1 INTRODUCTION

The Nunavut Land Claims Agreement (NLCA) established the Nunavut Planning Commission (NPC) which is responsible for developing land use plans, policies and objectives. The NPC emphasizes the current and future well-being of the residents and communities of the Nunavut Settlement Area (NSA).

The NPC is initiating a land use planning process to ensure the sustainable development of the lands, waters, wildlife and offshore areas of the NSA. This process includes compiling and analyzing information on key aspects of Nunavut's environment. This will facilitate discussions with communities and planning partners and ensure land use decisions are based on the best available information. Wildlife is a fundamental component of land use planning given its importance to Inuit culture and economy, to the ecology of the region and for its tourism value.

This report compiles wildlife resources and habitat values in Nunavut and includes the most current spatial database on Nunavut wildlife. The spatial information and issues identified can be used to determine appropriate zoning and terms for development.

1.1 Objectives

The primary objectives of this study are to identify wildlife species important for ecological, social, cultural and economic reasons, review their current status, habitat needs, and challenges and present potential solutions to those challenges. This amendment includes updates to figures from the 2010 Arctic Marine Workshop, recent published literature on the marine mammal, caribou, and muskox focus species, and has included the two proposed national parks and proposed Lancaster Sound Marine Conservation area.

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2 METHODOLOGY

2.1 Identification of Focal Species and Species Groups

A comprehensive list of all fish, birds, aquatic (freshwater and marine), and terrestrial species currently present in Nunavut was compiled. This report contains general descriptions of species groups, and summarizes the number of species, status, distribution, general ecology, habitat requirements, issues, and considerations for land use planning.

A short list of culturally, ecologically, and commercially important species was then developed. The focus of the short list is on species of importance for Inuit subsistence use, commercial harvest and harvest viability, species important for outfitting, ecologically sensitive species, and species with special status (e.g., special concern, threatened, endangered, or subject to protection or special commitments) at territorial, federal and international levels.

2.2 Literature Review

For each short-listed species, information on current status, distribution, general ecology, key habitat requirements, population status and trends, issues or pressures, and considerations for land use planning was compiled and reviewed. Information was obtained from research reports and progress reports from technical and scientific studies. Additionally, individuals known to be actively completing or undertaking research related to species on the short list were contacted. Sources of information for this report include:

- Federal Government agencies (e.g., Fisheries and Oceans Canada (DFO), Canadian Wildlife Service (CWS) (Environment Canada), Environmental Protection Branch (Environment Canada), Indian and Northern Affairs Canada (INAC), Natural Resources Canada
- Federal research institutes (e.g., Bedford Institute, Institute of Ocean Sciences)
- Government of Nunavut (GN) agencies (e.g., Department of Environment, Wildlife Research Group, Parks)
- Territorial research organizations and institutes (e.g., Nunavut Research Institute (NRI), Prince of Wales Northern Heritage Centre, Beverly and Quamanirjuaq Caribou Management Board, Bathurst Caribou Management Planning Committee)
- Nunavut Wildlife Management Board (NWMB), Regional Wildlife Organizations (RWO) and local Hunter and Trapper Organizations (HTOs)
- Universities and Colleges (e.g., ArcticNet, Canadian Arctic Shelf Exchange Study (CASES), Nunavut Arctic College, Arctic Science and Technology Information System (ASTIS) database, International Polar Year and Arctic Institute of North America)

The Inuit, through generations of observations, group animals and plants using practical characteristics such as appearance, behaviour, and relevance to the Inuit. In some cases, Inuit classification is fundamentally different from scientific taxonomy, often including an animal in more than one category. For example, ptarmigans (*aqiggit*), form part of the group of *ukiuqtait* because they stay in the North all winter; but as herbivores they also belong with the *nunatuqtiit*. This grouping shows an appreciation by the Inuit for two distinctive features in the ecology of the ptarmigan. In an Arctic environment, these features are more important than the species' genetic relatedness to other species.

The Inuit classification system has been incorporated into the description of short listed species and is included in the spatial database. Each short listed species can be characterized based on traditional Inuit classification in addition to standard scientific classification. By adopting this approach, both western and Inuit perspectives are incorporated into the database and map products. This facilitates the utility of the products during the land use planning process and community planning meetings.

2.3 Spatial Database

All spatial data are supplied in both ESRI Shapefile and Geodatabase format. An exception to this is the 1:250,000 scale contour files. The size of the contour files (1GB) makes it impractical to have multiple copies. Therefore, this dataset is provided in Shapefile format only.

Spatial data resides in six ESRI personal geodatabases:

- "NTDB_250K_Base_Date.mdb"—1:250,000 scale contour data acquired from NPC and National Topographic Data Base (NTDB) downloads
- "Nunavut_Base_Data.mdb"—1:7,000,000 scale base data acquired from Geogratis Atlas of Canada Base Maps
- "Nunavut_Birds.mdb"—bird spatial data
- "Nunavut_Fish_Invertebrates.mdb"—fish and invertebrate spatial data
- "Nunavut_Marine_Mammals.mdb"—marine mammal spatial data
- "Nunavut_Terrestrial_Mammals.mdb"—terrestrial mammal spatial data.

2.3.1 Metadata and Projection

Federal Geographic Data Committee Content (FGDC) compliant metadata are provided for all spatial layers, either in the .xml file in the case of the shapefile or contained within the geodatabase and viewed through ArcCatalog in the case of the feature class data. The metadata are also available in the "Data Dictionary" for all spatial layers. All internally created feature classes are accompanied by metadata created by Jacques Whitford AXYS (JWA).

In addition to the "Data Dictionary", there is an "ArcMap project (.mxd) Dictionary" summarizing each spatial layer used in each ArcMap project.

All spatial data are projected to Canada Lambert Conformal Conic, North American Datum 1983 (NAD83). For a listing of Lambert Conformal Conic data parameters, please refer to the spatial metadata information.

2.3.2 Spatial Data Creation and Processing

1:250,000 NTDB Base Data

The 1:250,000 feature data classes were merged into three feature classes. The first two feature classes contain all NTDB data provided by NPC and were broken down to ease handling due to file sizes. The third feature class contains all NTDB data downloaded by JWA. This version cannot be easily merged into the earlier version due to structural differences.

JWA Captured Spatial Data

The majority of Nunavut wildlife studies are available in hard copy and do not contain digital data files. As a result, JWA undertook the following process to capture these data:

- The figure in the report was scanned, creating an image file
- The image file was loaded into ArcMap and georeferenced
- The features were captured within ArcMap using heads-up on screen capture techniques
- Attributes were assigned to each feature
- The appropriate metadata were created.

The process used for data capture is included with the metadata for each file.

2.3.3 Mapping and Figure Production

Digital information used to create report maps are included in the accompanying data files. All final map documents (mxds) are included and organized within the structure of the folders. This report includes the following maps (with accompanying digital files):

- The range and important habitat of each short-listed wildlife species
- Identification of herds or subpopulations as appropriate
- Seasonal information (dates, importance) related to range and critical habitat of short-listed species where known and appropriate
- Range and critical habitat for other species, as appropriate
- Locations of current commercial wildlife harvesting operations, and potential areas for expansion of existing activities
- The spatial extent of wildlife data/information used to create each map
- The spatial extent of wildlife research coverage and gaps in Nunavut.

Two 11 x 17" landscape map templates were created in ArcMap; a regional map at the 1:11,000,000 scale and a detailed map at the 1:250,000 scale. The most suitable scale for each map was determined by data availability and distribution.

2.4 Habitat Analysis

Critical habitats are species specific, and defined as those necessary for the persistence of a population, for example areas of feeding or breeding. For some species, critical habitat is defined under a National Recovery Plan. In cases where Recovery Plans do not exist, professional judgement was used to delineate critical habitats for life requisites. Use of professional judgement for the purposes of this report does not imply a legal determination for these species under the *Species at Risk Act* (SARA) or other legislation. If available information was not suitable to infer important habitat, this was identified as an information gap (Section 7).

Potential opportunities to expand the commercial use of wildlife was drawn from existing research and discussions with local community organizations, Hunters and Trappers associations (HTO), researchers, wildlife managers, and the NPC. A complete analysis of commercial potential would require a detailed knowledge of demographic parameters and economics of the region, therefore recommendations regarding future opportunities for expansion are largely qualitative in nature.

3 FOCAL SPECIES AND SPECIES GROUPS

Table 3.2-1 (Appendix A) provides a list of wildlife species present in Nunavut land and waters and identifies focal species and species groups for further review and habitat analysis. Wildlife species were selected for further review if they met one or more of the following criteria:

- Recognized by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as a Special Concern, Threatened, or Endangered species
- Designated Sensitive, May Be At Risk, or At Risk by the Government of Nunavut
- Known to be of cultural, economic or subsistence interest to Nunavut residents.

These criteria resulted in 76 species or species groups being identified for assessment (Table 3.2–1, Appendix A). Species fact sheets have been developed and are provided in Section 4 for those species identified in the short list.

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4 LITERATURE REVIEW OF FOCUS SPECIES AND SPECIES GROUPS

4.1 Marine Mammals

4.1.1 Ringed Seal

Inuit Names: Netsiak, Netsiavinerk, or Netsilak
Scientific Name: *Phoca hispida*

Conservation Status

Not At Risk (COSEWIC 1989). Ringed seals are designated as Least Concern by the IUCN (Kovacs *et al.* 2008). Population estimates of this species are extremely difficult due to a number of factors including their wide-ranging and highly variable distribution, and the unknown relationship between the numbers of seals observed versus not observed (Frost and Lowry 1981). There are thought to be approximately one million in the eastern Canadian Arctic (DFO 2006a).

Distribution

The ringed seal has a circumpolar and ubiquitous distribution. They are the most abundant and widespread seal in the Arctic. The distribution of this circumpolar and ubiquitous species is strongly correlated with seasonally and permanently ice-covered waters and food availability (Freitas *et al.* 2008). They are particularly high in density in Lancaster Sound, Barrow Strait, Bellot Strait, the fjords off the east coasts of Ellesmere and Baffin Islands, the Beaufort Sea and the west coast of Banks Island (Finley *et al.* 1983; Kingsley *et al.* 1985; Born *et al.* 2004; Stirling and Smith 2004; Stephenson and Hartwig 2010a). Figure 4.1-1 (Appendix B) illustrates the range of ringed seals in Nunavut where they occur year-round. During winter, male and female non-breeders will migrate to floe-edges and other areas where food is available, while mature adults will stay in preferred breeding habitats under nearshore stable ice (Hammill and Smith 1991).

Ecology

This seal exclusively uses ice habitat consisting of leads, pressure ridges and polynyas on land-fast ice in the Arctic (Frost and Lowry 1981). Ringed seals tend to be solitary, but will congregate in large numbers to haul-out on fast and cracking ice of high cover and occasionally travel in loosely organized groups (Kingsley *et al.* 1985; Evans and Raga 2001). They are able to maintain breathing holes in ice using well-developed claws on their foreflippers which enables them to occupy areas of Nunavut inaccessible to other marine mammals during the colder seasons.

Highest densities are found near suitable birthing lair[1] habitat where shore leads and snow drifts are approximately one meter high (Kingsley *et al.* 1985), Figure 4.1-1 (Appendix B). Offshore pack-ice is occasionally used for birthing in Davis Strait (Wiig *et al.* 1999). Ringed seal pups are born mid-March

[1] Den-like place that seal will use to give birth

to mid-April and weaned prior to spring break-up in June (Frost and Lowry 1981; Evans and Raga 2001). Pups will stay in the subnivean[2] dens during the five to eight week lactation phase to remain out of sight from predators (Evans and Raga 2001).

In late June and early July (as early as March) large numbers of ringed seals haul-out on the sea ice to bask in the sun. Young seals feed mainly on small crustaceans (amphipods, mysids and shrimp) under the ice and in the water column. Adults' diets are composed of larger crustaceans, small fish (e.g., arctic cod) and plankton (Richard 2001).

Ecological/Economic Importance

Ringed seals are ecologically important and are considered a keystone species[3] (Ferguson *et al*. 2005). They are a significant food source for polar bears that feed on adults at the ice edge and pups in dens and for arctic fox which feed on denning pups (Hammill and Smith 1991). Coastal Inuit depend on ringed seals for meat (considered a main staple food source) and skins which are fashioned into various items to be used and sometimes sold (though market is depressed at the moment) (DFO 2011). All 28 communities in Nunavut harvest ringed seal (Priest and Usher 2004a). Over the course of a five year period, from 1996 to 2001, the total mean annual harvest was estimated at 25,086 (Priest and Usher 2004a). The Inuit describe ringed seals as a safe and reliable species to hunt because they inhabit the areas close to land all year round (Polar Eskimo in Richard 2001).

Issues/Concerns

Climate change is a prominent threat to ringed seals, particularly if it leads to large losses of stable ice habitat which the seals rely on for pupping and rearing (Tynan and DeMaster 1997; Kovacs *et al.* 2008; Laidre *et al.* 2008). Melting ice and early season rain is likely to increase in frequency, and may destroy suitable birth lairs, result in higher predation success of polar bears and increase the risk of hypothermia resulting in decreased recruitment (Hammill and Smith 1991; Smith and Harwood 2001; Ferguson *et al.* 2005).

Climate change may also affect the distribution and abundances of ringed seal prey items in the Arctic such as cod species. Reduction in regional productivity may contribute to poorer nutritional condition of ringed seals in the Beaufort Sea (Harwood and Stirling 1992; Tynan and DeMaster 1997). If reduced productivity because more frequent, the predicted effects are likely to have a significant negative effect on ringed seals in the Arctic.

Land Use Planning Considerations

Ringed seals may be susceptible to the effects caused by land-based development as adults overwinter under stable, coastal, nearshore ice (Smith 1981). Increases in environmental contaminants, offshore oil and gas activities, shipping, hunting, and commercial fisheries may

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[2] Beneath the snow cover; the interface between snow and the surface of the ground

[3] Keystone species are those which have a disproportionate effect on their environment relative to their abundance by affecting other organisms in their ecosystem and help to determine the types and numbers of various species in a community

increasingly become threats for ringed seals (Born *et al.* 1999; Becker 2000; Blackwell *et al.* 2004). If global warming contributes to a reduction in sea ice, it will likely lead to an increase in industrial activities such as resource extraction and associated shipping (Pagnan 2000).

There are no management practices or Total Allowable Catch (TAC) in place to manage the ringed seal population in Nunavut; however; the seal hunt management plan constructed by DFO for 2006 to 2010 recognizes that some ringed seals are taken for subsistence use during the seal hunt. There are no conservation strategies at present for the direct protection of ringed seals in Nunavut.

4.1.2 Bearded Seal

Inuit Name: Ugjuk
Scientific Name: *Erignathus barbatus*

Conservation Status

The bearded seal is listed as Data Deficient by COSEWIC because in Canada there are no complete, reliable or recent estimates of total abundance and spatial distribution (COSEWIC 2007f). More specifically, there are no population estimates for the bearded seal in Nunavut. The IUCN has listed the bearded seal as Least Concern because globally it has a large population size, broad distribution, variable feeding habits and no evidence of decline (Kovacs and Lowry 2008).

Distribution

Bearded seals have a circumpolar distribution and are found throughout all of Hudson Bay They are year-round inhabitants of Nunavut and can be found in northern regions during the summer and in southern regions during the winter (Kingsley *et al.* 1985; Gilchrist and Robertson 2000). They are typically observed as solitary individuals and prefer areas with moving pack ice, such as leads and polynyas. Small groups of animals form when ice availability is limited, such as during molting in midsummer (between March and August) (Evans and Raga 2001). Figure 4.1-2 (Appendix B) shows the known distribution of bearded seal in Nunavut.

Ecology

Bearded seals prefer water depths of less than 100 m that are often associated with areas of moving ice, such as leads, floes, rotten ice and polynyas and they are usually absent from multiyear ice (Kingsley *et al.* 1985). They maintain breathing holes in thin ice by breaking through with their heads. Burns (1967) noted that bearded seals tended to move away from shallow coastal water in fall as land-fast ice formed and ringed seal presence increased.

The majority of their diet includes benthic animals in the shallower waters of the continental shelf such as crustaceans, clams, and worms as well as some schooling and demersal fish (e.g., arctic cod, sculpin and flounder) (Lowry *et al.* 1980; Finley and Evans 1983). In the eastern Canadian Arctic summer, bearded seals prey primarily on fish, with their diet consisting of up to 90% fish, dominated by sculpins and Arctic cod (Finley and Evans 1983).

Bearded seals have well developed sight and hearing, and a moderate sense of smell. Males will communicate acoustically underwater during April and May to court females (Cleator *et al.* 1989). Their in-air vocal behaviour has not been studied to date.

Mating occurs mid-April to mid-May implantation is delayed for 2 months, followed by approximately 11 month gestation (Evans and Raga 2001). A single pup is born on ice in late April to early May nursing lasts 12 to 18 days after which the pup is abandoned (Evans and Raga 2001). Pups will join their mothers in the water within hours after birth (Kovacs *et al.* 1996). A female may give birth once every one to two years after reaching sexual maturity at the age of six until the age of 20 to 30 (Evans and Raga 2001).

Ecological/Economic Importance

Bearded seals are ecologically important as they are a significant food source for polar bears. Variables that negatively affect seal populations could adversely affect the entire arctic marine ecosystem.

Bearded seals are important subsistence for the Inuit of Nunavut (Furgal *et al.* 2002; Hovelsrud *et al.* 2008). They are widely hunted for their tough, flexible hides, which can be fashioned into harpoon lines, dog harnesses, whips, traces and boot soles. The meat of the bearded seal is consumed by the Inuit of Nunavut; however, less common than the ringed seal (Richard 2001).

There is no TAC for the bearded seal in Nunavut. All communities in Nunavut except one hunt the bearded seal. Over a five-year period from 1996 to 2001 the annual mean number of bearded seals taken from hunting was 1,476 (Priest and Usher 2004a).

Issues/Challenges

Arctic offshore oil and gas development, shipping activities, environmental contamination, hunting and commercial fisheries are all possible threats to the bearded seal. These threats may exclude them from preferred habitats, have negative effects on their health, over-exploit the population or increase competition for food sources (Huntington 2000). Oil spills and contamination may indirectly affect bearded seals by direct contact and damage to their benthic forage areas which are particularly vulnerable to oil contamination.

Climate change is a significant threat to the bearded seal because they rely on sea ice for whelping, nursing and as haul-out sites to rest. Changes in the extent and duration of sea-ice cover in Nunavut could result in reductions of suitable habitat (Tynan and DeMaster 1997; Huntington 2009). Climate change may also affect the distribution and abundance of bearded seal prey items in the Arctic. Warming of shallow water may move the summer position of the ice edge to deeper water, thus decreasing the availability of shallow thin ice cover habitat suitable for benthic foraging, which in the long term, could result in lower reproductive capability and species fitness (Tynan and DeMaster 1997).

Land Use Planning Considerations

Bearded seals inhabit shallow coastal areas, including estuaries and inlets (Kingsley *et al.* 1985). Increased development in coastal areas may cause increased pollution and acoustic disturbances. Vessel traffic and terminal construction has the potential to exclude bearded seal from their preferred habitats (as described above).

There is no TAC for hunting, or any management practices or conservation zones in place at present to manage the bearded seal. Several conservation zones described in Figure 4.1-2 (Appendix B) border the bearded seal range and high densities locations which likely provide some protection for the species.

4.1.3 Harp Seal

Inuit Name: Qairulik
Scientific Name: *Pagophilus groenlandicus*

Conservation Status

The harp seal has not been assessed by COSEWIC; however they are on the mid-priority candidate list (COSEWIC 2011). 'Candidate wildlife species' have been recognized by the Species Specialist Subcommittees or by the Aboriginal Traditional Knowledge Subcommittee as candidates for detailed status assessment because they are suspected of being at some risk of extinction or extirpation. The most recent aerial survey of the northwest Atlantic harp seal population was conducted in 2008 by DFO, and resulted in an estimate of 8.1 million individuals (95% CI=7.3 to 8.9 million). There are no regionally specific population estimates (i.e., for Nunavut). The IUCN has assessed the harp seal as Least Concern due to its large population size and increasing trends (Kovacs 2008).

