues must be managed through global, international efforts aimed at mitigating or eliminating the causes of these threats.

4.0

Conservation and Protection of Unique Habitats

CRITERIA

Designation of the AOI conserves or protects areas supporting unique or rare marine habitats including supporting ecosystem components, and environmental support systems.

Unique marine habitats include areas that differ from the typical or common habitats of the surrounding region. These habitats need not necessarily be critical or significant to the function of a particular species or ecosystem but may be important due to their irreplaceability.

EVALUATION

The AOI lies within the southern Beaufort Sea/Mackenzie River Delta and Estuary. The Areas comprising the AOI (Areas 1, 2, and 3) contain a number of unique and/or otherwise critical features which are significant to biota and/or to the physical, chemical, and/or biological processes in adjacent areas. The following is a brief discussion of some of the key habitat features of the AOI.

4.1 SUB-SEA LAKES

The AOI is within a sub-sea lake; the 'lake' is formed in winter when freshwater from the Mackenzie River pools under land fast ice. The 'lake' consists of approximately 70 km³ of fresh water, either replacing or lying above marine water, covering an area of approximately 12,000 km². This area provides over-wintering habitat for many anadromous fish.

4.2 MACKENZIE RIVER ESTUARY

The Mackenzie River Estuary provides highly significant habitat for seabirds and serves as a migratory corridor for anadromous fishes. The Mackenzie River, with an annual discharge of approximately 3.0×10^{11} m³, is the largest North American river that flows into the Arctic (Yunker et al. 1993). Consequently, the Mackenzie River is a substantive source of nutrients, heat, sediment, and organic carbon for the Beaufort Sea and it plays a pivotal role in the supply of

energy and nutrients to the coastal environment (Macdonald and Thomas 1991). All of these characteristics are fundamental to the creation and maintenance of critical habitat and ecological processes in the area as a whole, including the AOI.

The Mackenzie River plume influences the distribution of biota, including phytoplankton, fish, and higher trophic level species. In particular, the plume is significant for production, as it provides a rich supply of nutrients in an otherwise relatively nutrient-poor ecosystem (the Mackenzie River discharge is the most significant source of nutrients in the southern Beaufort Sea).

The coastline of southern Beaufort Sea retreats at rates greater than 1 m per year (up to 18 m/yr), resulting in unstable and dynamic shoreline habitats. Coastal erosion is significant due to its role in supplying sediments to the Beaufort Sea. However, the Mackenzie River contributes the greatest portion of sediments to the Beaufort Sea (the Mackenzie River is the most sediment-rich river in the Arctic).

4.3 SEABIRDS AND COASTAL WATERFOWL HABITAT

The AOI provides moulting, brooding, brood rearing, feeding, and staging habitat, and serves as a migration route for numerous coastal waterfowl and seabirds (Tuktoyaktuk Community Conservation Plan 2000, Searing et al. 1975, Alexander et al. 1988, ESSO Resources Canada 1982, Barry 1976).

The Kendall Island Zone of the AOI is adjacent to the Kendall Island Migratory Bird Sanctuary, established in 1961 to protect staging and breeding grounds for a number of water birds, particularly the Lesser Snow Goose (*Chen caerulescens caerulescens*) (Environment Canada 2001). This sanctuary is used by more than 100 species of birds (Environment Canada 2001).

4.4 POLAR BEAR HABITAT

The AOI provides habitat for the southern Beaufort Sea polar bear population, which inhabits the mainland coast from Baillie Island into Alaska. Polar bear mate on the ice and make limited use of maternity dens on small islands on the outer periphery of Mackenzie Estuary (the Mackenzie Bay Zone and the Kendall Island Zone). The coast of the Beaufort Sea also provides denning areas for polar bear (Melnyk 2001). As the AOI provides important seal habitat, it is also significant in providing food for polar bear.

4.5 BELUGA HABITAT

The AOI includes the three main summer beluga concentration areas in the southeastern Beaufort Sea (i.e., the BSBMP Zone 1(a)), which are important for socializing, moulting, calving, and for energetics (i.e., thermal advantage). Hunters have reported that feeding occurs in the AOI and is known to occur in adjacent offshore areas ('intermittent-use areas').



4.0 Conservation and Protection of Unique Habitats

4.6 DOLLY VARDEN HABITAT

Coastal waters of west Mackenzie Bay (i.e., Niakunak and Shallow bays) of the AOI support the only known populations of the northern form of Dolly Varden (*Salvelinus malma*) (Reist 2001). Anadromous Dolly Varden use Niakunak and Shallow bays as a summer feeding habitat.

5.0

Conservation and Protection of High Biodiversity

CRITERIA

Designation of the AOI conserves and protects an area of high biological diversity, including supporting ecosystem components, and environmental support systems.

EVALUATION

5.1 AREA SUPPORTS A RICHNESS OF VARIETY OR ECOSYSTEMS, HABITATS, COMMUNITIES, AND SPECIES

The AOI supports a richness of species including a number of marine mammals, polar bear, fishes, coastal waterfowl, seabirds, invertebrates, and algae. Epontic communities also develop annually within the AOI.

5.2 DIVERSITY OF AREA RELATIVE TO OTHER SIMILAR ENVIRONMENTS

Benthic invertebrate and zooplankton diversity is low in the nearshore areas of the Mackenzie Estuary. Wacasey (1975) attributes the low species diversity in the estuarine zone primarily to the reduced tolerance of many species (e.g., echinoderms) to low salinities over extended periods of time.

Conversely, the AOI supports a large number and high diversity of coastal waterfowl and seabirds. Over 130 bird species have been identified in the Mackenzie Delta (MDBSRLUPC 1991).

5.3 VARIABILITY AMONG SPECIES, COMMUNITY TYPES, AND ECOSYSTEM PROCESSES

The AOI is in a region exposed to relatively wide fluctuations (i.e., variability) in the physical and chemical environments, which subsequently cause high variability in species distribution, abundance, and composition, communities (e.g., primary production), and ecosystem processes.

Variability in the physical and chemical environments is due to seasonal fluctuations in light and temperature, both of which may directly affect species distribution and abundance. Seasonal variations in light and temperature may also dramatically affect the species composition, abundance, and even presence in the AOI. Wind is also highly significant as an erosion-driver and in the dispersal and transport of suspended sediments, due to its influence on mixing and dispersion of the Mackenzie Plume, and in influencing the location of ice. The most important factor that influences the chemical and physical conditions in the AOI is the Mackenzie River. Discharge and concentrations of nutrients, carbon, suspended mineral sediments, contaminants, and water temperature in the Mackenzie River play a vital role in defining conditions in the AOI. Parameters and conditions in the physico-chemical environment that are known to fluctuate substantively in the AOI include:

- Discharge of the Mackenzie River;
- Nutrient concentrations due to ice melt, upwellings, remineralization, and areas of rapid nutrient depletion;
- Salinity (i.e., ice brine pump, vertical stratification);
- Ice conditions (thickness, freeze-up and break-up times, location, leads, ice edges);
- Temperature;
- Light; and,
- Wind.

Due to the variance in the physico-chemical environment, biota and ecosystem processes also vary substantively in the AOI. Examples of high variability that are known to occur with respect to biota include:

- Benthic communities due to ice scouring;
- Seasonal composition, abundance and productivity of algal communities (planktonic, epontic, and benthic);
- Annual abundance of ringed and bearded seal populations;
- Dominance of heterotrophic vs. autotrophic food chains, which is related to the Mackenzie Plume, ice cover, and oceanographic conditions (Parsons et al. 1989);
- Dominance of various food chain components and the structure of the food web (Muir et al. 1997);
- Energy transfer pathways may vary seasonally (e.g., epontic biota very important in late winter and early spring, Bradstreet and Cross 1982); and,
- Relative dominance of benthic vs. pelagic production (affected by location of pack ice, Percy et al. 1985).

6.0

Conservation and Protection of High Biological Productivity

CRITERIA

Designation of the AOI conserves and protects an area of high biological productivity, including supporting ecosystem components, and environmental support systems.