Distribution

The Northwest Atlantic harp seal population is present in Nunavut during the open water season (mid-July to September) along the east coast of Baffin Island. They concentrate in large numbers (upwards of 20,000 individuals) in Lancaster, Eclipse and Jones Sounds and at the head of Cumberland Sound and Frobisher Bay (Stephenson and Hartwig 2010a). They are also present around coastal areas of Baffin Island, throughout Foxe-Basin, northern Hudson Bay and Hudson Strait (Richard 2001) (Appendix B, Figure 4.1-3). A small number of harp seals migrate westward in Hudson Bay to Southampton Island and occasionally as far south as the Belcher Islands near James Bay (Richard 2001) (Appendix B, Figure 4.1-3).

During the fall, when the sea ice begins to form in Nunavut, most adults and juveniles migrate south, along the east and west coast of Baffin Island, through Hudson Strait, to whelping grounds near Labrador and the Gulf of St. Lawrence (DFO 2005). Neither of the whelping grounds is near Nunavut boundaries.

Ecology

The seals migrate north for the summer, following the pack ice up the coast of Labrador with relatively small numbers entering Hudson Bay, around Baffin Island and the majority travel up both sides of Davis Strait (Lavigne and Kovacs 1988). Harp seals are social, travelling and foraging in groups. They consume a wide variety of prey relative to prey availability along their migration route, feeding intensely during summer and winter. In Nunavut, they feed on schooling fish, bottom fish, shrimp, krill and arctic cod in Nunavut (Richard 2001). They prefer shallow dives near the pack ice edge, especially during breeding and the spring moult (Folkow *et al.* 2004).

Males are sexually mature at 7 – 8 years, females at 4 – 6 and may live up to 35 years; however, few exceed 25 years of age. Harp seals give birth in large herds on ice in late February and March. The birth of the pups is highly synchronized after 11 months of gestation, they nurse for 12 days, then the pups are abandoned so the adults can mate in the water (Evans and Raga 2001; Richard 2001).

Ecological/Economic Importance

Harp seals have a long commercial harvest history in Canada and have been harvested by native peoples for subsistence use for thousands of years (Lavigne and Kovacs 1988). Local residents of Nunavut currently hunt harp seals for food and fur (Richard 2001). Many communities (18 out of 28) in Nunavut hunt harp seal (Priest and Usher 2004a). Over a five year period from 1996 to 2001 the total annual mean number of harp seals taken from hunting was approximately 1,432 (Priest and Usher 2004a).

The harp seal hunt in Nunavut is managed by the DFO and TACs are re-assessed on an annual basis. The TAC is set annually to account for new information on the status of the population, changing environmental conditions and levels of hunt in Arctic Canada and Greenland. The TAC for 2006 was 325,000 seals (DFO 2006a).

Issues/Challenges

Threats to harp seals include predation by polar bears, killer whales, and Greenland sharks (Richard 2001). Environmental contamination, offshore oil and gas activities, shipping, hunting, commercial fisheries and climate change all pose a potential threat to harp seals in Nunavut (Huntington 2009). Commercial fisheries may compete with harp seals for food (Huntington 2009) or may take harp seals as by-catch. Approximately 5,000 harp seals are taken each year for Canadian commercial fisheries (plus almost 20,000 caught as bycatch in the lumpfish fishery of Newfoundland) (DFO 2006a).

Climate change may have negative or positive effects on harp seals. Harp seals follow the receding and forming ice edge during their spring and autumn migrations (Richard 2001). Earlier ice break-up and longer ice-free seasons as a result of climate change may cause harp seal migration timing to be altered (Huntington 2009). It is possible that longer ice-free seasons in the Arctic could be beneficial to the harp seal and allow them to encroach into more northern latitudes and remain there longer (Moore and Huntington 2008; Huntington 2009). As well, it is likely that reductions in sea ice will likely have negative effects on harp seal reproduction due to their dependency on specific whelping areas on the ice (Moore and Huntington 2008). However, because there is little information on their activities during their residence in Nunavut, no accurate prediction can be made.

Land Use Planning Considerations

Future development, terminal construction and vessel traffic in Nunavut may displace harp seals from preferred habitat particularly along the east coast of Baffin Bay and through Lancaster Sound (Stephenson and Hartwig 2010b). Such an effect would occur only during the open water season when harp seals are present in Nunavut (DFO 2005). There are no conservation zones for the protection of the harp seal in Nunavut to be taken into account for land use planning.

4.1.4 Walrus

Inuit Name: Aivik
Scientific Name: *Odobenus rosmarus rosmarus*

Conservation Status

The Atlantic walrus is classified as Special Concern by COSEWIC (COSEWIC 2006b). This species is divided into four extant populations in the eastern Arctic for management purposes but population specific knowledge is not sufficient to assess them separately.

Distribution

The walrus has a discontinuous circumpolar distribution in the Arctic. Within Nunavut, the Atlantic walrus ranges from Bathurst and Prince of Wales islands to Davis Strait and from James Bay to Kane Basin (DFO 2008b). Four distinct populations of Atlantic walrus have been identified in Canada, all of which reside in Nunavut: South and East Hudson Bay, Hudson Bay-Davis Strait, Foxe Basin and Baffin Bay (Stewart 2002). These populations have been identified for management purposes based on geographical distribution, changes in abundance, contaminants, and lead isotope ratios and signatures; however, the level of interbreeding and resulting genetic mixing between populations in unknown.

Atlantic walruses are known to occur throughout the year in some areas of Nunavut and only seasonally others. The South and East Hudson Bay population is distributed over an area of about 65,000 km^2, from the Ottawa Islands south to the Ekwan Point area of James Bay and inhabit the Belcher Islands. The Northern Hudson Bay-Davis Strait population is distributed over an area of about 385,000 km^2, from Arviat on the west coast of Hudson Bay north and east through Hudson Strait to Clyde River on the east coast of Baffin Island. Walruses are widely distributed in the relatively shallow waters of northern Foxe Basin, an area of about 50,000 km^2, where they live year-round. The Baffin Bay population is distributed over an area of about 150,000 km^2 that extends west to Bathurst Island, north to Kane Basin and northwest to Greenland (COSEWIC 2006b). This population concentrates year-round at the northwest tip of Devon Island; however; some individuals will migrate through Lancaster Sound during the summer along the coastal waters of southern Devon Island. Distributions are illustrated in Appendix B, Figure 4.1-4.

Ecology

Atlantic walruses require large areas of shallow water (less than 80 m) with bottom substrates that support productive bivalve communities, open water and suitable ice or land nearby upon which to haul-out (Davis *et al.* 1980).

In winter, walruses are found hauled out on ice floes in large social groups. The rest of the year, they often gather in large herds and are associated with moving pack-ice (Richard 2001). When ice is lacking in summer and fall Atlantic walrus congregate on land in a few predictable haul-out locations (Appendix B, Figure 4.1–4) (COSEWIC 2006b). The largest haul-out sites in Nunavut are located on the northwest shores of Coats Island, Bencas Island and Walrus Islands of Hudson Bay (COSEWIC 2006b). Suitable land habitat is defined by low, rocky shores with steep or shelving subtidal zones where animals have easy access to the ocean for feeding activities or for escape from predators. Walruses generally move to more sheltered areas when there are strong onshore winds and heavy seas (COSEWIC 2006b).

Walruses are known to travel long distances by swimming or by riding ice floes but their seasonal movements are not well understood. They feed predominantly on bivalve molluscs and arctic cod; however a wide variety of other animals have been found in their stomach contents including gastropods, sea cucumbers, sea urchins, polychaetes, amphipods and isopods, and brachiopods (Fisher and Stewart 1997).

Walruses are polygynous; one male competes to mate with multiple females from February through April. Implantation of the embryo is delayed until late June or early July, and gestation is about 11 months (Garlich-Miller and Stewart 1999). Most young are born in late May and early June and suckle for 25 to 27 months (Fisher and Stewart 1997). Females mature between the ages of 5 to 10 years and give birth to a single pup about once every three years (Garlich-Miller and Stewart 1999). Walruses have a lifespan of approximately 35 years (Richard 2001).

Ecological/Economic Importance

Walrus was an important part of the traditional subsistence economy for the Inuit of the Nunavut (COSEWIC 2006b). The meat is an important source of protein and the ivory is harvested and sold (Hovelsrud *et al.* 2008). Many (18 out of 28) communities in Nunavut hunt the walrus (Priest and Usher 2004a). Over a five year period from 1996 to 2001 the total annual mean number of walruses taken from hunting was approximately 768 (Priest and Usher 2004a).

Walruses have a major role in the marine ecosystem, strongly influencing productivity and ecological function through predation on benthic invertebrates, disturbance to bottom sediments and facilitating flow of nutrients in the water (Ray *et al.* 2006). The walrus is taxonomically important as the only living representative of the Family Odobenidae.

Issues/Challenges

Atlantic walrus populations in Canada may be limited or threatened by environmental contamination, hunting, offshore oil and gas activities, shipping, commercial fisheries and climate change

(Huntington 2009). Their preferred shallow coastal habitat and restricted seasonal distribution make walruses relatively easy to hunt and vulnerable to environmental changes.

Analysis of walrus tissue detected numerous accumulating contaminants such as lead, mercury, cadmium, nickel, cobalt, copper, strontium, Dichloro-Diphenyl-Trichloroethane (DDT) and Polychlorinated biphenyls (PCBs); however, the long-term effects of environmental contamination are unknown (Wiig *et al.* 2000).

Disturbances (e.g., anthropogenic noise, vessel presence or other human activities) may induce haul-out clearing and stampedes. This effect may increase injury and mortality risk, energy expenditure, and stress, or cause communication masking, and a change in thermoregulation (Born *et al.* 1995; Kucey 2005). These parameters are especially important for young animals and pups. Prolonged or repeated disturbances may cause walruses to abandon their haul-outs (Mansfield and St. Aubin 1991; Richardson *et al.* 1995).

At present levels of industrial activity, potential anthropogenic threats to walruses related to industrial activity are low. It is possible that commercial fisheries may compete for resources, potentially damaging seabed and causing temporary disturbances to habitats (COSEWIC 2006b). Ship noise and oil and gas exploration have the potential to displace walruses from their haul-outs and interfere with their communication (Stewart 2002).

The walrus is an ice obligate species, relying on ice as a platform for hunting, breeding, and resting. A decrease in the extent and duration of Arctic sea ice in response to warming might increase food availability for walruses by increasing bivalve production and improving access to feeding areas in shallow inshore waters (Born *et al.* 1995). However, recruitment and body condition may decline the sea ice platform used for hunting, breeding, and resting (Moore and Huntington 2008). Walrus fitness is directly correlated with the presence of sea ice (Laidre *et al.* 2008). As the amount and duration of ice cover in the Arctic declines, hunting areas will become more accessible and pressure on walrus is likely to increase as a result (NAMMCO 2006). Predation by polar bears may increase in the absence of ice as walrus are increasingly forced to use terrestrial sites (COSEWIC 2006b).

Land Use Planning Considerations

Walruses predominantly rely on sea ice and shallow water habitat; however, during the summer and fall months they tend to congregate and haul out on land at known locations, typically situated on low, rocky shores. As walruses have high site fidelity, these terrestrial haulouts need to be considered during land-use planning.

Some walrus haul-out habitat is currently protected under land managed by the Government of Canada and includes:

- Polar Bear Pass, National Wildlife Area
- Nirjutiqavvik National Wildlife Area, Coburg Island
- Bylot Island Migratory Birds Sanctuary, Wallaston Islands
- East Bay Bird Sanctuary, Southampton Island

- Bowman Bay Wildlife Sanctuary, Baffin Island
- Northeast coast Bathurst Island, proposed National Park.

Appendix B, Figure 4.1-4 illustrates summer haulouts and protected areas.

4.1.5 Narwhal

Inuit name: Qilalugaq qernartaq
Scientific name: *Monodon monoceros*

Conservation Status

Narwhals have a status of Special Concern due to uncertainty in population numbers, trends, life history parameters and levels of sustainable hunting (COSEWIC 2004b). They were assessed to be ‘Near Threatened’ in 2008 under the International Union for the Conservation of Nature IUCN (Jefferson *et al.* 2008). Narwhals were listed under Appendix II of the *Convention on International Trade in Endangered Species* (CITES) in 1979 to restrict trade in their ivory tusks. Most of the global population of narwhal occur in the Canadian High Arctic, over 70,000 animals estimated (NAMMCO 2005).

Distribution

There are two populations of narwhal that inhabit the waters of Nunavut, the Baffin Bay population and the Hudson Bay population. The Baffin Bay narwhal population occupies the area from the Southern end of Baffin Island to the northern waters of Hall Basin. Narwhal have been observed further west during the summer (DFO 2002d). During the spring, as the ice edge recedes, narwhals start their northern migration along the offshore ice-edge east of Baffin Island. Hundreds of individuals then migrate west into northeastern Baffin Island, Lancaster Sound and adjoining waters as ice retreats. They reach summer habitats where they concentrate at edges of fast-ice (Eclipse Sound, Navy Board Inlet, Admiralty Inlet Prince Regent Inlet and Peel Sound) (Heide-Jorgensen *et al.* 2003). Some narwhal travel to Foxe Basin through Fury and Hecla Strait to spend a portion of their summer and have been observed in Queens Channel and McLean Strait between King Christian and Lougheed Island (COSEWIC 2004b).

During summer (late June to late August/early September), the Hudson Bay population occupies the water surrounding Southampton Island, largely concentrating in Repulse Bay, Frozen Strait, Western Foxe Channel and Lyon Inlet (Appendix B, Figure 4.1-5). They are sometimes seen at the floe-edge near Coral Harbour (late June to early July and late August to early September) and passing through west of Igloolik Island to Fury and Helca Strait (COSEWIC 2004b). A group of animals from an unknown population may also summer in the Smith Sound-Kane Basin area. These individuals have been observed in fjords of eastern and southern Baffin Island, Totnes Road and the Sunneshine Fjord (COSEWIC 2004b). Some animals may also summer in Wager Bay or Duke of York Bay. During the spring and fall narwhals travel offshore through the Hudson Strait to wintering grounds in the eastern Hudson Strait (Appendix B, Figure 4.1-5).

Autumn migration commences as sea ice begins to freeze in late September or early October. Southward migration along the east coast of Baffin Island occurs in late September and moves eastward toward Lancaster Sound (Dietz *et al.* 2001). The majority of the Baffin Bay population will use Lancaster Sound as their migration route, travelling south-eastward along the east coast of Baffin Island, visiting fiords along the way. Wintering areas for this population are Baffin Bay and northern Davis Strait (COSEWIC 2004b). Those that summered in Fury and Hecla Strait may migrate through Lancaster Sound or may continue through Foxe Basin and Hudson Strait (Stewart *et al.* 1995). Some individuals from this population may also overwinter in the north-water of Baffin Bay and have been observed at least as far north as Smith Sound during winter (Finley and Renaud 1980).

During autumn, narwhals of the Hudson Bay population travel east, through Frozen Strait and follow the east coast of Southampton Island. They have been observed on occasion in Coral Harbour and winter in the eastern Hudson Strait (Appendix B, Figure 4.1-5) (McLaren and Davis 1981; Richard 1991). Some individuals from this population may also winter in open leads and polynyas of northern Hudson Bay and western Hudson Strait (Richard 1991; COSEWIC 2004b).

Ecology

Narwhals tend to concentrate in deep coastal areas associated with the continental shelf during the summer (Hay and Mansfield 1989; Richard 1991). This preference for deep water during the late summer and may be related to bottom-feeding activity. Narwhals prefer deep fjords and continental slopes along the east coast of Baffin Island (Dietz and Heide-Jorgensen 1995; Dietz *et al.* 2001). Intense benthic feeding in the winter has been observed in Baffin Bay and Davis Straight, regions associated with the continental slope, high gradients in bottom temperatures, open water and high density of prey items (Laidre *et al.* 2003; Laidre *et al.* 2004).

Leads, fast ice and broken pack ice density are key factors in habitat selection (COSEWIC 2004b). During winter, narwhals occupy the offshore pack ice of which provides shelter from the rough seas and predation from killer whales (Dietz *et al.* 2001; DFO 2002d).

Deep water habitats may be used as calving grounds as well as feeding areas (COSEWIC 2004b). Mating occurs in spring on offshore pack ice and females start bearing single calves at six to eight years of age every three years between the months of July and August (Cosens and Dueck 1990; Evans and Raga 2001; COSEWIC 2004b).

Narwhal generally travel in small pods of less than 10 individuals during summer; whereas during spring and fall migrations they congregate together to form large aggregations of hundreds of individuals (Koski and Davis 1980; Richard *et al.* 1994; COSEWIC 2004b).

Vocalizations are not common, but increase when narwhals travel in large, loosely dense organizations, likely to communicate to straying members (Shapiro 2006). Narwhal also use sounds for echo-location of prey (Richardson *et al.* 1995). They are known to feed on shrimp (*Pandalus*) and squid and a variety of Arctic fish species such as Greenland halibut, Arctic cod, and polar cod (which is associated with the underside of ice) (Richard *et al.* 1994; DFO 2002d).

Issues/Challenges

Threats to narwhals include ice entrapment, predation by killer whales and polar bears, disease and parasites, climate change, environmental contaminants, offshore oil and gas activities, shipping, hunting and commercial fisheries (COSEWIC 2004b; Huntington 2009). Noise and vessel presence from offshore oil and gas exploration may deter animals from their preferred habitat and migration routes. Shipping and vessel presence increases the risk of environmental contamination which has the potential to disrupt biological functions. Hunting pressure may contribute to deplete decrease in population size or inhibit recovery and commercial fisheries may alter food webs by reducing available prey (Huntington 2009). Narwhal are sensitive to underwater sound as they use a variety of click-sounds for orientation and echolocation of prey, as well as squealing, growling, and whistling for communication (COSEWIC 2004b). As well, some Inuit hunters suggest that narwhals are sensitive to and avoid noise from industrial machines and explosions (COSEWIC 2004b). Unlike many other marine mammal species, narwhal display a ‘freeze’ response when approached by vessels (Finley *et al.* 1990). Because of the narwhals’ deep habitat and widespread distribution, many of the animals occur in offshore pack ice and isolated areas of the Arctic, which are outside of normal hunting areas and most industrial activity (COSEWIC 2004b). Their habitat selection may help to mitigate effects of hunting and shipping.

Due to their strong association with ice, climate change which affects ice distribution may induce changes in habitat, migration patterns and predation rates. Changes in primary productivity may alter the location of prey and force animals into new feeding areas (Moore and Huntington 2008). Narwhals follow ice edges during migration and changes in the timing of ice break-up and freezing may alter their seasonal migratory cycle (Moore and Huntington 2008).

Changes in extent and duration of sea-ice has resulted in increased killer whale presence in Nunavut, a known predator of narwhal (Laidre *et al.* 2006). A decrease in ice due to climate changes would decrease shelter habitat, elevating predation risk from killer whales, polar bears, and hunters and expose the animals to the rough ocean environment of Baffin Bay.

Ecological/Economic Importance

The narwhal is of ecological importance as it is an apex predator in the Arctic food chain and is taxonomically important as it is the only species in its genus.

Narwhals are hunted in Nunavut by the majority of communities (18 out of 28) for subsistence use (Dietz *et al.* 2001; Priest and Usher 2004a). Over a five year period from 1996 to 2001 the total annual mean number of narwhal taken from hunting was approximately 734 (Priest and Usher 2004a). Their skin and underlying fat is consumed and the valuable ivory tusks are sold (DFO 1998a, b).

Land Use Planning Consideration

Increased land development along the coast may cause negative effects on narwhals. Potential increases in shipping and offshore oil and gas development may induce temporary or long term changes in habitat availability, and changes in behaviour such as distribution and migration (Richard 2001; Huntington 2009).

4.1.6 Killer Whale

Inuit Name: Aarluuk
Scientific Name: *Orcinus orca*

Conservation Status

The Northwest Atlantic/Eastern Arctic population of killer whales has a COSEWIC status of Special Concern due to its small size and potentially increasing external threats such as hunting, acoustic and physical disturbance and contamination (COSEWIC 2008c). There are no estimates for the population size in northwestern Atlantic and eastern Canadian Arctic.