EVALUATION

6.1 HABITATS OR FEATURES CHARACTERISTIC OF HIGH PRODUCTIVITY

The Mackenzie River Delta is considered a moderately productive estuary (Muir et al. 1999) and the Beaufort Sea is one of the least productive seas in the Arctic (Percy et al. 1985). In general, the AOI is characterized by low biological productivity. However, primary production is greater in nearshore areas, relative to more distant offshore locations (Hsiao 1976, Hsiao et al. 1977); in the nearshore areas, primary productivity is limited primarily by turbidity (Grainger 1975). Due to the light-limiting effects of the turbid Mackenzie River, the precise location of the Mackenzie River plume will determine the distribution of primary productivity (i.e., productivity is generally higher at the edge of the plume).

6.2 GENERATION OF LARGE 'BIOMASS'

Primary production in the Beaufort Sea is characteristically low and due to strong influence of sediment scouring and resuspension, it contains relatively low quantities of benthic invertebrates (Carey 1991). However, the AOI supports patches of relatively high abundances of zooplankton, particularly at the estuary 'front', which subsequently provide energy to bowhead whales. Therefore, the AOI plays a role in supporting the high biomass of marine mammal populations in the area.

6.3 KEY INDICATOR SPECIES OF PRODUCTIVITY

Key indicator species of productivity that are represented in the AOI include the abundance of zooplankton (especially the copepod *Limnocalanus macrurus*) in the Mackenzie Estuary, and aggregations of bowhead, beluga, ringed seal, coastal waterfowl and seabirds, and fish.

7.0

Conservation and Protection to Fulfill the Mandate of the Minister of Fisheries and Oceans

CRITERIA

Designation of the AOI conserves and protects an area of the marine environment for the purposes of research in order to improve understanding of the function and interaction of species, communities, and ecosystems, or to understand the impact and results of marine management activities.

EVALUATION

7.1 SCIENTIFIC RESEARCH

7.1.1 Scientific Research: Existing And Potential Future Activities

There are a number of research activities currently being conducted within the AOI and in adjacent areas that may be affected by the designation of MPA status. A brief discussion of some of these current activities is provided below.

7.1.1.1 Beluga Whale Management Plan

- Annual monitoring of beluga harvest (Harwood 2000);
- Research program, initiated in 2000, examining beluga health, reproduction, and contaminant levels sponsored by the FJMC and conducted by DFO and local Inuvialuit technicians (Harwood 2000); and,
- Stock discrimination.

7.1.1.2 Integrated Fisheries Management Plan for Coney (Inconnu)

- Documentation of current stock conditions;
- Distribution of life stages by area and habitat;
- Documentation of traditional ecological knowledge regarding inconnu;
- Identification of inconnu spawning sites; and,
- Harvest management studies (DFO 2000a).

7.1.1.3 Other Fisheries Research Initiatives

- Timing of migration, stock health, and critical habitat information on coregonids (whitefish) (DFO 2000a).

7.1.1.4 Permafrost, Climate Change, Coastal Processes, and Thermal Regimes

Studies, directed by the Geologic Survey of Canada (GSC), in the region of interest include assessments of the occurrence of ground ice, landslides

and climate relationships, coastal processes, monitoring of regional active-layer and permafrost thermal state, studies pertaining to carbon sources and sinks in the Mackenzie Delta/Beaufort Sea. A substantive amount of research on these issues is conducted through the GSC at the Mackenzie Delta regional study area.

7.1.1.5 Arctic Monitoring and Assessment Program (AMAP)

A large volume of research has been and continues to be collected under the international Arctic Monitoring and Assessment Program (AMAP) and the Northern Contaminants Program. Ongoing research activities include:

- A contaminant trend monitoring program;
- A contaminant effects monitoring program; and,
- Supporting studies.

Information to be collected under the trend monitoring program includes measurements of contaminants in all components of the Arctic environment. The effects monitoring program is aimed at detecting and characterizing stress-related effects on Arctic flora, fauna, and humans. Supporting studies include work conducted that is intended to provide essential information for interpretation of information collected under the first two components. Work is to be conducted on a global scale, through comprehensive research and monitoring of 'key areas'. One of these key areas is the Lower Mackenzie River and Delta area. Details regarding the specific information collected under the AMAP Trends and Effects Programme can be found in AMAP (2001).

Ongoing activities, as reported in AMAP (1999), conducted in the Canadian Arctic pertinent to contaminant effects include: (1) incorporation of traditional knowledge in studies of gross abnormalities in freshwater fish; (2) studies of immunotoxicological, histopathological, endocrine, and nutritional effects of Cd on King and common eiders; (3) continuation of effects monitoring program for beluga whales, including assessment of immune status, gross assessment and histopathology, retinal electron microscopy, detoxification mechanisms for Hg—Se in liver, brain, and blood, and speciation of Hg in blood, brain, spinal cord, and liver; and, (4) assessment of effects of persistent organic pollutants (POPs) on endocrine, nutritional, immunological, and histopathological status of polar bears. Furthermore, the U.S. is conducting effects-related research and monitoring of beluga (Hg—Se—Ag interactions, metal distributions, necropsies) and bowhead (metals, necropsies) whales. Cd is also being addressed through evaluations of histology, cell culture, and metallothionein.

Studies of contaminants and human health, under the AMAP Human Health Program, are on-going. Work underway in the Mackenzie Delta area includes monitoring of maternal blood contaminants at Inuvik and analysis of dietary surveys of Inuit communities (including Inuvialuit) (AMAP 2000).

7.1.1.6 Ecological Monitoring and Assessment Network Mackenzie Delta Site

Environment Canada co-ordinates and facilitates the conduct of the National Ecological Monitoring and Assessment Network (EMAN). The Mackenzie Delta is one of a number of Arctic EMAN sites (EMAN—NORTH) (one of

approximately 100 in Canada), and is home to a variety of monitoring and research projects conducted by government, academic institutions, and local communities. Many of these programs are conducted in association with other government agencies, academic institutions, and local communities.

Programs include:

- long-term monitoring of snow geese and brant populations;
- a NWT bird checklist survey;
- an ecosystem health monitoring plan (focussed efforts on climate change, contaminants, and development);
- monitoring and modelling of the Mackenzie Delta water level and flow;
- the Rat River char monitoring study; and,
- the Big Fish River—Cache Creek char monitoring study.
- the Gwich'in harvest study;
- the Gwich'in Territorial Park waterfowl survey;
- the Peel River fish study; and,
- monitoring impacts of climate change on the coastal environment (i.e., erosion).

7.1.1.7 Potential Future Research

Potential future research activities in the AOI are numerous. In some instances (i.e., for some species or ecosystem processes or components), the potential for future research in the AOI is significant due to a near absence of information (e.g., bearded seal biology/ecology, winter fish species distribution). In other cases, where a considerable knowledge has already been gained through past research activities, there is a benefit to protecting the potential for additional research (e.g., beluga). In these instances, furthering past research through collection of additional information may be particularly significant from a scientific perspective as further research may generate very useful, and potentially unique, information in the scientific and management realms. Some areas for potential future research are listed below.

Beluga whale:

- Although completed, a number of studies were recently conducted which have generated a need/desire for further research activities on the eastern Beaufort beluga stock, including a need to verify aging data generated in earlier studies;
- Identification of over-wintering sites (Norton and Harwood 2001); and,
- Information on the breeding biology of beluga would also be beneficial to existing management initiatives (i.e., BSBMP) (Harwood 2000).

Contaminants:

A number of studies previously and currently being conducted under AMAP are aimed at addressing trends and monitoring for effects of contaminants in the Arctic. Supporting research initiatives are also being conducted under this programme (AMAP 2001). One of the key areas where AMAP research and monitoring are being focussed is the lower Mackenzie River/Delta area. Future research initiatives could include:

- evaluation of tributyltin (TBT) residues in abiotic and biotic media;
- evaluation of contaminants in biota, including bowhead whale and fish (data are scarce for these organisms); and,
- evaluation of sub-lethal effects of contaminants in beluga whale (and other biota).