Distribution

Killer whales are distributed worldwide and are known to inhabit Arctic waters; however, no clear migratory patterns have been documented in the eastern Canadian Arctic. Killer whale presence in the Arctic appears to be expanding due to decreasing sea ice. High densities of killer whales have been observed in Lancaster Sound. “Hotspots” for killer whales in the eastern Arctic include Cumberland Sound, Pond Inlet/Bylot Island, Lancaster Sound, Admiralty Inlet and western Hudson Bay (particularly Repulse Bay area) (Appendix B, Figure 4.1-6).

Ecology

Life history characteristics have not been well documented for northeast Atlantic/eastern Canadian Arctic killer whales (Lawson *et al.* 2007). While habitat use likely varies between populations, killer whales generally appear to use and tolerate wide habitat variability (depth, size of water body, water temperature) and only appear to be limited by ice at high latitudes (COSEWIC 2008c). It is generally believed that killer whales do not range into regions of pack ice due to their large dorsal fin.

Females give birth at an average age of 15 to an average of one calf every five years (Evans and Raga 2001). Calf mortality is about 50% in the first six months of life; however once the calf reaches six months, the average lifespan is about 50 years for females and 29 years for males (Evans and Raga 2001). Gestation is about 17 months and weaning is between 1 – 3 years (COSEWIC 2008c). Older females stop reproducing around the age of 40 (Olesiuk *et al.* 1990).

Killer whales in Nunavut have been observed consuming both marine mammals and fish species (Lawson 2007; COSEWIC 2008). Both Inuit traditional knowledge and scientific data indicate that killer whales prey on a variety of Arctic marine species (including narwhal, beluga and bowhead whales). For example, Inuit of Pond Inlet and Arctic Bay have extensive knowledge of relationships between killer whales, narwhals and sea ice (COSEWIC 2001c). In the spring, killer whales follow narwhals through Pond Inlet, Eclipse Sound and Navy Board Inlet and narwhals avoid predation through cracks and leads in Admiralty Inlet. Killer whales do not enter the fjord until the ice has cleared, at which time narwhals must use shallow water to avoid killer whales. In the fall, when new ice begins to form, both species depart the area. Narwhals delay their departure until the killer whales leave (COSEWIC 2008). Most reported beluga predation events in Nunavut have occurred in Hudson Bay and Cumberland Sound. Bowhead whale predation in Nunavut has been reported in northwest Hudson Bay, Foxe Basin, Hudson Strait, throughout Baffin Bay and Lancaster Sound.

There have also been a high percentage of bowhead whales predation event reported, as killer whales often leave superficial scratches and bite marks visible to humans (Finley 2001).

Ecological/Economic Importance

Given the lack of information on killer whale abundance, timing and distribution in Nunavut, it is difficult to determine their ecological importance. As a top level predator they can be a major limiting factor on the growth and regional distribution of other Nunavut marine mammals (Finley 2001).

Inuit of Nunavut do not currently harvest killer whales and therefore do not contribute economically through harvesting. The predation of other marine mammals by killer whales may influence harvesting rates through reductions in population numbers or through predator avoidance and therefore, would be less available to hunters.

Issues/Challenges

Relatively little is known about natural mortality of killer whales. Potential sources include disease, accidental beaching, parasites, biotoxins, starvation and the occasional ice entrapment (Mitchell and Reeves 1988; Baird 2001). Since population sizes are generally small, even infrequent occurrences of such events may have dramatic impacts on populations (COSEWIC 2008c).

The largest source of killer whale mortality in the northwest Atlantic and eastern Canadian Arctic is hunting, mostly by Greenland Inuit. Killer whales have historically been hunted by Canadian Inuit but takes are likely non-existent at present (Higdon 2007).

In the Pacific, killer whales are among the most heavily contaminated marine mammals on earth (Higdon 2007); however, studies of contaminant levels in Arctic killer whales are still in initial stages. The effects of contaminants on Arctic killer whales have been identified as a research priority (Higdon 2007).

In recent years Inuit hunters have noted that killer whales are increasing throughout Nunavut, particularly Hudson Bay, where they were unknown prior to the mid-1900s (Reeves and Mitchell 1988). This increase has been related to a decline in sea ice in Hudson Strait, suggesting that declining ice cover has influenced killer whale movements and distribution; allowing them to both extend their range and stay longer in Arctic regions (Higdon 2007). There are important implications for the arctic ecosystem as increases in killer whale numbers in Nunavut will likely result in increased predation rates (Higdon 2007).

Land Use Planning Considerations

Killer whales are susceptible to bioaccumulation of contaminants and acoustic disturbances from shipping; hence coastal development inducing marine discharges from land based activities and in areas that require supplies by marine vessels need to be taken into account.

4.1.7 Beluga Whale

Inuit Name: Kilalugak
Scientific Name: *Delphinapterus leucas*

Conservation Status

Four populations of beluga occur in Nunavut with distinct conservation issues and status. The western Hudson Bay beluga population is approximately 50,000 animals and is assessed as a species of "Special Concern" by COSEWIC (COSEWIC 2004a). There are about 21,213 eastern high arctic-Baffin Bay population which is also listed as "Special Concern" (Innes *et al.* 2002). The Cumberland Sound population is listed as "Threatened" and consists of approximately 1,547 animals (DFO 2002c) and the eastern Beaufort Sea population is listed as 'Endangered' and comprises of about 39,258 whales (Harwood *et al.* 1996). The IUCN has listed beluga whale as Near Threatened globally due to uncertainty about numbers and trends for some parts of the range.

Distribution

There are seven sub-populations of beluga whales in Canada which are determined by their separate summer distributions (Appendix B, Figure 4.1-7). Of the seven, five are found in Nunavut:

- The western Hudson Bay sub-population ranges north to Southampton Island and Roes Welcome Sound.
- The Eastern High Arctic-Baffin Bay sub-population ranges from Lancaster sound, Barrow Strait, Prince Regent Inlet and Peel Sound.
- The Cumberland Sound sub-population is fairly restricted to the Cumberland Sound area and concentrates in Clearwater Fjord during July and August.
- The Eastern Beaufort Sea sub-population enters the waters of Parry Channel between Melville Island and Victoria Island (Nunavut) but only during the summer months.
- A group of animals which may be a separate population than the others in Hudson Bay or possibly a mixture of the east and western populations (de March and Postma 2003). This population is observed along the coastlines of the Belcher Islands (Kingsley 2000; COSEWIC 2004a).

In the autumn, belugas migrate long distances to over-wintering areas which are sometimes shared by several sub-populations. Winter distributions (Appendix B, Figure 4.1-7) of the five sub-populations that occur in Nunavut include:

- Western Hudson Bay sub-population migrates to the offshore areas of the Hudson Strait to overwinter
- Eastern high Arctic-Baffin Bay sub-population winters in the North Water
- Cumberland Sound population is fairly restricted to the Cumberland Sound area and migrates towards the mouth of the Sound during the winter months
- Eastern Beaufort Sea population over-winter in the Bering Chukchi Sea

- Sub-population of unknown identity migrates through Hudson Bay to winter in Hudson Strait

Ecology

Habitat requirements of beluga whales are seasonal. During spring break-up (late spring) belugas concentrate along ice-edges and leads (Stirling 1980). In summer they concentrate in shallow estuaries and coastline environments where they may be avoiding predation from killer whales, moulting, calving and/or feeding (St. Aubin *et al.* 1990; Smith and Martin 1994; COSEWIC 2004a). Along western Hudson Bay belugas spend summers in shallow coastal areas. In August they are usually observed in waters less than 40 m deep (Martin *et al.* 2001). During their long migrations from these estuarine areas, (mid-August until mid/late September) the Eastern High Arctic and Eastern Beaufort beluga sub-populations use deep water areas (800 m) for what appears to be intensive feeding activities (Smith and Martin 1994; Richard *et al.* 2001).

Belugas live for 15 to 30 years (Harwood and Smith 2002). They feed most intensively during late summer in deep water (Smith and Martin 1994; Richard 2001), possibly on Arctic cod (Bradstreet *et al.* 1986; COSEWIC 2004a). From traditional Inuit knowledge, belugas are reported to feed on Greenland Halibut (*Reinhardtius hyppoglossoides*) at floe-edges in Cumberland Sound and Arctic Bay (Kilabuk 1998; COSEWIC 2004a). They are also known to feed on capelin, saffron cod and some invertebrates (Vladykov 1946; Sergeant 1973; COSEWIC 2004a).

Mating occurs during late winter to early spring with peak mating before mid-April in offshore ice-filled waters (COSEWIC 2004). Inuit knowledge from hunters also indicates that mating occurs along floe-edges far offshore in spring (COSEWIC 2004). Timing of peak calving is not well understood possibly because it occurs during late spring migration in offshore areas (Beland *et al.* 1990). Some calving may occur in warm estuarine waters during the early summer, though most observations have been of females entering estuaries with calves and no recorded calving events (COSEWIC 2004). Inuit knowledge reports calving occurs from July to September in estuarine environments and offshore (COSEWIC 2004). In summer, males and females are segregated in estuaries and juveniles and calves stay with their mothers (Smith and Martin 1994).

Ecological/Economic Importance

The beluga whale is an ecologically important species as it is a part of the Arctic food web. They are preyed upon by various marine mammals of the Arctic including polar bears and killer whales.

Beluga whales are economically important to Inuit in Nunavut and are hunted by many communities (20 out of 28) (Priest and Usher 2004). Over a five year period from 1996 to 2001 the total annual mean number of belugas taken from hunting was approximately 1,339 (Priest and Usher 2004). Inuit knowledge suggests that belugas are easier to hunt than other marine mammals (walruses) because they are not as suspicious of humans and are easily approached (Richard 2001). Beluga is used for its meat, which is mostly used for dog food and skin and blubber layer which is desirable for human consumption (Richard 2001).

Issues/Concerns

Threats to beluga whales include predation, environmental contamination, offshore oil and gas development, shipping, hunting and commercial fisheries (Huntington 2009).

Ice entrapment has been observed in northern Foxe-Basin and predators and hunters take advantage of these incidents (Kilabuk 1998). Polar bears and killer whales are known predators of belugas (Smith and Sjare 1990; COSEWIC 2004a). Beluga whales exhibit strong site-fidelity, making them easy targets for commercial and subsistence hunters (Reeves and Mitchell 1987; COSEWIC 2004a). With the introduction of new hunting technologies, Inuit have expressed an increase in competition during the beluga hunt and suggest this may result in larger harvest numbers (Kilabuk 1998).

Reaction of beluga whales to noise generated from vessels associated with offshore oil and gas exploration range from tolerance to extreme sensitivity (Richardson *et al.* 1995). Sensitive reactions involve short-term displacement and may change local distribution (Richardson *et al.* 1995). The relative broad range of reactions from belugas may be a result of their ability to adapt to repeated ongoing man-made noises (Richardson *et al.* 1995). However, belugas often flee from fast and erratically traveling vessels and have been reported to displace up to 2.4 km away (Richard 2001). As well, belugas have been observed by Inuit to react negatively (avoidance behaviour) to noisy anthropogenic sources (boats) and are implicated in declines in abundance at Pangnirtung (Kilabuk 1998). Inuit also suggest that avoidance behaviour caused belugas to be less healthy (skinnier) (Kilabuk 1998).

The ability for contaminants to accumulate in the tissue of beluga whales has been widely studied in the St. Laurence population. Such contamination is linked to reproductive impairment, immunosuppression, and tumour incidence (Becker 2000; Hickie *et al.* 2000).

The effects of climate change on beluga whales are uncertain. They are highly adapted to Arctic seas, yet capable of survival far from sea ice, and sometimes select open-water habitats at least for part of the year (Moore and Huntington 2008). It is likely that climate change will result in changes in the extent and duration of sea ice (Huntington 2009). This may alter beluga migrations and may cause them to penetrate further into the Arctic environment possibly allowing new feeding habitat to be exploited (Huntington 2009). Shifts in sea ice regimes with climate change will impact the timing and extent of primary production which may have negative effects on the beluga whale prey or could cause shifts in the location of prey (Moore and Huntington 2008). Climate change has also been attributed to increases in the number of killer whales along the coasts of Nunavut (Higdon 2007). Such changes in the range of killer whales may cause increased predation on belugas resulting in higher incidences of mortality, injury and avoidance behaviour (Higdon 2007). This coupled with decreases in available ice refuge may result in a negative cumulative effect on beluga populations (Higdon 2007; Moore 2008; Huntington 2009).

Land Use Planning Considerations

Belugas inhabit shallow coastal areas and estuarine environments in the summer; thus coastal development (i.e., marine terminal construction and especially vessel traffic) may deter beluga from preferred habitat (avoidance behaviour) and could cause increased environmental contamination.

Land use planning should consider sensitive times of year for belugas, site-fidelity, migration routes and local concentration areas (e.g., estuaries).

Because of their high site-fidelity, management strategies aimed to avoid areas of high concentrating belugas in the summer and winter months should be fairly straight forward. Mitigating the disruption to migrating belugas has the potential to present certain challenges although our knowledge on general migration routes and timing is fairly established.

The Eastern Hudson Bay belugas are subjected to harvesting quotas and closed hunting seasons established by Nunavik and DFO. The Cumberland Sound population is managed by the Pangnirtung HTO, DFO and NWMB. The eastern Beaufort population is managed by the HTOs, the Inuvialuit Game Council, DFO and the Fisheries Joint Management Committee.

4.1.8 Bowhead Whale

Inuit Name: Arviq
Scientific Name: *Balaena mysticetus*

Conservation Status

The bowhead whale is listed as Special Concern by COSEWIC (COSEWIC 2009). Internationally they are listed as least concern on the International Union for Conservation of Nature (IUCN) Red List because the global population appears to be increasing (Reilly *et al.* 2008).

Distribution

Bowhead whales occur in nearly all areas of the northern hemisphere polar region. Two recognized populations exist: the Bering-Chukchi-Beaufort population and the Eastern Canada-West Greenland population (COSEWIC 2009). The Eastern Canada-West Greenland population is widespread in Nunavut and known to summer mainly in northwestern Hudson Bay, Foxe Basin, the Lancaster Sound Region and western Baffin Bay (Dueck *et al.* 2006; Wheeler and Gilbert 2007). They likely winter in northern Hudson Bay the Hudson Strait and in central Davis Strait, southern Baffin Bay and west near Greenland (Appendix B, Figure 4.1-8).

Ecology

Bowhead whales occur in a variety of marine areas ranging from open water to leads, polynyas and heavy pack ice. Bowheads are capable of breaking through one foot of ice to breath if necessary (Finley 2001).

In Foxe Basin bowhead whales congregate along the land-fast ice edge in June and July before the ice breaks up. The ice edge provides food and shelter and bowhead whales can be found socializing and feeding (Thomas 1999).

Bowhead whales tend to congregate in areas that have major underwater bathymetric features such as Isabella Island (Finley 2001) (Appendix B, Figure 4.1-8). Most feeding activity takes place in deep troughs where prey is concentrated, and most reproductive activity takes place on Isabella Bank, possibly because it offers protection from orcas and shelter from strong currents (Finley *et al.* 1994).

The majority of biological information on bowhead whales comes from studies on harvests from the Alaskan population. They are slow swimmers and are among the more vocal of the baleen whales (Clark and Johnson 1984). These vocalizations may function to maintain social cohesion of groups and monitor changes in ice conditions (Evans and Raga 2001). Sexual activity occurs over most of the year, but with conception occurring in late winter or early spring. Gestation lasts 12 – 16 months with one offspring per pregnancy (Evans and Raga 2001).

Bowhead whales have well adapted features for the arctic environment; long lifespan (upwards of 100 years) (Evans and Raga 2001), large energy storage capability, sensitive acoustic abilities and long-range communication (possibly aids in navigation through ice) and a padded crown for breaking through ice to breathe (Finley 2001). Common prey species include crustacean zooplankton, particularly euphasiids and copepods, and epibenthic organisms, such as mysids and gammariid amphipods (Burns 1993; Lowry 1993; Finley 2001).

Ecological/Economic Importance

The bowhead whale tends to inhabit areas of high productivity and concentrations of zooplankton (Burns *et al.* 1993). Bowhead whales are important low-level trophic feeders and consume an estimated 23,810 kg of copepods during the feeding season (Burns 1993). Bowhead whales are known to be preyed upon occasionally by killer whales but to what degree is uncertain (Burns *et al.* 1993).

Commercial whaling for the bowhead whale was extensive and profitable during the 1600s to the 1900s. The Inuit bowhead whale hunt in Nunavut is a historic and culturally important event. One bowhead whale is harvested by Inuit in Nunavut every two to three years and represents a notable economy in these communities of Nunavut. Four out of twenty-eight communities participated in the hunt over a five year period from 1996 to 2001. The muktuk is widely distributed and consumed. The present significance of bowheads to humans can be expressed in terms of their future potential as a renewable subsistence and aesthetic resource (Reeves and Mitchell 1990).

Issues/Concerns

Threats to bowhead whales include predation, accidental ingestion, environmental contamination, disease, offshore oil and gas exploration, shipping, illegal hunting and tourism.

Commercial whaling caused a severe depletion of the bowhead whale population in several parts of its range. Currently, in the eastern Canadian Arctic killer whales are an increasing threat to bowhead whales (Finley 2001; Moshenko *et al.* 2003).

A variety of anthropogenic inputs into the environment in Nunavut contribute to threats for the bowhead whale. Ingestion of foreign material through the process of skim feeding is a minor threat (Finley 2001). Contaminants have been shown to cause health problems and death in bowhead whales (Finley 2001). Bowheads can live > 100 years and therefore are susceptible to the accumulation of toxins over a long period of time.

Acoustic disturbances may increase as interest in offshore developments and tourism increases. Bowhead whales use long-range communication and are sensitive to low-frequency industrial sounds (Burns *et al.* 1993). At Isabella Bay, bowheads react strongly at far distances to outboardpowered boats and ships and attempt to flee either by moving into shallow waters or traveling long distances away (Finley 2001). Migrating bowheads have been reported to stay 20 km from seismic and support vessels and drilling ships (Finley 2001).

The bowhead whale is listed as an indicator species for climate change in the north. Climate change is predicted to cause changes in ice distribution and condition, surface temperatures, currents and mixing. Such changes in Nunavut could alter the bowhead whales' migration patterns, feeding locations and increase their susceptibility to predation and hunting. Changes in currents and productivity have the potential to alter the feeding habitat of bowhead whales. Bowhead whale fecundity has been related to zooplankton production therefore, climatic change is likely to have an impact on population growth (negative or positive) through changes in the extent of sea ice (Finley 2001). Such changes will have direct and indirect effects bowhead health, population and distribution.

Land Use Planning Considerations

Bowhead whales make use of land-fast ice edges which may be associated with established shipping routes. Increased development and land activities associated with an increase in marine transport have the potential to effect bowhead whale populations and should be taken into consideration when planning coastal developments.

4.1.9 Polar Bear

Inuit Name: Nanook
Scientific Name: *Ursus maritimus*

Conservation Status

Polar bears are listed as Special Concern by COSEWIC (COSEWIC 2008d), protected under Appendix II of CITES and classified by IUCN as 'Vulnerable' (Schliebe *et al.* 2008). Polar bear policy and management in Nunavut is complicated because it involves polar bear populations which inhabit other territories and provinces in Canada and is also managed under federal jurisdiction as well as management boards established under the NLCA.

Distribution

Polar bears are found throughout Nunavut and range from the northern end of Ellesmere Island south to James Bay (COSEWIC 2008d). Their distribution varies with seasonal ice; in summer some bears remain with the pack ice, while others (e.g., in Hudson and James bays) are restricted to land until the following freeze-up. In winter the bears are widely distributed, with the pregnant females typically denning on land within 50 km of the coast (COSEWIC 2008d).

There are twelve polar bear sub-populations that inhabit the Nunavut region (Table 4.1-1). Population estimates and distribution of each subpopulation of Polar bear in Nunavut is based on studies of range and movement using satellite telemetry, mark-recapture studies, tags returned from hunted bears, and traditional knowledge (Appendix B, Figure 4.1-9).