Fish Stocks:

- Future research in the AOI could include collection of information pertaining to estimating the abundance and distribution of over-wintering fish species, distribution of various life stages, and levels of contamination in fish.

7.1.2 Research On Inuvialuit Traditional Knowledge

Little research has been done to document Inuvialuit knowledge related to the function and interaction of species, communities, and ecosystems, or that will increase the understanding of the impact and results of marine management. Although Inuvialuit have contributed a lot of knowledge to research focussed on initiatives like land use, conservation or wildlife management plans, little of it has been presented as a separate body of knowledge. Studies to date have focussed on aspects of the beluga whale (Byers and Roberts 1995), the broad whitefish (Freeman and Stevenson 1995, Freeman 1997), and only peripherally touched on the char in the western coastal areas of the proposed MPA (Byers 1993). Inuvialuit of Tuktoyaktuk participated in a study on their perceptions of contaminants (Usher et al. 1995). Inuvialuit perspectives on nature-based tourism (Dressler et al. 2001) were examined, as was the perceptions of contaminants among Inuvialuit in Tuktoyaktuk (Usher et al. 1995). Inuvialuit will need to determine what issues are of concern to them and set priorities for future traditional knowledge research.

7.1.3 Support Or Assistance Of Existing Management Efforts

The AOI overlaps precisely with the existing Beluga Management Zone 1(a), recognized and managed under the Beaufort Sea Beluga Management Plan (FJMC 2001). Numerous additional management plans and initiatives are in place or under development in the ISR, including the AOI (see Sections 1.5 and 2.4 for detailed discussions of fisheries and marine management initiatives).

The AOI also provides important over-wintering habitat for a number of ecologically and socially significant fish species. Protection of these areas would further the mandate of DFO with respect to fish habitat protection. There are also on-going management initiatives and supporting scientific research activities being conducted under the Integrated Fisheries Management Plan for Coney (DFO 2000a) and the Rat River Char Fishing Plan (Aklavik RRC et al. 2000).

7.1.4 Active Support For Research In The Area

Research activities in or adjacent to the AOI have been and continue to be supported by research institutes, academic institutes, and government agencies. For details concerning the nature of current research supported by these organizations, see North/South Consultants Inc. and Inuvialuit Cultural

Resource Centre (2003), the EMAN web site (<http://www.emannorth.ca/>), and various web sites for the academic institutions, research institutes, and government agencies. In general, research has been and continues to be conducted in the AOI or in adjacent areas on themes such as climate change and permafrost monitoring, contaminants, human health, oceanography, and various activities associated with biology/ecology. Organizations that have been involved in research in the Canadian Arctic include, but are not necessarily limited to:

7.1.4.1 Research Institutes and Universities

- Aurora Research Institute (formerly the Inuvik Research Centre) (Inuvik, NT);
- Association of Canadian Universities for northern studies (Ottawa, ON);
- Canada Centre for Remote Sensing (Natural Resources Canada);
- Bartol Research Institute (University of Delaware);
- Department of Indian Affairs and Northern Development (DIAND);
- Freshwater Institute, DFO (Winnipeg, MB);
- McGill University (Montreal, QB);
- National Hydrology Research Centre (Environment Canada (EC));
- World Wildlife Fund (WWF) Canada;
- Northern Studies Centre (Churchill, MB);
- Geological Survey of Canada (Natural Resources Canada (NRC));
- National Water Research Institute (EC);
- South Slave Research Centre (Fort Smith, NWT);
- Dene Cultural Institute (Hay River, NWT);
- Arctic Research Establishment (Pond Inlet, NWT);
- Aurora College (Fort Smith, NWT);
- Nunavut Research Institute (Iqualuit, NWT);
- Simon Fraser University (Burnaby, BC);
- Trent University (Peterborough, ON);
- Laval University (Sainte-Foy, QB);
- University of Northern BC (Prince George, BC);
- University of Saskatchewan (Saskatoon, SK);
- University of Toronto (Toronto, ON);
- University of Winnipeg (Winnipeg, MB);
- Wilfred Laurier University (Waterloo, ON);
- Yukon College (Whitehorse, YN);
- University of Manitoba (Winnipeg, MB);
- University of Alberta (Edmonton, AB);
- University of British Columbia (Vancouver, BC);
- University of Calgary (Calgary, AB) (including the Arctic Institute of North America);
- University of Montreal (Montreal, QB);
- Lakehead University (Thunder Bay, ON);
- Laurentian University (Sudbury, ON);
- Carleton University (Ottawa, ON);
- Memorial University of Newfoundland (St. John's, ND);

7.1.4.2 Non-government Agencies

- WWF;
- Association of Canadian Universities for northern studies (Ottawa, ON);
- Canadian Arctic Resources Committee (Ottawa, ON);
- Canadian Geotechnical Society (Ottawa, ON);
- Yukon Conservation Society (Whitehorse, YN);

7.1.4.3 Government Agencies

- Agriculture and Agri-Food Canada;
- Canadian Polar Commission;
- DFO;
- DIAND;
- EC;
- GSC (NRC);
- Government of the Northwest Territories;
- Health Canada;
- National Energy Board;
- NRC; and,
- Parks Canada.

7.1.4.4 Management Organizations, Committees, and Corporations

There are numerous organizations and co-management groups involved in renewable resource management in the AOI, including many formed under the Inuvialuit Final Agreement. These groups include:

- FJMC;
- Inuvik HTC;
- Aklavik HTC;
- Tuktoyaktuk HTC;
- Inuvik—Aklavik Community Conservation Plan Working Group;
- North Slope and NWT Wildlife Management Advisory Councils (WMACs);
- Various Community Corporations (CCs) (i.e., Aklavik CC, Inuvik CC, and Tuktoyaktuk CC);
- Inuvialuit Regional Corporation;
- Impact Review Board;
- Environmental Impact Screening Committee;
- Inuvialuit Game Council;
- Gwich'in Renewable Resources Board;
- Gwich'in Land Use Planning Board;
- Gwich'in Tribal Council; and,
- Gwich'in Land and Water Board.

7.1.5 AOI As Benchmark For Scientific Monitoring

The AOI is located within the Mackenzie Delta EMAN site and is an area of focus under AMAP (see above for details). Under the auspices of these programs, a number of studies have already been initiated and are scheduled to continue for at least several years. Many of these studies could contribute valuable information regarding general trends and effects in the Canadian Arctic, the Arctic in general, and in a global context.

Specifically, research and monitoring efforts aimed at issues pertaining to climate change and contaminants could generate information that would serve as a 'benchmark' for trends in a larger geographic scope, as well as temporal trends. The Beaufort Sea and coast is particularly vulnerable to effects of climate change and it is believed that it would serve as an early warning indicator of global climate change. In addition, accumulation, and the associated effects, of contaminants in the abiotic and biotic environment of the Beaufort Sea would also provide information regarding the magnitude of global contamination due to anthropogenic activities. This is largely due to the preponderance for accumulation of contaminants in the north via long-range atmospheric and hydrological transport (i.e., the cold finger effect).

7.1.6 Potential To Serve As A Reference Area

Due to development pressures in the north, protection of the AOI from development could prove of additional benefit from the perspective of assessing change in other areas. Specifically, the AOI could serve as a reference area for environmental impact assessment associated with proposed development and monitoring effects of anthropogenic activities in other areas of the Mackenzie River Estuary. With projected increases in oil and gas development in the coastal Beaufort Sea in the near future (Brackman 2001), this use could be of particular merit to the region as a whole.

7.1.7 Interdisciplinary Research Initiatives

As discussed above, there are a number of active interdisciplinary research and monitoring initiatives in the AOI. Organizations involved in research activities include representative groups from local communities, national and local governments, research institutions, and academic organizations.

7.1.8 Variety Of Habitat Types/Ecosystem Relationships Relevant For Research

As the AOI is located in a complex and dynamic environment, potential for unique and valuable research is great. However, it is understood that the high degree of natural variability may limit the area's attractiveness to many as a research site.