Table 4.1-1: Polar Bear Populations and Estimates in Nunavut

Population Name	Population Estimate
Western Hudson Bay	935
Foxe Basin	2,300
Lancaster Sound	2,541
Baffin Bay	1,546
Norwegian Bay	190
Kane Basin	164
Davis Strait	2,251
Gulf of Boothia	1,528
M'Clintock Channel	284
Viscount Melville Sound	215
Northern Beaufort Sea	1,200
Southern Beaufort Sea	1,526

NOTE:
Source: COSEWIC 2008

Ecology

Habitat requirements for polar bears include coastal (land and nearshore) and offshore open water and ice environments. Sea ice is a primary influence on habitat use. Their distribution on the ice is closely linked to the distribution of ringed seals, their primary prey and to a lesser degree the bearded seal (Stirling 1980). Specific ice habitat selection by polar bears is complex and varies by area (Regehr *et al.* 2007). During spring and summer, bears within the archipelago region used landfast ice more frequently, whereas bears in Baffin Bay used moving ice (thick first-year ice found in large floes) (Ferguson *et al.* 2000). Both ice types likely represent areas where most spring seal pupping occurred (Ferguson *et al.* 2000). Polar bears tend to select first-year ice in winter as new ice forms and multiyear ice (where found) in autumn when maximum ice melt has occurred (Ferguson *et al.* 2000; Ferguson *et al.* 2001b). Polar bears appear to anticipate seasonal fluctuations in ice. For example, polar bears were found close to ice edges in spring in advance of the availability of ice edges (Ferguson *et al.* 2000). As ice melts in the summer some bears may remain on the multi-year ice (where found) while others may follow the receding ice (Taylor *et al.* 2001). In the summer, some bears will inhabit coastal land and live off stored body fat or feed on grasses, lichens, mosses and berries (COSEWIC 2008).

Shelter dens are also a component of polar bear habitat. In the northern regions of Nunavut, shelter dens are found on multi-year ice and are used during the winter. In contrast, shelter dens in southern regions of Nunavut were found on land and are used during the autumn (Ferguson *et al.* 2000).

Pregnant females require suitable habitat to make dens so they can give birth and feed their young cubs. The majority of maternity denning occurs on land; however, multiyear ice has also provided suitable denning habitat to some pregnant females. Most maternity dens are dug into snowdrifts on south-facing slopes of hills or valleys. In more southerly populations it is not uncommon for them to be dug into the banks of creeks or lakes. Van de Velde (1971) reported that dens made by pregnant females and bears of other age and sex classes tend to be found in the same areas year after year (Van de Velde *et al.* 2003). It is also believed that in coastal areas most female polar bears den within a few kilometres of the coastline (Harington 1968 and Messier *et al.* 1994, in Van de Velde *et al.* 2003).

Polar bears are carnivorous and hunt throughout the year in areas of multi-year ice. They prey predominantly on ringed seals, but also catch bearded seals, harp seals, hooded seals, harbour seals, and occasionally, walruses, beluga whales and narwhals (COSEWIC 2008). During the summer they will also eat grasses, lichens, mosses, and berries. Studies have shown that these bears consume the majority of the calories they need for an entire year during the spring and early summer (COSEWIC 2008).

Female polar bears typically mature sexually when they are four or six years old (COSEWIC 2008). Males usually reach sexual maturity at the age of five or six, but because of competition with larger adult males they will not usually mate for their first time until they are at least eight years old (Ramsay and Stirling 1986; Derocher and Stirling 1998).

Mating occurs during the spring. Only pregnant females enter dens for a significant period of the winter. The rest of the population remains active and will only return to temporary shelter dens when the weather is sufficiently bad (Ferguson *et al.* 2000). The gestational period is only two months and females cannot breed more often than every three years (Stirling and Derocher 2007). Cubs are nursed inside maternity dens until late February to mid-April. Cubs are typically weaned at two and a half years of age and may stay with their mothers for three and a half years (Ramsay and Stirling 1986).

Seasonal fidelity to local areas seems to occur with both sexes in Nunavut. They also seem to occupy fixed home ranges rather than continuous expanding ranges (Taylor *et al.* 2001).

Ecological/Economic Importance

Polar bears are ecologically important to the Arctic ecosystem in Nunavut as they are the top predator within the food web. Polar bears also have significant cultural, nutritional and economic importance to the Inuit and are hunted by almost all communities (25 out of 28) (Priest and Usher 2004). Over a five year period from 1996 to 2001 an annual mean of 292 polar bears were hunted (Priest and Usher 2004). Hides are sold commercially and may bring high prices in the fur market. Inuk guided hunting is also a source of income (COSEWIC 2008).

Issues/Challenges

Threats to polar bears include reduction in food availability, over-hunting, environmental contamination, offshore and land-based oil and gas exploration, industrial development (e.g., mineral exploration and development), tourism and climate change (see below; COSEWIC 2008). It is noted that low reproductive rates in female bears increases vulnerability and population abundance (COSEWIC 2008).

Polar bears are vulnerable to pollutants directly and indirectly. They are the top predator in Arctic food webs and therefore are susceptible to bioaccumulation[4] within this ecosystem. In recent years, significant levels of various contaminants have been documented in polar bear tissues or tissues of their prey (COSEWIC 2008). Though demographic effects relating to contaminants have not been observed the effects of these compounds in polar bears (and ringed seals) are unknown (COSEWIC 2008).

Increased human activity, oil and gas exploration and coastal development in the Arctic may diminish important land based maternity denning habitat and possibly spring feeding habitats at the ice edge. However, the presence of stationary drill-ships and drill-sites may attract polar bears, from increased seal presence (new breathing holes associated with rig-induced cracks/ice-management). This may increase access to their prey (Richardson and Malme 1995) but may also increase the threat of mortality (bear management in relation to human activity). As well, polar bears do not seem to be deterred from noise associated with offshore oil activities (even when swimming in the water), construction, ice-breakers or vessel traffic (Richardson *et al.* 1995). The effect of land-based activities on maternal denning is not well understood.

Climate change is the major threat to polar bears because they rely on the ice for traveling, feeding, and reproduction (COSEWIC 2008). Polar bears demonstrate site fidelity and fixed home ranges which make them susceptible to changes in their habitat (Derocher *et al.* 2004). Changes in timing, duration, extent and quality of ice (due to climate change), as they relate to polar bear health, is receiving increased scientific attention (Derocher *et al.* 2004; Stirling and Parkinson 2006; Stirling and Derocher 2007; Stirling *et al.* 2008). With changing ice conditions, polar bears may be forced to coastal land areas earlier on in the summer season (Stirling and Parkinson 2006). This will alter the amount of time they spend foraging on seals and would require a longer time spent not feeding and more time relying on stored body fat (Stirling and Parkinson 2006). Changes in sea ice timing and duration may also affect polar bears by changing ringed seal distribution, forcing them to search for alternative food (Stirling and Parkinson 2006). Polar bears may be forced onto coastal land-based areas with higher human activities. Inuit hunters in Nunavut recently report more polar bears near settlement areas during the open water season (Stirling and Parkinson 2006). All of these changes would increase the difficulty of survival (Derocher *et al.* 2004).

Land Use Planning Considerations

Land use planning must consider the coastal habitat required by polar bears for denning and sea ice habitat for feeding.

Possible land-use plan issues that may affect polar bears are:

- Coastal development (on land and land-fast ice); terminals, on-shore development and shipping and vessel traffic. These may decrease suitable land-based and sea ice polar bear habitat (see threats section).

[4] Bioaccumulation is the process of accumulation of a substance leading to progressively higher concentrations of a contaminant up through a food chain, via predators ingesting prey that have previously accumulated contaminants in their body tissue.

- Offshore developments; oil and gas exploration. This may diminish polar bear winter and spring habitat however, as stated above, some evidence suggests polar bears are largely unaffected by routine industrial activity. Also, increased open-water during the winter (as a result of drill-rig induced ice-management) may act to increase ringed seal density/local abundance, which may in turn benefit polar bears. Accidental oil spills are expected to be detrimental to polar bears, their habitat and primary prey species.

Discussions between government jurisdictions to facilitate management are largely coordinated through the Federal/Provincial/Territorial Polar Bear Technical Committee (PBTC). Internationally, research and management of polar bears are coordinated under the Agreement on the Conservation of Polar Bears (signed in 1973) that was accepted under the federal government for all provinces and territories of Canada (COSEWIC 2008). Under this agreement polar bears are to be traditionally hunted only by Inuit hunters or sports hunters guided by Inuit hunters (see the Consultative Meetings of the Contracting Parties to the Agreement on the Conservation of Polar bears 1981 for more information on this agreement). Furthermore, due to climate change it is important to plan for the possibility that polar bear distribution and range could change, causing increased abundances on land.

4.2 Marine Fish

Coad and Reist (2004) reported 189 marine fish species in the Arctic of which 182 are found in Nunavut marine waters.

4.2.1 Starry Flounder

Inuit Name: Nataaznak
Scientific Name: *Platichthys stellatus*

Conservation Status

Unknown.

Distribution

Starry flounder are common across their range that extends throughout the North Pacific and Arctic Ocean (Percy *et al.* 1985; Coad and Reist 2004) including the Beaufort Sea-Amundsen Gulf (Percy *et al.* 1985; Coad and Reist 2004) (Appendix B, Figure 4.2-1). In Nunavut they are found in Dolphin and Union Strait, Coronation Gulf (Hunter 1984) and Queen Maud Gulf (Coad and Reist 2004). They are not known to occur east of Queen Maud Gulf.

Ecology

Starry flounder prefer benthic, shallows to 375 m (Coad and Reist 2004). They are mainly associated with shallow coastal waters and will occasionally enter river mouths. During winter they move offshore into deeper waters.

The biology of starry flounder is poorly understood. They are believed to spawn near river mouths during the winter months (Percy *et al.* 1985). Maximum size is reported as 91 cm (Coad and Reist 2004). Prey items include crustaceans, worms, mollusks, brittle stars and fishes (Coad and Reist 2004).

Ecological/Economic Importance

Starry flounder are sometimes taken for food.

Land Use Planning Considerations

If spawning areas are known then restrictions on the type of activities and timing, should occur for these areas.

4.2.2 Spotted Wolffish

Inuit Name: Unknown
Scientific Name: *Anarhichas minor*

Conservation Status

Spotted wolfish are identified as Threatened by COSEWIC in 2001 (COSEWIC 2001b) and SARA listed as Threatened.

Distribution

Hudson Strait, Labrador Sea, offshore Baffin Bay-Davis Strait (Coad and Reist 2004).

Ecology

They prefer benthic, shallows to 600 m (Coad and Reist 2004) but are generally considered a deep water species (Scott and Scott 1988) with the exception of larval stage which are found near surface (DFO 2004). In the Barents Sea, they are generally found over clay-sand bottoms (Scott and Scott 1988).

The biology of spotted wolffish is not very well known. Fecundity is low and they are thought to spawn late in the year (DFO 2004). Maximum size is reported to be 200 cm (Coad and Reist 2004). The oldest spotted wolfish captured was 21 years old (Scott and Scott 1988). They eat a wide variety of fish and invertebrates such as, echinoderms, crustaceans, molluscs, worms and fishes (Coad and Reist 2004; Kulka and Simpson 2004) but mainly feed on molluscs and echinoderms (Kulka and Simpson 2004).

Ecological/Economic Importance

Captured mainly as bycatch in Greenland halibut and snow crab fisheries (DFO 2004; Kulka and Simpson 2004).

Land Use Planning Considerations

The SARA in Section 32(1) states that “no person shall harm, harass, capture or take an individual of a wildlife species that is listed as an extirpated, an endangered or a threatened species.” However in Section 73(1) of the Act, exemptions are provided for through a permitting process. Bottom trawling (e.g., for Greenland halibut) disrupts and destroys spawning habitat (Jennings and Kaiser 1998). Oil and gas industry activities can also pose a threat to wolffish habitat (Kulka *et al.* 2007). The DFO

Recovery Strategy (Kulka *et al.* 2007) for northern and spotted wolffish should be considered when developing areas where northern wolffish occur.

4.2.3 Roughhead Grenadier

Inuit Name: Ingminniset (Coad and Reist 2004)
Scientific Name: *Macrourus berglax*

Conservation Status

Stable (COSEWIC 2007e).

Distribution

Hudson Strait, Labrador Sea, Baffin nearshore Bay-Davis Strait, offshore Baffin Bay-Davis Strait (Coad and Reist 2004) and Cumberland Sound.

Ecology

They occur in epibenthic, deep waters to 2,740 m (Coad and Reist 2004) but are most abundant between 200 – 600 m (Scott and Scott 1988). They are not found in water temperatures below 0°C.

Roughhead grenadiers are late maturing and have low fecundity (COSEWIC 2007e). They are slow growing (COSEWIC 2007) with maximum size reported as 100 cm (Coad and Reist 2004). They eat worms, molluscs, crustaceans, squids, brittle stars and fishes (Scott and Scott 1988; Coad and Reist 2004).

Ecological/Economic Importance

Important in commercial fisheries elsewhere (Coad and Reist 2004). They are occasional bycatch of Cumberland Sound and Davis Strait Greenland halibut fisheries.

Land Use Planning Considerations

No special considerations required.

4.2.4 Northern Wolffish

Inuit Name: Unknown
Scientific Name: *Anarhichas denticulatus*

Conservation Status

Listed as Threatened by COSEWIC in 2001 (COSEWIC 2001a). There have been significant declines in abundance over past 20 years (COSEWIC 2001a). In the core-range, off northeast Newfoundland, there was a 98% decrease in abundance between 1978 and 1994 (COSEWIC 2001a). SARA listed as Threatened.

Distribution

Hudson Strait, Labrador Sea, Baffin Bay-Davis Strait Offshore (Coad and Reist 2004). Possible occurrences in Viscount Melville Sound, and Beaufort Sea-Amundsen Gulf (Coad and Reist 2004) (Appendix B, Figure 4.2-2).

Ecology

Northern wolfish are an epibenthic species, living in the shallows to 1700 m. Generally occurs at depths greater than 100 m; most common between 150 and 900 m (COSEWIC 2001a). Larval northern wolffish are pelagic (Scott and Scott 1988). The northern wolffish prefers soft bottoms in proximity to boulders, and temperatures below 5°C (Scott and Scott 1988).

The biology of northern wolffish is not very well known. Fecundity is low (DFO 2004) and spawning is thought to occur over an extended period of time from April to October (Scott and Scott 1988). Maximum size of 180 cm (Coad and Reist 2004). Eats crustaceans, echinoderms, molluscs, comb jellies, jellyfishes and fishes (Coad and Reist 2004) but mainly feeds on mollusks and echinoderms (DFO 2004). Reaches maturity at approximately five years and lives to at least 14 years (COSEWIC 2001a).

Ecological/Economic Importance

Not used by people. Jelly-like flesh not favoured for eating, and skin is not suitable for tanning into leather (Scott and Scott 1988). By-catch in fishery for Greenland halibut and snow crab (DFO 2004; Kulka and Simpson 2004).

Land Use Planning Considerations

The *Species at Risk Act* in Section 32(1) states that "no person shall harm, harass, capture or take an individual of a wildlife species that is listed as an extirpated, an endangered or a threatened species." However in Section 73(1) of the Act, exemptions are provided for through a permitting process. Bottom trawling (e.g., for Greenland halibut) disrupts and destroys spawning habitat (Jennings and Kaiser 1998). Oil and gas industry activities can also pose a threat to wolffish habitat (Kulka *et al.* 2007). The DFO Recovery Strategy (Kulka *et al.* 2007) for northern and spotted wolffish should be considered when developing in areas where northern wolffish occur.

4.2.5 Greenland Halibut

Inuit Name: Nat-ah-nuh, Nataknuk, Natarnaq, Natarnak, Tikkalik (Coad and Reist 2004)
Scientific Name: *Reinhardtius hippoglossoides*

Conservation Status

Abundant (Coad and Reist 2004).

Distribution

Greenland halibut occur throughout Hudson Strait, Labrador Sea, Baffin Bay-Davis Strait Nearshore, Baffin Bay-Davis Strait Offshore, Lancaster Sound Region, High Arctic Archipelago, and the Beaufort

Sea-Amundsen Gulf (Chiperzak *et al.* 1995) (Appendix B, Figure 4.2-3). Greenland halibut occur from Smith Sound to southern Newfoundland (Parks Canada 1995). They are most abundant in Cumberland Sound and north through Davis Strait (Parks Canada 1995).

Ecology

The Greenland halibut is an epibenthic species, inhabiting waters from the surface to depths of 2,000 m (Coad and Reist 2004). Greenland halibut are most abundant between 800 and 1,200 m in Davis Strait and Baffin Bay (Coad and Reist 2004). Larger fish are generally found at deeper depths (Scott and Scott 1988).

Spawning is thought to occur in Davis Strait in winter or early spring at depths of 650 to 1,000 m (Scott and Scott 1988). The number of eggs produced by a female Greenland halibut in a single spawning can vary from 30,000 to 300,000 depending on the size of the female (Scott and Scott 1988). Greenland halibut reach a maximum size of 119 cm (Coad and Reist 2004). All fish over 90 cm have been found to be females (Scott and Scott 1988). Greenland halibut eats fish, crustaceans and squids (Coad and Reist 2004).

Ecological/Economic Importance

Greenland halibut are becoming increasingly important in developing commercial fisheries in the Eastern Arctic (Coad and Reist 2004). There has been a winter fishery for Greenland halibut in Cumberland Sound (near Pangnirtung) since 1986 (Pike 1994).

Land Use Planning Considerations

The management of commercial fishing areas should take into consideration other human activities that could potentially impact the commercial fishery for Greenland halibut.

4.2.6 Greenland Cod

Inuit Name: Uugaq, Uugak, Uugayak, Ogak, Ogac, Ovak, Uugavik, O-wuk, Ugak, Ôarsuk (Coad and Reist 2004)
Scientific Name: *Gadus ogac*

Conservation Status

Abundant (Coad and Reist 2004).

Distribution

Greenland cod range from Alaska to western Greenland. In Nunavut, they are found throughout James Bay-eastern Hudson Bay, Hudson Bay, Hudson Strait, Labrador Sea, Baffin Bay-Davis Strait Nearshore, Lancaster Sound Region, Queen Maud Gulf, Coronation Gulf and the Beaufort Sea-Amundsen Gulf (Hunter 1984; Coad and Reist 2004) (Appendix B, Figure 4.2-4).

Ecology

Greenland cod are a benthic species, inhabiting waters from the surface to depths of 400 m (Coad and Reist 2004). Greenland cod are more common in nearshore areas than offshore areas (Scott and Scott 1988).

Greenland cod are known to spawn at mouths of rivers during the ice-on period. Greenland cod eats fish, crustaceans, mollusks, starfish and worms (Scott and Scott 1988; Coad and Reist 2004). In the Saqvaqjuac area Greenland cod spawn from late March to early April (Mikhail and Welch 1989). They begin spawning at ages 2 – 3 (Mikhail and Welch 1989). The maximum recorded age for a Greenland cod in Sagvagjuac is 12 years (Mikhail and Welch 1989).

Ecological/Economic Importance

Greenland cod have a limited commercial importance (Coad and Reist 2004). Some subsistent harvesting of Greenland cod occurs in Nunavut.

Land Use Planning Considerations

During spawning periods Greenland cod congregate at river mouths. Maintaining good quality spawning habitat is critical for the sustainability of Greenland cod stocks. Greenland cod spawning habitat can be affected by development of coastal marine infrastructure, changes in water quality (e.g., spills) and changes in river outflow such as might occur from hydro-electric development.

Maintaining suitable Greenland cod spawning areas should be considered when development is proposed in these areas.

4.2.7 Fourhorn Sculpin (marine form)

Inuit Name: Kan-ny-yoke, Kaneeok, Kanyok, Kanajuk, Kanayuk (Coad and Reist 2004)
Scientific Name: *Myoxcephalus quadricornis*

Conservation Status

Fourhorn sculpin are very abundant in Nunavut. The marine form of the fourhorn sculpin in the Arctic was formally assessed and listed as Not at Risk by COSEWIC (Houston 1989).

Distribution

The marine form of the Fourhorn sculpin is distributed throughout James Bay-eastern Hudson Bay, Hudson Bay, Foxe Basin, Hudson Strait, Baffin Bay-Davis Strait Nearshore, Lancaster Sound Region, High Arctic Archipelago, Arctic Basin, Viscount Melville Sound, Queen Maud Gulf, and Beaufort Sea-Amundsen Gulf (Coad and Reist 2004).