7.2 OTHER ECOLOGICAL CONSIDERATIONS

7.2.1 Naturalness/State of the Environment

In general, the AOI is not degraded. However, the southern Beaufort Sea, in general, is subject to a number of anthropogenic stressors and pressures most notably:

- Harvesting;
- Oil and gas exploration and development;
- Shipping;
- Tourism;
- Climate change; and,
- Contaminants (point and non-point sources).

Available information indicates that harvesting does not appear to have degraded the local populations of marine mammals and fish. The eastern Beaufort Sea beluga stock is reportedly stable and is not being overexploited by current levels of harvest (DFO 2000b). Similarly, stocks of inconnu and Dolly Varden are also believed to be stable and sustainable at current harvesting rates (DFO 1998, 2001).

Oil and gas exploration activities have occurred within and adjacent to the AOI, particularly near the Kendall Island area and adjacent to the Kugmallit Bay Zone near Tuktoyaktuk (Melnyk 2001). In addition, there is one abandoned artificial island where drilling had taken place and a historical gas well in the Kendall Island Zone (Melnyk 2001). One of three proposed routes for a proposed Mackenzie Valley Pipeline, the Mackenzie Valley to Beaufort Sea/Alaska Pipeline (Arctic Resources Co.), also runs directly through the Mackenzie Bay Zone of the AOI.

Shipping and tourism activities generally exert reversible effects (i.e., effects are largely temporary physical disruptions); therefore, if these activities were reduced or eliminated in the AOI, their effects would also be reduced or eliminated. Perhaps the one exception to this generalization is the introduction of persistent contaminants from past and continuing shipping and tourism activities in the area (e.g., tributyltin tin leaching from ship hulls).

Currently, boat tours and flight paths for ecotourism are operated in the AOI (Melnyk 2001). Dressler (et al. 2001) noted the concern of some Inuvialuit elders regarding the effects of charter planes, kayaks, and outboard motors on beluga whales. A major shipping route for the transport of bulk cargo crosses through the Kugmallit Bay Zone (Melnyk 2001). Kugmallit Bay was exposed to heavy shipping traffic during peak oil exploration and development and it is likely that traffic would again increase in the event of renewed oil and gas development.

Effects of shipping activities on marine mammals (i.e., whales) are generally reversible (i.e., physical and acoustical disturbance). Management of shipping traffic in the AOI would mitigate the immediate effects of this activity on marine mammals. However, ongoing activities in areas adjacent to the AOI would affect the same populations of marine mammals and designation of an MPA would not eliminate the effects of this stressor on marine mammals.

Climate change is likely the most significant threat to the integrity of the Beaufort Sea, including the AOI. There is growing evidence that climate changes resulting from greenhouse gas emissions will probably be most severe at high latitudes, and particularly severe within the Beaufort Sea and Mackenzie Delta. During the last century, temperatures in the western Arctic have increased by at least four times the global average (Thomas 1992). If greenhouse gas concentrations continue to increase at the present rate, air temperatures in this region would warm by 4° or 5° C by 2050 (Tynan and DeMaster 1997). A warmer climate in the Beaufort Sea region is predicted to affect local marine coastal ecosystems through processes such as thawing

permafrost, reduction of the extent and thickness of sea ice, rising sea level, increased coastal erosion, and habitat alteration (Solomon and Forbes 1994, Cohen 1997, Tynan and DeMaster 1997). Stock reductions or collapse may occur if alterations in thermal regimes and/or suspended sediment levels due to erosion affect critical spawning or over-wintering habitats.

Changes in the extent and thickness of sea ice, which is expected to decrease, may affect the habitats and movements of fish, birds, and marine mammals. Alterations of seasonal distributions, ranges, migration patterns, feeding, reproduction, abundance, and stock structure are possible, particularly for marine mammals (Tynan and DeMaster 1997). Altered ocean circulation patterns and salinity levels can also affect fish stocks or marine mammal stocks by altering food webs, shifting species ranges and migration patterns (which can lead to invasions by exotic species as well as local extinctions) and by influencing reproduction. Inuvialuit observations of climate change have been documented for the Sachs Harbour area and serve as a good example of the types of impacts that are being witnessed and research that is needed (Riedlinger and Berkes 2001).