Ecology

The Fourhorn sculpin is a benthic fish, inhabiting shallow waters to depths of 45 m (Coad and Reist 2004). Fourhorn sculpins are often associated with shallow brackish waters such as those found in estuaries (Scott and Scott 1988).

Fourhorn sculpins lay their eggs in a nest which is protected by the male sculpin (Morrow 1980; Scott and Scott 1988). Fourhorn sculpins attain a maximum size of 39.6 cm (Coad and Reist 2004). Prey items include crustaceans, molluscs and fish (Coad and Reist 2004).

Ecological/Economic Importance

The marine Fourhorn sculpin is occasionally taken as a food fish throughout coastal Nunavut.

Land Use Planning Considerations

No special considerations are required for the marine form of the Fourhorn sculpin.

4.2.8 Atlantic Wolffish

Inuit Name: None
Scientific Name: *Anarhichas lupus*

Conservation Status

Uncommon (Coad and Reist 2004). Atlantic population listed as Special Concern by COSEWIC in 2000 (COSEWIC 2000a). Listed as Special Concern under SARA.

Distribution

Hudson Strait, Labrador Sea, Baffin Bay-Davis Strait Offshore (Appendix B, Figure 4.2-2).

Ecology

They live in the cold deep waters of the continental shelf (Kulka *et al.* 2007). They prefer rocky or hard clay bottoms (Kulka *et al.* 2007) and benthic, shallows to 600 m (Coad and Reist 2004).

The Atlantic wolffish is a solitary, slow growing fish. It matures late, has a low fecundity and lays its eggs in a nest which is guarded (Kulka *et al.* 2007). It achieves a maximum size of 152 cm (Coad and Reist 2004) and a weight up to 20 kg (Kulka *et al.* 2007) and preys upon echinoderms, molluscs, crustaceans and fishes (Coad and Reist 2004).

Ecological/Economic Importance

Little known ecological or economic value.

Land Use Planning Considerations

The SARA in section 32(1) states that “no person shall harm, harass, capture or take an individual of a wildlife species that is listed as an extirpated, an endangered or a threatened species.” However in section 73(1) of the Act, exemptions are provided for through a permitting process. Bottom trawling (e.g., for Greenland halibut) disrupts and destroys spawning habitat (Jennings and Kaiser 1998). Oil and gas activities also pose a threat to wolffish (Kulka *et al.* 2007). The DFO management plan (Kulka *et al.* 2007) for Atlantic wolffish should be applied for planning in areas where northern wolffish occur.

4.2.9 Capelin

Inuit Name: Qoliiligaq
Scientific Name: *Mallotus villosus*

Conservation Status

Abundant (Coad and Reist 2004).

Distribution

James Bay-eastern Hudson Bay, Hudson Bay, Foxe Basin, Hudson Strait, Baffin Bay-Davis Strait Offshore, Baffin Bay-Davis Strait Nearshore, Lancaster Sound Region, Queen Maud Gulf, Beaufort Sea-Amundsen Gulf (Coad and Reist 2004).

Ecology

They require cold, deep waters, moving inshore to spawn in areas of coarse sand and/or gravel (Scott and Scott 1988).

Off Labrador, capelin spawn June through July and occasionally into August (Scott and Scott 1988). They form mass aggregations when spawning. Capelin reach maturity at about 3 – 4 years of age (Scott and Scott 1988). Maximum size of a captured capelin is 25.2 cm however most adults captured range between13 – 20 cm (Scott and Scott 1988). Capelin are generally considered planktiverous (Scott and Scott 1988) but will also feed on marine worms and small fishes (Coad and Reist 2004). Warming trends due to climate change may be leading to increases in capelin in Hudson Bay (Gaston *et al.* 2003).

Ecological/Economic Importance

Important forage fish for some fish species, seabirds and marine mammals (Scott and Scott 1988) and is an important link between primary producers and higher trophic levels (Burton and Flynn 1998). Locally used and commercially important elsewhere (Coad and Reist 2004).

Land Use Planning Considerations

Coastal spawning and staging areas are critical to the sustainability to capelin populations and are key foraging areas for top predators (Davoren *et al.* 2006). Coastal infrastructure or spills can potentially impact capelin staging and spawning areas. Capelin staging and spawning areas should be considered when development is proposed in these areas. (Davoren *et al.* 2006) stated that these areas are critical areas for conservation.

4.2.10 Arctic Skate

Inuit Name: Unknown
Scientific Name: *Amblyraja hyperborea* (formerly *Raja hyperborea*)

Conservation Status

Common (Coad and Reist 2004).

Distribution

Arctic skate are distributed throughout Hudson Strait, Labrador Sea, Baffin Bay-Davis Strait Offshore, Baffin Bay-Davis Strait Nearshore, Lancaster Sound Region, and Beaufort Sea-Amundsen Gulf (Coad and Reist 2004) (Appendix B, Figure 4.2-3).

Ecology

Arctic skate are a benthic species, inhabiting deep waters down to 2,500 m (Coad and Reist 2004). They prefer cold deep waters (Jorgensen *et al.* 2005).

The biology of Arctic skate is poorly understood. They attain a maximum size of 87 cm (Scott and Scott 1988) and eat a variety of fish and crustaceans (Coad and Reist 2004). Arctic skate eggs are released in the form of an egg capsule.

Ecological/Economic Importance

Arctic skate are caught as by-catch in long-line and trawl fisheries for Greenland halibut (Coad and Reist 2004).

Land Use Planning Considerations

There are no special considerations for Arctic skate. However, this species should be managed as part of the Greenland halibut fishery.

4.2.11 Arctic Cod

Inuit Name: Uugaq (Coad and Reist 2004)
Scientific Name: *Boreogadus saida*

Conservation Status

Very abundant (Coad and Reist 2004).

Distribution

Arctic cod have a circumpolar distribution. They are found in virtually all marine waters of Nunavut including James Bay-eastern Hudson Bay, Hudson Bay, Foxe Basin, Hudson Strait, Labrador Sea, Baffin Bay-Davis Strait Nearshore, Baffin Bay-Davis Strait Offshore, Lancaster Sound Region, High Arctic Archipelago, Arctic Basin, Viscount Melville Sound, and Queen Maud Gulf (Appendix B, Figure 4.2-4).

Ecology

Arctic cod are cryopelagic or epontic, inhabiting waters from the surface to depths of up to 1,383 m (Coad and Reist 2004). However, Arctic cod are mainly found in the upper part of the water column (Scott and Scott 1988). Larval fish stay at or near the water surface (Graham and Hop 1995). Arctic cod are often associated with drifting pack ice (Scott and Scott 1988; Crawford and Jorgenson 1993).

Arctic cod spawn in winter under the ice (Craig *et al.* 1982; Bradstreet *et al.* 1986). Prey items include crustaceans, plankton, fish eggs and fry, fish (Cosens *et al.* 1990). Arctic cod occasionally occur in extremely large schools (Crawford and Jorgenson 1993; Welch *et al.* 1993).

Ecological/Economic Importance

Arctic cod are a critical component of the arctic marine food chain (Bradstreet and Cross 1982; Craig *et al.* 1982; Bradstreet *et al.* 1986; Welch *et al.* 1992). They are an important prey for many marine organisms, including sea-birds, seals, whales and other fish (Bradstreet and Cross 1982; Bradstreet *et al.* 1986). There are very few commercial fisheries for Arctic cod (Coad and Reist 2004). Local food use is also limited (Coad and Reist 2004).

Land Use Planning Considerations

Arctic cod spawning areas are largely unknown. However, human activities in areas where Arctic cod spawn should be limited during the winter period.

4.2.12 Thorny Skate

Inuit Name: Qarlêk
Scientific Name: *Amblyraja radiate*

Conservation Status

Common (Coad and Reist 2004).

Distribution

James Bay-eastern Hudson Bay, Hudson Strait, Labrador Sea, Baffin Bay-Davis Strait (Coad and Reist 2004).

Ecology

They require benthic habitat, shallow to 996 m (Coad and Reist 2004) on hard and soft bottoms (Scott and Scott 1988).

Thorny skates can spawn in any month of the year (Scott and Scott 1988). Fecundity is low (Sulikowski *et al.* 2005) and eggs are released in the form of an egg capsule (Scott and Scott 1988). Prey items include worms, crustaceans and fishes (Coad and Reist 2004). Thorny skates are long lived (Scott and Scott 1988; Sulikowski *et al.* 2005) and may grow to a length of over 100 cm depending on the area (Scott and Scott 1988).

Ecological/Economic Importance

Commercially important elsewhere (Coad and Reist 2004). Caught as by-catch in long-line and trawl commercial fisheries for Greenland halibut (Coad and Reist 2004).

Land Use Planning Considerations

Should be managed as part of the Greenland halibut fishery. No land use planning considerations.

4.3 Freshwater Fish

Richardson *et al.* (2001) reported on 46 freshwater fish species utilizing Canadian Arctic riverine systems and Evans *et al.* (2002) reported on 45 species of freshwater fish utilizing lacustrine environments. Many of these species referred in these two reports occur in both environment types. In Nunavut there are approximately only 20 freshwater species for all types of freshwater environments combined.

4.3.1 Arctic Char

Inuit Name: Erlakukpik, Kaloarpok, Ivatarak, Ivitagok (red or spawning char), Ikalopik, Ekalupik, Eqaluk, Ekalluk, Eekallûk, Equaluk, Ekaluppik, Kaïtilik, Ikalukpik, Ihkaluk, Iqalukpik, Iqalukpik, Iqaluppik, Iqalukpiaryuk, Ivitaaruq, Ivitaroq, Ivitaruk, Aniaq, Ekalluk, Eekalook, Iqaluk, Irkaluk, Angmalook, Hiwiterro, Tisuajuk, Ivisaruk, Nutilliajuk, Suvaliviniq, Aupalijaat, Aopalayâk, Aoparktulâyoq, Tadlulik (Coad and Reist 2004), Ikaliviit (Priest and Usher 2004a)
Scientific Name: *Salvelinus alpinus*

Conservation Status

Very abundant (Scott and Crossman 1973b; Richardson *et al.* 2001; Evans *et al.* 2002; Coad and Reist 2004). Populations can vary between systems depending on fishing pressure.

Distribution

Arctic char exhibit the most northerly distribution of any freshwater fish (Scott and Crossman 1973b). They are not found much farther south than 60°N (Mercier *et al.* 1994). In Nunavut, Arctic char are found along the west coast of Hudson Bay (Appendix B, Figure 4.3-2), throughout coastal areas of Kitikmeot (Appendix B, Figure 4.3-1), and on many Arctic islands, including Banks, Victoria, Devon, Somerset, and Baffin (McPhail and Lindsey 1970; Scott and Crossman 1973b; Mercier *et al.* 1994) (Appendix B, Figure 4.3-3). The largest recorded Arctic char run migrates upstream in the Iqaluit River, on northern Baffin Island [282,500 individuals; (Mercier *et al.* 1994)].

Ecology

Arctic char are a large freshwater species, attaining a maximum size of over 100 cm (Coad and Reist 2004) and a maximum weight of over 25 pounds (Scott and Crossman 1973b). Although growth rates vary considerably throughout their range, growth is typically slow (Scott and Crossman 1973b). For example, Arctic char from Frobisher Bay, Baffin Island do not attain lengths of 50 cm until the age of 14, and may live in excess of 24 years (Grainger 1953). In the marine environment, anadromous Arctic char feed on several marine fish species, including capelin, sand lance, Arctic cod, and young Greenland cod (Richardson *et al.* 2001). In freshwater environments, Arctic char feed on algae, insects, fish and plankton (Richardson *et al.* 2001).

Arctic char exhibit anadromous and lacustrine life history types, although the majority of Arctic char populations, especially at more northern latitudes, are anadromous (Scott and Crossman 1973b; Richardson *et al.* 2001). Arctic char spawn in lakes or rivers where there is gravel or other similar substrate (Hunter 1976). Char eggs require moving water to pass over them (Hunter 1976). In the

Tugaat River overwintering areas may be a limiting factor for arctic char (Read 2004), this is probably true for other rivers and lakes as well.

Anadromous—Adult anadromous Arctic char occur in rivers, lakes, estuaries, and marine environments (Richardson *et al.* 2001). They spawn in shallow waters (< 2 m) of rivers and lakes (Richardson *et al.* 2001). Preferred spawning substrates include cobble and gravel (Richardson *et al.* 2001). In the spring, adult Arctic char migrate downstream to marine waters (Richardson *et al.* 2001). Most fish remain in the vicinity of the estuary of their natal river, although tagging studies have shown that some fish may travel up to 80 km (Scott and Crossman 1973b). Adult Arctic char return to freshwater systems in the fall and overwinter there (Richardson *et al.* 2001). Juvenile Arctic char are generally found in shallow creek and lacustrine habitats (Richardson *et al.* 2001).

Lacustrine—Adult lacustrine Arctic char occur in the pelagic zone of lakes during the summer, and make seasonal shifts to benthic/littoral areas in the fall (Richardson *et al.* 2001). Spawning typically occurs over gravel and cobble substrates at depths of 2 – 10 m (Richardson *et al.* 2001). Young Arctic char occur in shallow nearshore areas, utilizing boulders and rubble as cover from predators (Richardson *et al.* 2001). Juvenile Arctic char are generally found in benthic habitats at depths greater than 5 m (Richardson *et al.* 2001).

Ecological/Economic Importance

Arctic char are an extremely valuable commercial species, and are harvested throughout their range (Scott and Crossman 1973b; Riewe 1992a; Mercier *et al.* 1994; Priest and Usher 2004a). Arctic char are also sought after by recreational anglers, and are commonly harvested as a food fish in Nunavut (Scott and Crossman 1973b; Riewe 1992a; Mercier *et al.* 1994; Priest and Usher 2004a).

Land Use Planning Considerations

Throughout Nunavut, many arctic char populations experience heavy fishing pressure (Carder and Peet 1983; Carder 1991, 1995; Read 2000; Read 2004). As such, commercial, recreational, and subsistence fisheries for Arctic char should be carefully managed to avoid overexploitation and to ensure the long-term sustainability of harvests. Spawning, rearing and overwintering habitat are critical to maintaining sustainable char populations. Special consideration for these critical habitats is important. Special management or mitigation measures should be considered on activities and/or timing of these activities in critical habitat areas as well as during periods of char migration. Land use planning should consider the maintenance of natural water flows in char river systems. Changes in natural water flows can reduce the amount of spawning and overwintering habitat available to char or reduce reproductive success. Special consideration when planning should be given to traditional fishing areas.

4.3.2 Slimy Sculpin

Inuit Name: Unknown
Scientific Name: *Cottus cognatus*

Conservation Status

Abundant (Richardson *et al.* 2001; Evans *et al.* 2002).

Distribution

The slimy sculpin is widely distributed across mainland Nunavut, but has not been observed on the Arctic Islands (McPhail and Lindsey 1970; Scott and Crossman 1973b) (Appendix B, Figure 4.3-5).

Slimy sculpins exhibit lacustrine and riverine life history types (Richardson *et al.* 2001). They are typically found in creeks, stream, and rivers, and are occasionally found in lakes (Richardson *et al.* 2001). Slimy sculpins spawn over sand, gravel and rock substrates in shallow waters of lakes (Richardson *et al.* 2001). Males construct nests beneath submerged stones and logs (Richardson *et al.* 2001). Juvenile slimy sculpins are commonly found over gravel and sand substrates, in water depths of < 2 m (Richardson *et al.* 2001).

Few studies have investigated the biology and/or ecology of slimy sculpins in their Arctic habitat; most studies are from the Great Lakes region. Slimy sculpins grow to a maximum size of approximately 12 cm (McPhail and Lindsey 1970). They feed on a variety of prey, including aquatic insects, crustaceans, small fishes and aquatic vegetation (Richardson *et al.* 2001).

Ecological/Economic Importance

The slimy sculpin is an important prey for a number of larger fish species, including lake trout, northern pike, and Burbot (Scott and Crossman 1973b; Hanson *et al.* 1992).

Land Use Planning Considerations

More research on the habitat requirements, ecology, and biology of the slimy sculpin in Nunavut is needed. There are no special considerations for slimy sculpins.

4.3.3 Lake Trout

Inuit Name: Ikalukpik (Priest and Usher 2004a)
Scientific Name: *Salvelinus namaycush*

Conservation Status

Abundant (Scott and Crossman 1973b; Richardson *et al.* 2001; Evans *et al.* 2002).

Distribution

Lake trout are widely distributed across mainland Nunavut in deep-water lakes (McPhail and Lindsey 1970; Scott and Crossman 1973b) (Appendix B, Figures 4.3-1 and 4.3-2). They are also found on many Arctic Islands, including Baffin, South Hampton, King William, Victoria, and Banks (Scott and Crossman 1973) (Appendix B, Figure 4.3-3).

Ecology

Lake trout are a strictly freshwater species (Richardson *et al.* 2001). They are generally found in large deep lakes, but may also be found in large clear rivers (Richardson *et al.* 2001). Adult Lake trout are pelagic in nature, commonly occurring at depths in excess of 10 m (Richardson *et al.* 2001). Spawning generally takes place over cobble, rubble and large gravel substrates, in areas free of sand, silt, clay and mud (Richardson *et al.* 2001). Spawning depths are highly variable, ranging from < 1 m to over 100 m (Richardson *et al.* 2001). There is some evidence that lake trout return to the same spawning grounds year after year (Martin 1960). Juvenile lake trout are often found in close association with the bottom, over cobble, rubble and boulder substrates (Richardson *et al.* 2001).

Lake trout spawn in the fall (September to October) at water temperatures of between 9 and 13°C (Scott and Crossman 1973a). In northern latitudes, lake trout reach sexual maturity at approximately 13 years of age (Scott and Crossman 1973a). They grow to a maximum size of approximately 130 cm, and often exceed 50 pounds (Scott and Crossman 1973a). Lake trout feed on a variety of prey including fish, mollusks, crustaceans, freshwater sponges and small mammals (Richardson *et al.* 2001).

Ecological/Economic Importance

Lake trout are an extremely valuable commercial species, and are harvested throughout their range (Scott and Crossman 1973a; Riewe 1992b; Priest and Usher 2004b). Lake trout are also sought after by recreational anglers, and are commonly harvested as a food fish in Nunavut (Scott and Crossman 1973a; Riewe 1992b; Priest and Usher 2004b). There are numerous commercial fishing lodge operations in Nunavut which depend on sustainable populations of lake trout.

Land Use Planning Considerations

Commercial, recreational, and subsistence fisheries for lake trout should be carefully managed to ensure long-term sustainability. Spawning areas should be carefully managed and the type and timing of activities in spawning areas should be considered when planning for these areas. Special planning consideration should be given to fishing lodge operations as these operations are also impacted by activities which can affect the natural aesthetics of an area.

4.3.4 Lake Herring

Inuit Name: Arnaqsleq, Kapisilik, Kavisilik, Kaviselik (Coad and Reist 2004)
Scientific Name: *Coregonus artedii*

Conservation Status

Abundant (Richardson *et al.* 2001; Evans *et al.* 2002; Coad and Reist 2004).

Distribution

Lake herring are abundant throughout mainland Nunavut. James Bay-eastern Hudson Bay, Hudson bay, Hudson Strait, Lancaster Sound Region, Viscount Melville Region, Queen Maud Gulf, Beaufort Sea-Amundsen Gulf (Appendix B, Figure 4.3-4). Most northern record was collected from Bernier Bay, Baffin Island (Ellis 1962).

Ecology

Lake herring are primarily a lacustrine species but an anadromous life history type is known to occur in the James Bay region (Richardson *et al.* 2001). Lake herring are occasionally found in large rivers (Richardson *et al.* 2001). Lake herring are generally pelagic, occurring most commonly at depths of 10 – 60 m throughout the year (Richardson *et al.* 2001). Lake herring spawn in shallow water (1 – 5 m) over sand and gravel substrates (Richardson *et al.* 2001). Juvenile lake herring are often found schooling in shallow-water areas of protected bays, in association with rocky substrates and vegetation (Richardson *et al.* 2001).