Climate change and its effects on the AOI (and the Beaufort Sea in general) can not be managed through designation of an MPA and effects that have occurred to date, as well as those that will continue to develop, can not be remediated.

Research to date has indicated that the Beaufort Sea contains relatively low levels of Cd and some organic contaminants but relatively high levels of other organic contaminants and metals, such as mercury. Specifically, some organochlorines and Cd are lower in the Beaufort Sea than other regions of the Canadian Arctic (Macdonald et al. 2000). Conversely, levels of mercury are higher in the Beaufort Sea than in the eastern Arctic, although this disparity is believed to be due to differences in biogeochemistry and geology and not due to higher inputs of mercury in the west (Wagemann et al. 1995). In general, concentrations of Hg in marine mammals, including beluga whale, are higher in the western Arctic, including the Beaufort Sea, while concentrations of Cd are lower than the eastern Arctic (Muir et al. 1999). Concentrations of Hg in tissues of beluga whale from the Mackenzie Delta have also exceeded the federal consumption limit of 0.5 µg/g for decades (Muir et al. 1992, 1999, Wagemann et al. 1996).

In a more general context, due to long-range atmospheric transport processes, a suite of contaminants are present in Arctic air, snow, water, and biota (Macdonald and Thomas 1991, Macdonald et al. 2000). Therefore, contaminants are present in all components of the Beaufort Sea, including the AOI. Like effects of climate change, introduction of contaminants from non-point sources, including long-range atmospheric and hydrological (i.e., sea ice and water) transport, can not be managed through designation of an MPA.

7.2.2 Integrity

7.2.2.1 Adequate Size of the AOI

The size of the AOI is adequate to manage local activities that may exert stress upon the local ecosystem and biota while they reside in the area (i.e., beluga habitat in the AOI). Specifically, the designation of the AOI as an MPA would provide a mechanism for limiting and/or managing any activities that currently occur or could potentially occur in the area in the future (i.e., within the boundaries of the AOI). These activities would include oil and gas development, transport industry activities (i.e., shipping, ice roads, air transportation), mining, harvesting, tourism, and any potential local development (e.g., infrastructure such as harbours).

However, the designation of MPA status would not be adequate to address potential stress arising from activities outside the MPA boundaries or threats due to non-localized processes and activities. Specifically, designation of an MPA would not provide a mechanism for managing or mitigating effects to the ecosystem, including beluga whale, due to stressors such as climate change and accumulation of contaminants due to long-range, non-point source introduction. As both of these stressors are considered the largest threats to the integrity of the Beaufort Sea, it is critical that these issues be addressed through other legislative mechanisms (e.g., *Fisheries Act*, International Treaties and Conventions).

With respect to beluga whale, and other migratory species, it is further recognized that provision of marine protected status in the AOI (beluga management zone 1(a)) does not address stressors that are exerted on the population outside of the AOI. Therefore, management of the eastern Beaufort Sea beluga stock, as opposed to management of the congregation areas in the AOI, would be required through inter-jurisdictional and international initiatives to provide protection to this stock in a more comprehensive manner. The same argument applies to other biota that are not permanent residents of the AOI (i.e., migratory species). For some species, critical habitat is located outside of the AOI. For example, it is believed that the most critical threats to the Rat River Dolly Varden stock are habitat alteration and/or degradation of spawning and over-wintering sites on Fish Creek (DFO 2001).

Due to the dynamic and complex nature of the Beaufort Sea in general, it is also acknowledged that conditions outside the AOI boundaries may have profound effects on conditions within the AOI. Furthermore, the three areas within the AOI are not discretely bounded and are in fact continuous with the Estuary and Beaufort Sea. In addition, the three areas are greatly influenced by activities that occur upstream, such as those that occur in the Mackenzie River watershed. Therefore, to provide protection to non-permanent resident species, their entire home range would require protection.

8.0

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