Lake herring are a pelagic species, forming large schools in their lake habitats (Scott and Crossman 1973a). In the Arctic, lake herring reach sexual maturity at approximately 5 – 6 years, and may live to 13 (Scott and Crossman 1973a). Lake herring grow to a maximum size of approximately 40 cm and may weigh up to 4 pounds (Scott and Crossman 1973a). They feed primarily on plankton, but also eat large crustaceans, chironomid larvae and young fish (Richardson *et al.* 2001).

Ecological/Economic Importance

Lake herring are very important ecologically as they are one of the principal prey of lake trout, as well as other predaceous fish (Scott and Crossman 1973a). Lake herring are harvested commercially throughout their range, and are a locally important food fish in many parts of Nunavut (Scott and Crossman 1973a; Riewe 1992b; Coad and Reist 2004; Priest and Usher 2004b).

Land Use Planning Considerations

Commercial and subsistence fisheries for lake herring should be carefully managed to ensure long-term sustainability. Spawning habitat for this species should be carefully managed, taking into account types and timing of activities in these areas. Special consideration should be given to traditional harvest areas.

4.3.5 Lake Whitefish

Inuit Name: Pi-kok-tok, Jikuktok, Anahik, Kapihilik, Pikuktuuq, Kakiviaktok, Kavisilik, Anâdlerk, Kakiviartût, Keki-yuak-tuk, Kapisilik, Anadleq, Kakkiviartoq, Kaviselik, Qelaluqaq (Coad and Reist 2004). Kapihiliit (Priest and Usher 2004b)
Scientific Name: *Coregonus clupeaformis*

Conservation Status

Abundant (Richardson *et al.* 2001; Evans *et al.* 2002; Coad and Reist 2004).

Distribution

The lake whitefish is widely distributed throughout mainland Nunavut. It is found in the following ecozones: James Bay-eastern Hudson Bay, Hudson Bay, Hudson Strait, Baffin Bay-Davis Strait Nearshore, Lancaster Sound Region, Queen Maud Gulf, and Beaufort Sea-Amundsen Gulf (Coad and Reist 2004) (Appendix B, Figure 4.3-4). In Nunavut, the northern limit of lake whitefish is near Cambridge Bay on Victoria Island (McPhail and Lindsey 1970; Scott and Crossman 1973a).

Ecology

Lake whitefish exhibit anadromous, adfluvial, and lacustrine life history types (Richardson *et al.* 2001).

Anadromous: Adult anadromous lake whitefish generally occur in low-salinity nearshore areas and in deep delta channels (Richardson *et al.* 2001). Spawning takes place in the shallows of major rivers and their tributaries, in moderately swift currents (Evans *et al.* 2002). Preferred spawning substrates include gravel, sand, and hard silt (Richardson *et al.* 2001; Evans *et al.* 2002). Primary nursery areas used by juvenile lake whitefish are: delta lakes and channels; inner and outer estuaries; coastal areas; and back eddies of major rivers (Richardson *et al.* 2001).

Lacustrine: Adult lacustrine lake whitefish are primarily bottom-dwelling, occurring at depths greater than 10 m (Richardson *et al.* 2001). Spawning takes place in shallow water areas (<5 m) in both lakes and rivers (Richardson *et al.* 2001; Evans *et al.* 2002). Preferred spawning substrates include boulder, cobble and gravel, although spawning may also occur over fine sediments (Richardson *et al.* 2001). Juvenile lake whitefish are most often found in shallow water, in areas of boulder, cobble and gravel substrates in association with emergent vegetation and woody debris (Richardson *et al.* 2001).

Lake whitefish spawn in the fall (October to December) in cold waters. Eggs hatch in the spring (April-May), and juvenile fish form large aggregations in shallow water along steep shorelines. Lake whitefish exhibit rapid growth rates, reaching a maximum size of approximately 91 cm at 8 to 9 years of age (Scott and Crossman 1973a; Coad and Reist 2004). Anadromous lake whitefish feed on gastropods, pelecypods, amphipods, chironomids, notostracans, cladocerans, ocstracods and various insects (Richardson *et al.* 2001). Lacustrine lake whitefish are bottom feeders and feed on snails, clams, chironomid larvae and small fishes (Richardson *et al.* 2001).

Ecological/Economic Importance

Lake whitefish are an extremely valuable commercial species, and are harvested throughout their range (Scott and Crossman 1973a; Riewe 1992b; Priest and Usher 2004b). Lake whitefish are also sought after by recreational anglers, and are commonly harvested as a food fish in Nunavut (Scott and Crossman 1973a; Riewe 1992b; Priest and Usher 2004b).

Land Use Planning Considerations

Commercial, recreational, and subsistence fisheries for lake whitefish should be carefully managed to ensure long-term sustainability. Special consideration should be given to manage or mitigate activities which may interfere with commercial fishing operations and areas used for domestic harvesting. Spawning areas should be given special consideration and should take into account the types and timing of activities which might occur in these areas.

4.3.6 Northern Pike

Inuit Name: Hiulik (Priest and Usher 2004b)
Scientific Name: *Esox lucius*

Conservation Status

Abundant (Richardson *et al.* 2001; Evans *et al.* 2002).

Distribution

Northern pike are widely distributed across mainland Nunavut, but have not been reported from the northern Keewatin region or the Arctic islands (McPhail and Lindsey 1970; Scott and Crossman 1973a) (Appendix B, Figure 4.3-5).

Ecology

Northern pike exhibit lacustrine, adfluvial and riverine life history types (Richardson *et al.* 2001). They are principally found in shallow (< 5 m) weedy areas of slow meandering rivers and in weedy bays of lakes (Richardson *et al.* 2001). Northern pike produce eggs that adhere to short emergent vegetation such as grasses, sedges and bulrushes with fine leaves (Richardson *et al.* 2001). Spawning generally takes place in the shallows of lakes and in the backwaters of rivers (Richardson *et al.* 2001). Preferred spawning substrate includes fine silt and mud (Richardson *et al.* 2001). Juvenile Northern pike are generally found in shallow water areas (< 1 m) in association with submergent vegetation (Richardson *et al.* 2001). Adult Northern pike are ambush predators and use the cover of logs and weeds to ambush their prey (Richardson *et al.* 2001).

Northern pike are a relatively fast-growing species, attaining sexual maturity between five and six years of age (Scott and Crossman 1973a). Growth rates are somewhat decreased at northern latitudes (compared to southern latitudes), and longevity is increased (Scott and Crossman 1973a). Northern pike may grow to lengths of over 130 cm and may weigh in excess of 50 pounds (Scott and Crossman 1973a). They are an aggressive ambush predator, and feed on a variety of prey including fish, frogs, leeches, insects, small rodents and birds (Richardson *et al.* 2001).

Ecological/Economic Importance

Northern pike are a major predator of a variety of organisms in lakes and rivers, particularly other freshwater fish (Mauck and Coble 1971; Scott and Crossman 1973a; Richardson *et al.* 2001). Northern pike are highly prized as a sport fish throughout their range. In Nunavut, Northern pike are occasionally taken as a food fish (Priest and Usher 2004b).

Land Use Planning Considerations

The preferred habitats of Northern pike are shallow, weedy, slow-moving waters. These areas are often found close to shore, making them vulnerable to human activities such as urban development. As such, shallow vegetated habitats used as pike spawning habitat should be taken into consideration when planning development in shoreline areas. Special consideration should be given to areas which have commercial sport fishing lodges which depend on sustainable populations of northern pike and maintaining the appearance of a pristine environment.

4.3.7 Fourhorn Sculpin (freshwater form)

Inuit Name: Kan-ny-yoke, Kaneeok, Kanyok, Kanajuk, Kanayuk (Coad and Reist 2004)
Scientific Name: *Myoxcephalus quadricornis*

Conservation Status

The freshwater form of the Fourhorn sculpin was listed as "Special Concern" by COSEWIC in 1989 (Houston 1989). Based on an updated status report, the freshwater form was re-listed as "Data Deficient" in 2003 (COSEWIC 2003a).

Distribution

The freshwater form of the Fourhorn sculpin is found in landlocked, deep cold lakes in North America and northern Europe. In Nunavut they have been captured in at least three lakes in the eastern portion of Victoria Island, Lake Tuborg and Romulus Lake on Ellesmere Island, Eleanor and Sophia Lake on Cornwallis Island, Garrow Lake on Little Cornwallis Island, unnamed lakes on Melville, Bathurst and Hepburn Islands, Stanwell/Fletcher Lake on Somerset Island and Nauyak Lake on Kent Peninsula.

Ecology

Little is known about the habitat requirements of the freshwater fourhorn sculpin, but these may be limited in some lakes. Temperature may play a role in their distribution in lakes as they are thought to exhibit seasonal vertical migrations (COSEWIC 2003a). A few populations are isolated in marine layers in freshwater lakes and these represent isolates of the marine form (Coad and Reist 2004).

Very little is known about the biology of the fourhorn sculpin and what is known is mainly inferred from knowledge of the marine form or the freshwater form found in northern Europe. Prey items include crustaceans, mollusks, priapulids, annelids, chironomids and small fishes (COSEWIC 2003a). It is thought that the freshwater form may exhibit similar spawning behaviour to the marine form which builds nests for its eggs. These nests are guarded by the male sculpin (Morrow 1980).

Ecological/Economic Importance

The ecological importance of freshwater fourhorn sculpins is unknown and this species has no economic importance. The freshwater form is important for scientific purposes in understanding the evolution of relic populations.

Land Use Planning Considerations

Special attention should be given to this species when considering activities in lakes where they are present. Further research is required to better understand their life history and status.

4.3.8 Arctic Grayling

Inuit Name: Hulupaugaq (Priest and Usher 2004b)
Scientific Name: *Thymallus articus*

Conservation Status

Abundant (Scott and Crossman 1973a; Richardson *et al.* 2001; Evans *et al.* 2002).

Distribution

In Nunavut, Arctic graylings are distributed throughout mainland Nunavut to the west of Hudson Bay (McPhail and Lindsey 1970; Scott and Crossman 1973a) (Appendix B, Figure 4.3-5). Arctic grayling have not been recorded from the Arctic Islands (McPhail and Lindsey 1970; Scott and Crossman 1973a).

Ecology

Arctic graylings exhibit lacustrine, adfluvial, and riverine life history types (Richardson *et al.* 2001). They are commonly found in clear water of large cold rivers, streams, and lakes at depths of < 3 m (Stewart *et al.* 2007b). Adult arctic graylings are often found beneath the cover of overhanging riparian vegetation (Stewart *et al.* 2007b). Arctic graylings spawn in shallow streams over gravel and rock substrates (Richardson *et al.* 2001). They may also spawn in lakes, although this has not been recorded for populations in Nunavut (Richardson *et al.* 2001). Juvenile arctic graylings are often found in lotic and littoral areas at depths of less than 1 m (Richardson *et al.* 2001). Cover (e.g., rocks) is very important for juvenile Arctic grayling (Evans *et al.* 2002; Stewart *et al.* 2007b).

At northern latitudes, arctic grayling are relatively slow growing, reaching sexual maturity between 6 and 9 years of age (Scott and Crossman 1973a). They grow to a maximum size of approximately 75 cm, and may reach 5 lbs in weight (Scott and Crossman 1973a). Arctic graylings feed on a variety of aquatic and terrestrial insects including mayflies, caddisflies, midges, bees, wasps, grasshoppers, ants and beetles (Stewart *et al.* 2007a).

Ecological/Economic Importance

Throughout their range, arctic grayling are a commonly targeted sport fish. They are one of the few northern fishes that can be caught fly-fishing (this is because their diet consists primarily of terrestrial insects). Arctic grayling are occasionally harvested as a food fish, and also as food for dogs (Riewe 1992b; Priest and Usher 2004b).

Land Use Planning Considerations

Although arctic grayling are not currently targeted in commercial fisheries, their ease of capture, late maturity and slow growth, and reliance on cold, clear, unpolluted water make them vulnerable to both overfishing and human development. Spawning, rearing and overwintering habitat is critical to maintaining sustainable populations of Arctic grayling. Special consideration should be given for maintaining the quality of these habitats. Managing the types of activities and the timing of these activities in critical Arctic grayling habitat is important to minimize impact on this species.

4.3.9 Burbot; Loche

Inuit Name: Tataliq, Tiktabek, Titalik, Tiktaaliq, Tiktalik, Tiktalaq, Tiktailik, Shulukpaoluk, Nettârnak (Coad and Reist 2004)
Scientific Name: *Lota lota*

Conservation Status

Abundant (Scott and Crossman 1973a; Richardson *et al.* 2001; Evans *et al.* 2002).

Distribution

Burbot are widely distributed throughout mainland Nunavut, although they are absent from the northernmost regions of Kitikmeot and Kivaliq, as well as the Arctic islands (McPhail and Lindsey 1970; Scott and Crossman 1973a; Coad and Reist 2004) (Appendix B, Figure 4.3-5). Throughout its range, Burbot is ubiquitously distributed in all suitable habitats (Scott and Crossman 1973a).

Ecology

Burbot exhibit lacustrine and adfluvial life history types (Richardson *et al.* 2001). They are most commonly found in deep-water lakes, although they may also occur in rivers and small streams (Davis *et al.* 1980). Adult burbot are benthic and nocturnal, generally occurring over boulder, rubble, cobble and sand substrates (Richardson *et al.* 2001). Burbot are known to spawn in lakes, rivers and streams (Richardson *et al.* 2001). Spawning generally takes place over sand, gravel, or rubble substrates at depths of < 3 m (Richardson *et al.* 2001). During the daytime, juvenile and adult burbot seek shelter under physical structures such as boulders, cobble, logs and submergent vegetation (Richardson *et al.* 2001).

The burbot is one of the few Canadian freshwater fish that spawns during the winter. In Canada, burbot spawn under the ice between January and March. Burbot grow to approximately 90 cm, and may weigh up to 18 lbs (Scott and Crossman 1973a). Young burbot feed on a variety of invertebrate prey, including aquatic insects, crayfish, and molluscs (Richardson *et al.* 2001). Adult burbot are primarily piscivorous, feeding on ciscoes, cottids, whitefish, sticklebacks and trout-perch (Richardson *et al.* 2001).

Ecological/Economic Importance

In North America, burbot are of limited commercial importance (Scott and Crossman 1973a; Coad and Reist 2004). In Nunavut, burbot is occasionally taken as a food fish (Riewe 1992b; Priest and Usher 2004b) and as dog food.

Land Use Planning Considerations

As burbot are known to utilize submerged physical structures such as boulders, logs and submergent vegetation, consideration should be given to maintaining structural complexity in burbot habitat. Managing the types and timing of activities should be considered for periods of migrations and spawning.

4.3.10 Broad Whitefish

Inuit Name: Anaklek, An-ark-hlirk, Anah'lih', Aanaaksiiq, Kavisilik (Coad and Reist 2004)
Scientific Name: *Coregonus nasus*

Conservation Status

Common (Richardson *et al.* 2001; Evans *et al.* 2002; Coad and Reist 2004).

Distribution

In Nunavut, the broad whitefish is found only on the Kitikmeot mainland (McPhail and Lindsey 1970; Scott and Crossman 1973a) (Appendix B, Figure 4.3-4). It is not known to occur on any of the Arctic islands (Scott and Crossman 1973a; Coad and Reist 2004).

Ecology

Broad whitefish are primarily an anadromous species, occurring in large river systems, delta lakes, and brackish estuarine waters (Richardson *et al.* 2001). Broad whitefish are also known to exhibit a lacustrine life history type (Richardson *et al.* 2001). Adult broad whitefish are generally found in nearshore coastal estuaries where they feed (Richardson *et al.* 2001; Evans *et al.* 2002). Spawning takes place in the shallow pools of rivers, over sandy-gravel and rocky substrates (Evans *et al.* 2002). Nursery areas for juvenile broad whitefish include: coastal rivers; tundra lakes; and the inner and outer deltas of major rivers (Richardson *et al.* 2001; Evans *et al.* 2002). Juvenile broad whitefish are often found associated with sand, cobble, silt and gravel substrates (Evans *et al.* 2002).

The biology and ecology of the broad whitefish is not well known. Studies of this species in Siberia suggest that it lives to at least 15 years of age (Scott and Crossman 1973a). Broad whitefish attain a maximum size of 71 cm, and may grow to weights in excess of 4 lbs (Scott and Crossman 1973a; Coad and Reist 2004). Broad whitefish feed on bottom-dwelling organisms including aquatic insect larvae, small mollusks and crustaceans (Richardson *et al.* 2001).

Ecological/Economic Importance

In Nunavut, broad whitefish are locally harvested as a food fish, and are occasionally harvested for dog food (Scott and Crossman 1973a; Coad and Reist 2004).

Land Use Planning Considerations

Spawning and overwintering habitat is critical to maintaining sustainable populations of broad whitefish. Special planning considerations should be given to these areas. Managing the types and timing of activities should be considered for critical habitat areas and at times of migrations. Special consideration should be given to traditional harvesting areas.

4.4 Marine Invertebrates

It is difficult to obtain a count on the number of species of invertebrates found in Nunavut marine waters but it is likely to be in the thousands; for example for only the areas of Foxe Basin, Foxe Channel and Hudson Strait, Atkinson and Wacasey (1989) reported 541 benthic invertebrate species. This does not include pelagic invertebrate species for those areas. There are still many invertebrate species yet to be identified in Nunavut.

4.4.1 Squid

Inuit Name: Amigguq (Government of Nunavut 2010)
Scientific Name: *Gonatus fabricii*

Conservation Status

Unknown but probably common.

Distribution

Gonatus fabricii is the most abundant squid in marine waters of the Arctic and sub-Arctic (Bjorke 2001).

Ecology

Young squid are most often found in the upper 60 m of the ocean (Bjorke 2001). Upon reaching 50 – 60 mm mantle length as adults, *G. fabricii* descends to depths greater than 400 m (Bjorke 2001) and up to 1,100 m (Frandsen and Wieland 2004).

Squid are short lived and fast growing (Frandsen and Wieland 2004) Bjorke (2001) suggests that their life span does not likely exceed two years of age but spawning has been reported to occur up to three years of age (Frandsen and Wieland 2004). The largest recorded specimen of *Gonatus fabricii* was 385 mm mantle length (Bjorke 2001).

Ecological/Economic Importance

Squid are considered ecologically important (Frandsen and Wieland 2004). They are an important prey species for a variety of fish and marine mammals (Bjorke 2001). Finley and Gibb (1982) report that *G. fabricii* an important food item for narwhals. They are also a food source for hap and hooded seals (Haug *et al.* 2004) and maybe for beluga whales (Richard *et al.* 1998). Squid were the predominant prey in the stomachs of Greenland halibut collected on the deep slope of the Northeast Newfoundland continental shelf in 1,000 to 1,250 m of water (Dawe *et al.* 1998). In Greenland, squid is sometimes used as bait in Greenland halibut and snow crab fisheries (Frandsen and Wieland 2004).

Land Use Planning Considerations

No special planning considerations required.

4.4.2 Whelk, Snail

Inuit Name: Unknown
Scientific Name: *Buccinium* sp.

Conservation Status

Unknown.

Distribution

Distribution is poorly known. The whelks *Buccinium sp.* occur in North Atlantic Ocean and the North Sea (Food and Aquaculture Organization of the United Nations 2008). In Nunavut it is known to occur offshore of Grise Fiord, Pond Inlet and Clyde based on bearded seal stomach contents (Finley and Evans 1983).

Ecology

Whelks are poorly adapted to intertidal zone (Food and Aquaculture Organization of the United Nations 2008). Mainly found below low tide mark to 100 m but are known to occur deeper (Food and Aquaculture Organization of the United Nations 2008). Prefer sand, sandy-mud or stony bottoms (Food and Aquaculture Organization of the United Nations 2008).

Buccinium whelks grow slow and in the St Lawrence River estuary reach a maximum age of 15 years (Giguere 1997). The males mature earlier (six years) than the females (seven years) in the St Lawrence River estuary (Giguere 1997). Vulnerability of whelks to predators such as asteroids is reduced with size (Rochette and Himmelman 1996). Whelks have a mostly sedentary lifestyle but can move quickly when food or predators are close by (Giguere 1997). Whelks feed mainly on molluscs and other invertebrates (Giguere 1997).

Ecological/Economic Importance

Some commercial fisheries in eastern Canada. Prey items for bearded seals (Finley and Evans 1983) and walrus (Fay and Burns 1988).

Land Use Planning Considerations

Areas of high whelk concentrations are largely unknown and require investigation.

4.4.3 Green Sea Urchin

Inuit Name: Mirqulik (Nunavut Department of Culture Language Elders and Youth 2010)
Scientific Name: *Strongylocentrotus droebachiensis*

Conservation Status

Unknown.

Distribution

Circumpolar, found along coast of Baffin Island, Foxe Basin, Hudson Strait and Foxe Channel (Atkinson and Wacasey 1989). Found in Hudson Bay and James Bay (Stewart and Lockhart 2005). Likely found in eastern marine waters of Nunavut as well.

Ecology

Green sea urchins generally occur in shallow subtidal environments. They prefer rocky benthic substrates and are not commonly found on sandy or muddy bottoms (Himmelman 1986).

Aggregations of green urchins are generally correlated with high abundances of macroalgae, the primary food of green urchins (Himmelman 1986).

There is little information on sea urchin biology in Arctic waters. Green sea urchins generally decrease in abundance and size with depth (Himmelman 1986). Spawning generally occurs in spring with larvae being planktonic (Brady and Scheibling 2006). They are herbivorous invertebrates, and graze primarily on fleshy marcoalgae (Himmelman 1986). Green sea urchins are known to be subject to mass mortalities when food supplies are outstripped (Brady and Scheibling 2006).

Ecological/Economic Importance

Commercially harvested in Eastern Canada. May have limited potential commercial in Nunavut. Green sea urchins are harvested locally for food off the Belcher Islands (Stewart and Lockhart 2005).

Land Use Planning Considerations

More information is required on distribution and abundance of green sea urchins to determine areas of critical habitat.

4.4.4 Clam

Inuit Name: Ammuumajuk, Ammuumajuq (Government of Nunavut 2010)
Scientific Name: *Mya truncata*

Conservation Status

Common.

Distribution

Clams occur in the coastal fjords of eastern Baffin Island and in nearshore areas of the Baffin Island shelf (Aitken and Fournier 1993). Clams have been collected from Barrow Strait-Lancaster Sound Hobson and Welch (1992) collected samples from Barrow Strait-Lancaster Sound) and Resolute Bay (Welch and Martin-Bergmann (1990) collected 220 clams from 10 – 15 m depth in Resolute Bay on July 31, 1985).

Ecology

Clams are found buried in sandy or muddy benthic substrates (Aitken and Fournier 1993). They are most common in waters < 50 m in depth (Aitken and Fournier 1993).

Clams are infaunal suspension feeders. While their bodies remain buried, *M. truncata* protrude their siphons from the seabed to feed on phytoplankton (Welch and Martin-Bergmann 1990; Ruppert and Barens 1994).

Ecological/Economic Importance

Clams are a major prey of walrus (Welch and Martin-Bergmann 1990). It is estimated that a single walrus consumes 4,500 to 6,500 *M. truncata* per day (Welch and Martin-Bergmann 1990). These clams are occasionally harvested for local consumption. Clams are commercially harvested in other parts of Canada.

Land Use Planning Considerations

Identification of clam beds and local harvest areas need to be determined. Activities should be carefully managed in areas of high densities of clams, especially those areas which are harvested by local communities.

4.4.5 Icelandic Scallop

Inuit Name: Tallurunnaq (Government of Nunavut 2010)
Scientific Name: *Chlamys islandica*

Conservation Status

Generally unknown but likely stable.

Distribution

Icelandic scallops are found throughout Hudson Bay (Parks Canada 1995). Icelandic scallops are also found in fiords along the east coast of Baffin Island and Hudson Strait (Crawford 1992) and in Cumberland Sound (Parks Canada 1995) (Appendix B, Figure 4.4-1). The northern limit of Icelandic scallops along the east coast of Baffin Island is Cambridge Fiord (Syvitski *et al.* 1989). Local distribution of Icelandic scallops in the Canadian Arctic is very patchy and dense aggregations are uncommon (Crawford 1992).

Ecology

Icelandic scallops are most common at depths of 20 to 60 m (Pedersen 1994). They are epibenthic (Crawford 1992) and are generally found on substrates consisting of shells, gravel, stones, rocks, and occasionally mud (Pedersen 1994). Icelandic scallops are often in areas associated with strong tidal currents (Pedersen 1994).

Icelandic scallops reach a maximum size (shell height) of approximately 100 mm with a maximum recorded size of 120 mm (Crawford 1992). Growth is seasonal. Icelandic scallops are epifaunal suspension feeders, consuming primarily phytoplankton (Pedersen 1994; Ruppert and Barens 1994). Icelandic scallops are slower growing in arctic waters then in areas off southern Canada (Crawford 1992). They spawn in June and July (Crawford 1992).

Ecological/Economic Importance

Icelandic scallops are commercially harvested in eastern Canada, the Gulf of St. Lawrence and Greenland (Pedersen 1994). In Nunavut there have been exploratory fisheries for Icelandic scallops in Cumberland Sound (Cosens *et al.* 1990) and Frobisher Bay (Crawford 1992).

Land Use Planning Considerations

There are limited data on the distribution and abundance of Icelandic scallops. Human activities can potentially impact the substrate of Icelandic scallop beds thereby affecting the sustainability of local scallop populations. Activities should be carefully managed in areas of high density scallop beds, especially those areas which are harvested by local communities.

Consideration should be given to identifying and mapping scallop beds, especially near local communities.

4.4.6 Northern Shrimp and Striped Pink Shrimp

Inuit Name: Unknown
Scientific Name: *Pandalus borealis* and *Pandalus montagui*

Conservation Status

Common.

Distribution

In the Western Atlantic, northern shrimp are most abundant north of the 46°N (Koeller 2000). They are found in Cumberland Sound, Davis Strait, and Hudson Strait (Stephenson and Hartwig 2010) (DFO 2008a) (Appendix B, Figure 4.4-1). Concentrations of striped pink shrimp have recently been identified in eastern Hudson Strait and Ungava Bay (DFO 2006b).

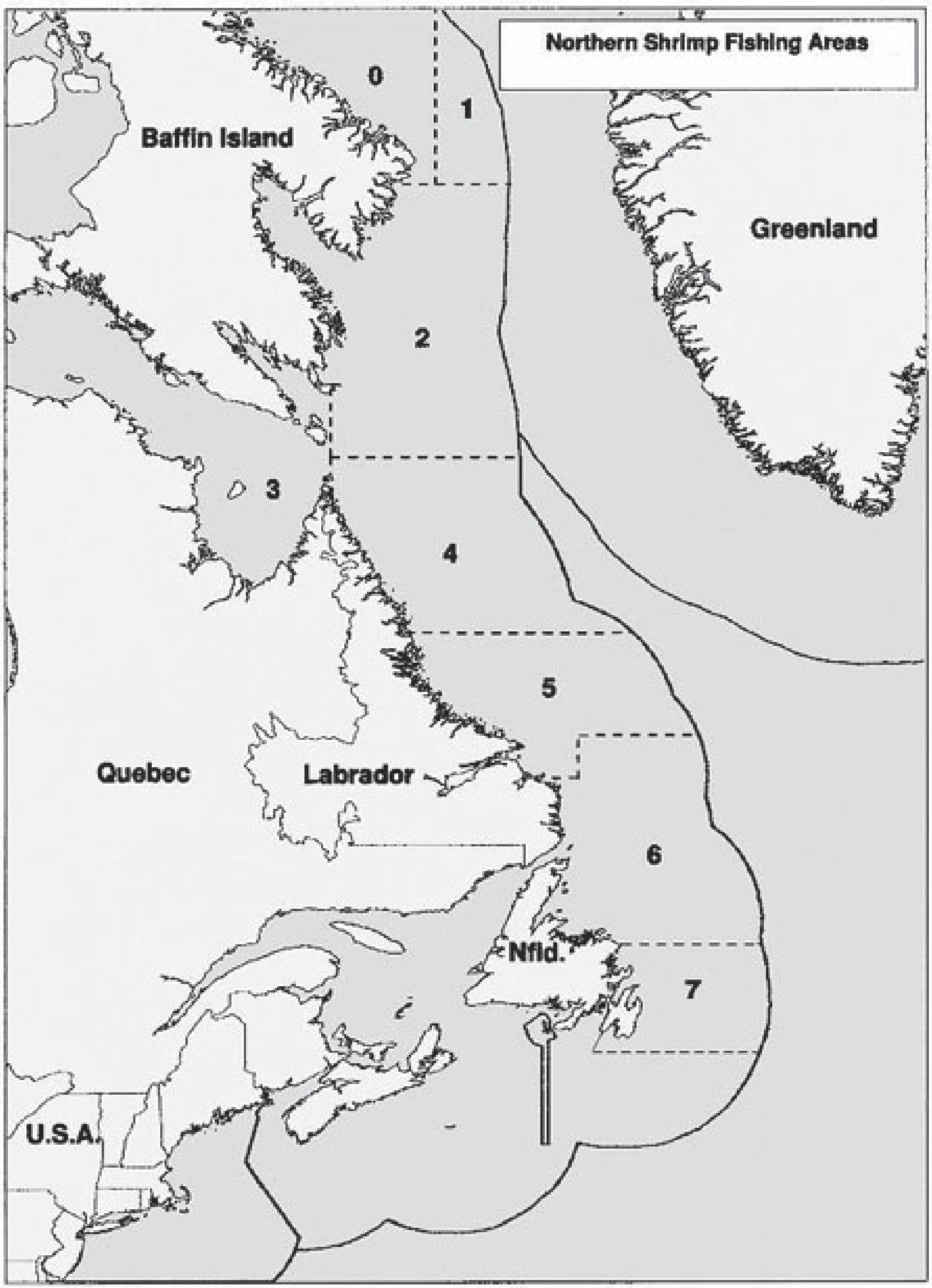
Ecology

Northern shrimp generally occur over mud, sand and clay substrates (Koeller 2000). They are most abundant at depths greater than 200 m (Koeller 2000). Northern shrimp prefer temperatures of 1 – 6°C (Koeller 2000).

Northern shrimp attain a maximum size of approximately 16 cm (DFO 2006b). During the day, northern and striped pink shrimp feed on the bottom, consuming various organisms such as worms, small crustacean, detritus and marine plants (DFO 2006b). During the night, the shrimp migrate vertically in the water column to prey upon copepods and euphasids (DFO 2006b).

Ecological/Economic Importance

There is a year-round fishery for Northern shrimp off the east coast of Baffin Island and in Hudson Strait (Figure 4.4-2) (DFO 2008). In 2007, the TAC for the Northern shrimp fishery was 34,367 tonnes (Table 4.4-1) (DFO 2008). This fishery includes *Pandalus borealis* and *Pandalus montagui* (DFO 2008). Northern and striped pink shrimp are preyed upon by 26 species of marine fish, mammals, and invertebrates in the North Atlantic (Parsons 2005). These include seals, Greenland halibut, and an arctic cod (DFO 2006b).



(Source: http://www.dfo-mpo.gc.ca/decisions/fm-2007-gp/nshrimp-crevetten_e.htm)

Figure 4.4-2: Northern Shrimp Fishing Areas

Table 4.4-1: TAC for Northern Shrimp Industry

SFA	Fleet/Interest	2007
0	Offshore Licence Holders	500
1	Offshore Licence Holders	14,246
	Nunavut	3,722
	Makivik	449
Total		**18,417**
2	Offshore Licence Holders	5,250
	Offshore Licence Holders (Expl. *Pandalus borealis* E of 63°W)	1,750
	Nunavut (N of 63N and E of 63W)	1,750
	Nunavut (Exploratory Pandalus montagui inside NSA)	2,000
Total		**10,750**
3	Offshore Licence Holders (Pandalus montagui in SFAs 2/3/4 West of 63W)	3,300
	Nunavut (Exploratory Pandalus montagui inside the NSA)	1,000
	Pandalus Borealis (bycatch)*	400
Total		**4,700**

NOTE:
Source: http://www.dfo-mpo.gc.ca/decisions/fm-2007-gp/nshrimp-crevetten07_e.htm)

Land Use Planning Considerations

Consideration should be given to prevent potential conflicts with shrimp industry. This may include the planning of timing of other shipping, fishing, or oil and gas activities.

4.4.7 Blue Mussel

Inuit Name: Amyak
Scientific Name: *Mytilus edulis*

Conservation Status

Unknown.

Distribution

Blue mussels are widely distributed occurring in the Arctic, North Atlantic and North Pacific Oceans. In North American waters they occur from Baffin Island to North Carolina. They are widespread throughout Hudson Bay (Stewart and Lockhart 2005). Areas around the Belcher Islands in Hudson Bay are thought to be very productive areas for blue mussels (Parks Canada 1995).

Ecology

Blue mussels occur both intertidally and subtidally. They are sessile organisms, requiring hard substrates (e.g., bedrock, boulder, cobble, docks, pilings) for attachment although they can also inhabit areas of sand or mud if there are hard objects (e.g., stones or other shells) within it to attach to (Newell 1989).

Blue mussels grow to a maximum size of approximately 6 cm (Kozloff 2003) although they can grow larger in more northerly latitudes (Newell 1989). They are suspension feeders, consuming primarily phytoplankton (Ruppert and Barens 1994). Blue mussels tend to grow slower at northern latitudes due to colder water temperatures. They are slow growing and take 6 – 8 years to reach a marketable size of 50 mm. Predators include seabirds such as the common eider (Bustnes 1998; Stewart and Lockhart 2005), fish and some mammals (Stewart and Lockhart 2005). The optimal temperature for blue mussels is between 5 – 20°C although they can survive in cooler temperatures as well (Food and Aquaculture Organization of the United Nations 2008).

Ecological/Economic Importance

Important prey species for various fish and seabird species (Stewart and Lockhart 2005). In Norway blue mussels are the most important food item for common eiders (Bustnes 1998). Subsistent harvested regularly for food (Stewart and Lockhart 2005). Exploratory fisheries have occurred in the past at Whale cove, Chesterfield Inlet and Arviat but none of these exploratory fisheries have resulted in commercial fisheries starting. Blue mussels are harvested and farmed in southern Canada, the United States and Europe.

Land Use Planning Considerations

Mussels are slow growing in Nunavut. Consideration should be given to identifying and mapping mussel beds. Activities affecting the seabed or water quality should be carefully managed in areas where blue mussels occur. Special consideration should be given to areas where mussels are locally harvested.

4.4.8 Snow Crab

Inuit Name: Unknown
Scientific Name: *Chionoecetes opilio*

Conservation Status

In Atlantic Canada, snow crab stocks are variable and subject to natural fluctuation (DFO 2003). Recent studies suggest that there is an overall decline in abundance and size of snow crabs throughout the North Atlantic region (DFO 2003).

Distribution

Snow crabs are found throughout the Northeast Atlantic from Greenland to the Gulf of Maine (DFO 2003). Snow crabs are also found in Davis Strait. Snow crab moults have been found washing up on beaches on Herschel and Banks Islands (Stephenson and Hartwig 2010b).

Ecology

Snow crabs are most common on muddy substrates at depths of 70 to 160 m (Powles 1968). They prefer temperatures between -1 and 2°C (Powles 1968).

Female snow crabs reach a maximum size (carapace width) of approximately 9.5 cm, while males may reach 14 cm (DFO 2003). Snow crabs consume a variety of prey, including fish, clams, polychaete worms, brittle stars, shrimps and other crustaceans (DFO 2003; Squires and Dawe 2003).

Ecological/Economic Importance

Snow crabs are a very important commercial resource in Canada (Comeau *et al.* 1998). In 2002, the total snow crab quota set by DFO for the Atlantic Provinces was 92,127,000 kg (DFO 2003). In 2002, exports of Canadian snow crab product were worth $678 million (DFO 2003).

Land Use Planning Considerations

Distribution and abundance of snow crab in Nunavut is poorly understood. Research on distribution, abundance and critical habitat is required for planning.

4.5 Waterfowl

Conservation Status

Conservation rankings of waterfowl by Nunavut and COSEWIC are summarized in Table 4.5-1. The harlequin duck is the only species of waterfowl in Nunavut to be listed under SARA. It is designated as Special Concern.

Table 4.5-1: Waterfowl Species Found in Nunavut

Common Name	Scientific Name	Inuit Name	GS Nunavut Rank 2005	COSEWIC
Common Loon	*Gavia immer*	Tuulligjuak	Secure	Not At Risk
Red-throated Loon	*Gavia stellata*	Qaqsauq	Secure	
Pacific Loon	*Gavia pacifica*		Secure	
Yellow-billed Loon	*Gavia adamsii*		Secure	Not At Risk
Horned Grebe	*Podiceps auritus*		Undetermined	Special Concern 2009
Canada Goose	*Branta canadensis*	Nirlivik, Uluagullik	Secure	
Cackling Goose	*Branta hutchinsii*		Secure	
Greater White-fronted Goose	*Anser albifrons*		Secure	
Snow Goose	*Chen caerulescens*	Kanguq	Secure	
Ross's Goose	*Chen rossii*		Secure	
Brant	*Branta bernicla*	Nirlirnaq	Secure	
Tundra Swan	*Cygnus colombianus*	Qugjuk		
Green-winged Teal	*Anas crecca*		Undetermined	
King Eider	*Somateria spectabilis*	Qingalik, Mitiviarjuk	Sensitive	
Common Eider	*Somateria mollissima*	Amauligjuaq, Surluktuuq	Sensitive	
American Black Duck	*Anas rubripes*		Undetermined	

Common Name	Scientific Name	Inuit Name	GS Nunavut Rank 2005	COSEWIC
Mallard	*Anas platyrhynchos*		Undetermined	
Northern Pintail	*Anas acuta*		Secure	
Northern Shoveler	*Anas clypeata*		Undetermined	
American Wigeon	*Anas americana*		Undetermined	
Ring-necked Duck	*Aythya collaris*		Undetermined	
Black Scoter	*Melanitta nigra*		Undetermined	
Harlequin Duck	*Histrionicus histrionicus*	Tulajun	Sensitive	Special Concern
Surf Scoter	*Melanitta perspicillata*		Undetermined	
White-winged Scoter	*Melanitta fusca*		Undetermined	
Long-tailed Duck	*Clangula hyemalis*	Aggiarjuk	Secure	
Common Goldeneye	*Bucephala clangula*		Undetermined	
Bufflehead	*Bucephala albeola*		Undetermined	
Hooded Merganser	*Lophodytes cucullatus*		Undetermined	
Common Merganser	*Mergus merganser*		Undetermined	
Red-breasted Merganser	*Mergus serrator*	Kajjiqtuuq	Secure	

King eider, common eider and harlequin duck are treated separately due to their conservation status. This section summarizes other waterfowl with widespread distribution in Nunavut.

Distribution

Loons

Four loons breed in Nunavut: common, red-throated, Pacific, and yellow-billed. All migrate to warmer areas around the Gulf of Mexico and on the east and west coasts of North America for the non-breeding season, and return to northern lakes to breed when the ice melts in spring.

Grebes

The horned grebe is the only grebe that ranges into Nunavut. Its North American breeding range extends from Alaska east to Manitoba, and south as far as Oregon and Minnesota. Horned grebes winter along the Atlantic and Pacific coasts, as well as lakes and rivers in the southern United States and Mexico.

Swans and Geese

Six species of geese breed in Nunavut: Canada, cackling, greater white-fronted, snow, Ross's, and brant. Wintering ranges vary from southern Canada to Mexico. One swan, the tundra swan also breeds in northern Nunavut and winters in southern Canada and the United States.

Dabbling Ducks

Six dabbling ducks are found in Nunavut: green-winged teal, American black duck, mallard, Northern pintail, Northern shoveler, and American wigeon. The Northern pintail breeds across the western half of Nunavut mainland and all other dabbling ducks reach the northern limit of their range in the southwest corner of Nunavut. All dabbling ducks in Nunavut migrate to the southern United States, Mexico and Central America for winter.

Diving Ducks

Diving ducks ranging into Nunavut include: ring-necked duck, black scoter, surf scoter, white-winged scoter, harlequin duck, long-tailed duck, common eider, king eider, common goldeneye, bufflehead, hooded merganser, common merganser and red-breasted merganser. Most of these species reach the northern limit of their range in southwestern Nunavut, except the long-tailed duck and red-breasted merganser, which breed throughout Nunavut. Diving ducks winter in southern Canada, the United States, Mexico and Central America. See Sections 4.5.2, 4.5.3, and 4.5.4 for full species accounts for king eider, common eider, and Harlequin duck respectively.

Ecology

Loons

Loons spend the majority of their time on open water and come to land mainly to nest. Loons are poorly adapted to movement on land and build their nests close to water. Loons have high nest fidelity, preferring sites completely surrounded by water, including on islands, muskrat houses, half-submerged logs and sedge mats. Being solitary nesters on smaller lakes 5 to 50 ha in size, a single nesting pair will occupy the entire lake. The red-throated loon takes flight more easily than the other loons and may be found on smaller water bodies. Multiple pairs will nest on larger lakes, with each pair occupying a section or portion of the lake. Adults may fly to adjacent lakes to feed.

Loons are among the first species to arrive back at northern lakes after spring thaw. Loons travel in pairs, with the pair bond previously established. Loon pairs are solitary and territorial during the breeding season. Small groups of loons may be found group feeding for fish on lakes in the late summer and during fall migration. Loons may also be found in small groups at their over-wintering grounds (Canadian Wildlife Services (CWS) 1994; National Audubon Society (NAS) 2008a).

Grebes

The horned grebe breeds on small to mid-sized shallow freshwater ponds, marshes and occasionally on rivers. Nests are normally found off-shore on a floating platform of vegetation or on a rock. Larger congregations of horned grebes can be found during migration and in overwintering areas on large lakes and coastal waters. The horned grebe winters along coasts and on large bodies of water. Grebes forage by diving underwater, in both open water and among aquatic vegetation as well as by picking insects off the water surface (Canadian Wildlife Services (CWS) 2008).

The horned grebe was designated as Special Concern (COSEWIC 2009b) due to both long-term and short-term declines with 92% of the breeding range in Canada. Threats include loss of habitat, increased predation of nests, and oil spills in wintering oceanic areas.

Swans and Geese

In Nunavut, geese and swans breed primarily on marshy tundra, marshy lakes and bays. Most nests are located near water and often on islands. Nest sites are chosen to offer some protection from exposure to wind while giving the incubating female a clear line of sight to detect approaching predators. Geese and swans return to nest in the same area where their parents nested and often use the same nest site year after year. Geese feed mostly on grass, sedges, aquatic plants, berries, and grains. Swans feed on seeds and roots of aquatic vegetation (Canadian Wildlife Services (CWS) 2008).

Dabbling Ducks

Dabbling ducks typically nest near lakes, ponds, or rivers, but may sometimes be far from water. Dabbling ducks feed primarily on vegetation, algae, seeds, and insects obtained through foraging from the surface in shallow water (Canadian Wildlife Services (CWS) 2008; National Audubon Society (NAS) 2008c).

Diving Ducks

Diving ducks occur in a variety of coastal waters, including deeper areas as well as estuaries, mudflats, and large lakes and rivers. Diving ducks commonly build their nests near open water in the shallows of large sloughs, or marshy areas, among cattails, bulrushes, and reeds. The ducks dive from the surface to forage underwater on aquatic plants, shrimp, fish and insects (Canadian Wildlife Services (CWS) 2008).

Ecological or Economic Importance

Waterfowl are of high socio-economic value in Nunavut and are sensitive because they nest in colonies and occur in large congregations during the flightless moult period. They are used for subsistence (meat, eggs and feathers) during the spring and summer. Waterfowl have strong cultural significance and are often featured in carvings.

Issues/Concerns

Principal concerns for waterfowl include effects of development—pollution, human disturbance, changes in water levels on lakes where they breed, or in the fish populations within those lakes. Additionally overhunting of some species has historically been a potential cause of population declines (Canadian Wildlife Services (CWS) 2008).

Land Use Planning Considerations

Waterfowl species are protected on their breeding grounds under the federally regulated *Migratory Birds Convention Act*. Waterfowl species are hunted throughout their ranges.

4.5.1 King Eider

Inuit Name: Qingalik, Mitiviarjuk
Scientific Name: *Somateria spectabilis*

Conservation Status

In the Inuit tree of life, king eider is classified among the uumajuit (the living), tingmiat (those that fly), and niqituqtiit (eaters of meat/fish).

King eider has not been assessed by COSEWIC. The Nunavut population of King eider is unknown, but estimated to be more than 10,000 birds (GNDoE 2005). However, the species is ranked as Sensitive in Nunavut on the basis of national declines, which may be a function of harvesting.

Distribution

King eider has a circumpolar breeding distribution including Russia, Alaska, Canada and Greenland (Sea Duck Joint Venture 2003). In western Canada the majority nest on Banks and Victoria Islands with lower densities occurring on mainland tundra (Barry 1986; Dickson *et al.* 1997). In eastern arctic Canada, the breeding range extends from the High Arctic Islands to lower Hudson Bay, but the prime nesting areas are likely on Boothia Peninsula and along the coasts of Foxe Basin, including Southampton Island (Abraham and Finney 1986; Sea Duck Joint Venture 2003). The breeding range is estimated at 58% of Nunavut, including all coastlines and substantial portions of the adjacent inland (GNDoE 2005).

Ecology

King eiders breed in coastal areas of the arctic, typically nesting in low marshy areas or near freshwater ponds on tundra. They primarily winter in marine waters along both the northern Pacific and Atlantic coasts, including along southwestern Greenland (Sea Duck Joint Venture 2003). Migration usually occurs offshore and hence is not well known. Eastern arctic eiders travel along both the west coast of Greenland and the east coasts of Labrador and Baffin Island (Abraham and Finney 1986). Eiders arrive on their breeding grounds around mid-June (Cotter *et al.* 1997; Sea Duck Joint Venture 2003), and are thought to stage on polynyas prior to nesting (Abraham and Finney 1986).

Issues/Concerns

King eider is an important species in the subsistence harvest with an estimated 20,000 taken annually (Sea Duck Joint Venture 2004b). Many eastern Canadian king eiders winter in Greenland, where they are commercially harvested and caught incidentally during fishing activities. Additionally, mass starvation of adults during spring migration occurs occasionally, due to lack of open water or adverse weather. Offshore oil development along the Beaufort Sea coast is increasing and may pose a risk to migrating eiders (Sea Duck Joint Venture 2004b).

Land Use Planning Considerations

King eiders and their nests are protected on their breeding grounds under the federally regulated *Migratory Birds Convention Act*. Eiders are subsistence hunted in Canada in relatively large numbers.

4.5.2 Common Eider

Inuit Name: Amauligjuaq, Surluktuuq
Scientific Name: *Somateria mollissima*

Conservation Status

In the Inuit tree of life, common eider is classified among the uumajuit (the living), tingmiat (those that fly), and niqituqtiit (eaters of meat/fish).

Common eider has not been assessed by COSEWIC. It is considered Sensitive in Nunavut on the basis of recent declines in some areas (Robertson and Gilchrist 1998) and a lack of detailed knowledge about the status of most of the territorial population (GNDoE 2005).

Distribution

Common eiders breed along much of the coast of northern North America, south to Maine in the east and to the Alaska Peninsula in the west, and across the arctic. In winter they shift southward, as far as Florida in the east and Washington in the west. However, the bulk of the Atlantic coast eiders winter along Newfoundland and Labrador and on Cape Cod, Massachusetts. The common eider's breeding range extends to approximately 15% of Nunavut (GNDoE 2005).

Three subspecies of the common eider are found in Nunavut, largely separated throughout the year and varying slightly in size and plumage. The Pacific race (*S. m. v- nigra*) breeds primarily from Queen Maud Gulf west to the Bering Sea and Aleutian Islands, with key areas including Amundsen Gulf, Dolphin and Union Strait, Coronation Gulf, and Queen Maud Gulf (Sea Duck Joint Venture 2003). They winter in ice-free regions of the Bering Sea and Gulf of Alaska, with highest concentrations off Russia's Chukotka Peninsula. The Hudson Bay race (*S. m. sedentaria*) breeds in Hudson and James bays, and in winter is largely restricted to open water near the Belcher Islands along the Quebec coast of Hudson Bay (Goudie *et al.* 2000). The northern race (*S. m. borealis*) breeds throughout coastal areas of the eastern Canadian arctic, from south-central Labrador north to Ellesmere Island; it also breeds in parts of west Greenland. The majority of the population nests along the coasts of Hudson Strait and southeast Baffin Island (Abraham and Finney 1986), with key breeding areas including northern Labrador (north of 54°N), Ungava Bay, Frobisher Bay and Cumberland Sound in southeast Baffin Island, Southampton Island, the western part of Foxe Basin, and a few High Arctic islands in Jones Sound located between Devon and Ellesmere Islands (Sea Duck Joint Venture 2003). All High Arctic colonies are located near permanent areas of open water. The northern race winters in the Gulf of St. Lawrence and on the coasts of Labrador, Newfoundland, and southwest Greenland (Sea Duck Joint Venture 2004a).

Ecology

Common eiders are closely tied to marine habitat and inland freshwater habitats including ponds, lakes, islands and coastal areas. They often breed and nest in colonies along marine coasts, mostly on islands and islets and occasionally on islands in freshwater free of mammalian predators (Sea Duck Joint Venture 2004a; Canadian Wildlife Services (CWS) 2005). They overwinter and moult in open water leads in pack ice and along leeward sides of islands in arctic and subarctic waters across their range as well as ice-free waters in New England and the Maritimes. During spring migration (March to mid-June), large aggregations may occur immediately south of heavy arctic ice and in open leads (Sea Duck Joint venture 2004b internet site). They frequently nest in dense colonies starting in May or June (dates are progressively later toward the north). Females typically return to their natal areas and often reuse the same nest sites. Nests are built on the ground and are lined with a thick layer of down plucked from the female's breast (Goudie *et al.* 2000).

Issues/Concerns

Because common eiders are often colonial and aggregate in dense flocks throughout the year, they can be particularly susceptible to natural and anthropogenic pressures including oil spills (Sea Duck Joint Venture 2003). Eiders are also susceptible to bioaccumulation of contaminants from their environment (Sea Duck Joint Venture 2003; Mallory *et al.* 2004).

Aboriginal subsistence hunters harvest this eider population (adults, eggs, and down) throughout the year (Wendt and Silieff 1986; Wein *et al.* 1996; Christensen 2001). Little information is available regarding population trends and harvest levels. Harvest and population surveys have recently been initiated in selected areas to address this lack of information (Sea Duck Joint Venture 2003).

Land Use Planning Considerations

Common eiders and their nests are protected on their breeding grounds under the federally regulated *Migratory Birds Convention Act*. Common eiders are harvested by subsistence hunters and for eiderdown, which can be harvested from the nest without harming the birds if only a fraction of the lining of each nest is taken. This is still done commercially on certain islands in the Gulf of St. Lawrence and by Inuit from the community of Sannikiluak, in Hudson Bay (Canadian Wildlife Services (CWS) 2005).

4.5.3 Harlequin Duck

Inuit Name: Tulajun
Scientific Name: *Histrionicus histrionicus*

Conservation Status

In the Inuit tree of life, harlequin duck is classified among the uumajuit (the living), tingmiat (those that fly), and niqituqtiit (eaters of meat/fish).

The eastern population of harlequin duck is estimated to be over 2,000 birds. On the basis of this small population, COSEWIC has designated it as a species of Special Concern and it is listed as such by SARA on Schedule 1 (COSEWIC 2002c). While no accurate population estimates are known for Nunavut, the number is likely in the low hundreds, and harlequin duck is therefore ranked as Sensitive (GNDoE 2005).

Distribution

Most harlequin ducks in the eastern population breed in Labrador, along eastern Hudson Bay, and on the Great Northern Peninsula of the island of Newfoundland. Breeding is limited to approximately

9% of Nunavut, primarily in southeastern Baffin Island (SARA Public Registry 2008a). Harlequin ducks winter along the rugged coasts of southern Newfoundland, Nova Scotia, New Brunswick, and the Gulf of Maine to as far south as the mouth of the Chesapeake Bay (Robertson and Goudie 1999).

Ecology

Harlequin ducks spend most of the year in coastal marine environments on turbulent seas and the rocky parts of coastal areas (Robertson and Goudie 1999). During the winter, harlequin ducks are often associated with offshore islands, headlands, and rocky coastline where the surf breaks against rocks and ice build-up is minimal (SARA Public Registry 2008a). The birds locate their food by diving in shallow waters over wave-pounded rocks and ledges to find prey among crevices (Canadian Wildlife Service (CWS) 1997). Each spring they move inland to nest on the ground along turbulent rivers where they pry insect larvae from the river bed. Food is believed to be a limiting factor in northern areas (Canadian Wildlife Service (CWS) 1997).

Issues/Concerns

Though small, the harlequin duck population is larger than previously thought. Their tendency to congregate in relatively large groups when moulting and wintering makes them susceptible to human disturbances and oil spills (Canadian Wildlife Service (CWS) 1997; COSEWIC 2002c). Harlequin ducks have a low reproductive rate and therefore might take longer to rebuild after a decline than other waterfowl. Their low productivity is related to a later age at first breeding, small average clutch size, and the high proportion of non-breeding birds in some years, when fewer than half the females are thought to nest, possibly because insects are less abundant (Canadian Wildlife Service (CWS) 1997).

The primary cause of the harlequin duck’s rarity is not clearly known, however, over-hunting could be an important factor. Although hunting of harlequin ducks has not been permitted in recent years, the birds remain extremely vulnerable to hunters because they are unwary and easily approached, they resemble female and immature ducks of other species which may be legally hunted, and because of their tendency to feed close to shore (Robertson and Goudie 1999).

The contamination, destruction, and alteration of their habitat are also considered important factors for the decline of the eastern population of the harlequin duck (Robertson and Goudie 1999). Some of the once fast-flowing streams have been altered by hydro and mining projects, and other human activities have impinged on the breeding and wintering grounds, and the food supply. Oil spills and chronic oil pollution are major threats to the duck's wintering habitat (SARA Public Registry 2008a).

Land Use Planning Considerations

The eastern population of harlequin duck is protected by the federal *Migratory Birds Convention Act*. Under this Act, it is prohibited to kill, harm, or collect adults, young, and eggs. Harlequin ducks are also protected in New Brunswick, Nova Scotia, and Newfoundland and Labrador under their respective *Endangered Species Acts* (SARA Public Registry 2008a).

The hunting of harlequin ducks was banned in the four Atlantic Provinces and Québec in 1990. This ban effectively stopped all hunting for this species within the Atlantic Flyway, allowing the population an opportunity to rebound from the impacts of this threat.

4.6 Raptors

4.6.1 Rough-legged Hawk

Inuit Name: Qirliq, Kaajuuq or Kahyook
Scientific Name: *Buteo lagopus*

Conservation Status

In the Inuit tree of life, rough-legged hawk is classified among the uumajuit (the living), tingmiat (those that fly), and angunasuktiit (the hunters).

Rough-legged hawk was reviewed by COSEWIC in 1995, and determined to be Not at Risk. Rough-legged hawk is considered Secure in Nunavut as they are common and widespread and no population declines or threats to their population have been identified, though population data is unavailable (GNDoE 2005).

Distribution

Rough-legged hawk has a circumpolar distribution, including over 77% of Nunavut, but is absent from the northern parts of Baffin and/or Ellesmere Islands (Bechard and Swem 2002) GNDoE 2005). Populations in Nunavut are not defined due to lack of research (GNDoE 2005).

Ecology

Rough-legged hawk inhabits tundra, and during peaks of prey abundance may expand to the northern taiga (Poole and Bromley 1988; Bechard and Swem 2002). Ridges and cliff ledges are favoured for nesting, and these are most often located along river valleys. Only rarely does it nest on the ground in flat landscapes or in trees (Sutton and Parmelee 1956; Ritchie 1991; Bechard and Swem 2002). Only rarely are nest sites under protective cover from overhead outcroppings (Poole and Bromley 1988). Rough-legged hawks primarily forage over open tundra for lemmings and voles.

Ecological or Economic Importance

Raptors have strong cultural significance and are often featured in carvings. Their ecological importance is related to their being a high-level predator at the top of the food chain and members of the raptor group are considered sensitive to environmental contaminants and human disturbance.

Issues/Concerns

Rough-legged hawk populations fluctuate along with small mammal cycles (Bechard and Swem 2002). Populations around Kugluktuk and Hope Bay appear to be fairly stable, but there is some evidence of a national decline, and insufficient monitoring of the Nunavut population to accurately assess trends (GNDoE 2005). No significant threats to the population have been identified. Documented mortalities are primarily associated with shooting and vehicle collisions (Bechard and

Swem 2002). Observations seem to indicate that rough-legged hawk is relatively tolerant to disturbance throughout the year, but little research has specifically addressed this issue (Bechard and Swem 2002).

Land Use Planning Considerations

The Government of Nunavut and the NWMB are responsible for rough-legged hawk management in Nunavut. Rough-legged hawk eggs and nests are protected under section 72 of the *Nunavut Wildlife Act* (NWA), and harvest quotas are established under associated regulations. Additionally, the GNDoE maintains a raptor nest site database that should be reviewed to determine if there are known nest sites in areas proposed for development, camps, and other human activities.

4.6.2 Golden Eagle

Inuit Name: Qupanuaqpaq, Naktuligaq, Nakturalik, Naturralik or Nattugalik
Scientific Name: *Aquila chrysaetos*

Conservation Status

In the Inuit tree of life, golden eagle is classified among the uumajuit (the living), tingmiat (those that fly), and angunasuktiit (the hunters).

Golden eagle was reviewed by COSEWIC in 1996 and determined to be Not At Risk, thus it is not been assessed under SARA (COSEWIC 1996). Golden eagle is considered Sensitive in Nunavut due to its limited distribution and vulnerability to disturbance (GNDoE 2005).

Distribution

The breeding range of golden eagle extends across most of western North America, and parts of the eastern Canadian subarctic (Kochert *et al.* 2002). It occupies approximately 12% of Nunavut, mostly in southwest Kivalliq and west Kitikmeot (GNDoE 2005). Populations in Nunavut are not defined due to lack of research (GNDoE 2005).

Ecology

Golden eagles inhabit a variety of open habitat across their range; in Nunavut mostly tundra, especially in areas with high cliffs or escarpments and an abundance of ground squirrels, which are their primary prey (Poole and Bromley 1988; Kochert *et al.* 2002; Sinclair *et al.* 2003). Most golden eagles are migratory, arriving in the north in March and returning to southern Canada and the United States in September to overwinter. Golden eagles nest on remote cliff faces. They may have several nests within a territory and use these same nests in alternate years for many decades (Sinclair *et al.* 2003). Nests are commonly located on high ledges of cliffs, usually under a rock overhang, and often overlooking lakes or rivers (Kochert *et al.* 2002). Northern populations are particularly vulnerable to inclement weather early in the breeding season, and therefore especially are likely to seek well-sheltered nest sites (Morneau *et al.* 1994). Like other raptors, golden eagles are a key predator and play an important role in regulating small mammal populations. Their dependence on ground squirrels and other small mammals makes golden eagles a good indicator of overall ecosystem health and productivity.

Issues/Concerns

Documented mortality in North America is mostly related to human activity, whether shooting, vehicle collisions, electrocutions, or incidental poisoning (Kochert *et al.* 2002). The largely remote population in Nunavut is therefore exposed to fewer threats than in most of the rest of North America. However, several studies have suggested that golden eagles are sensitive to disturbance, especially when nesting. Therefore, expanded development could have an effect on the species (Kochert *et al.* 2002).

Land Use Planning Considerations

The GN and the NWMB are responsible for golden eagle management in Nunavut. Golden eagle eggs and nests are protected under section 72 of the NWA, and harvest quotas are established under associated regulations. The GNDoE (2006) currently recommends a total allowable harvest of zero. Additionally, the GNDoE maintains a raptor nest site database that should be reviewed to determine if there are known nest sites in areas proposed for development, camps, and other human activities.

Identification of key habitats may be used as a basis for designating areas where human disturbance to is to be avoided or minimized. Key habitats for golden eagle include cliff faces and rocky outcrops, which serve as nesting sites, as well as surrounding shrub, sedge/tussock and heath habitats. Limiting access to nesting areas to minimize disturbance of golden eagles is another land use planning consideration.

There are no identified areas of high use by golden eagles in Nunavut. Given the probable remote location of most nests, and the relative low density of nesting, land use considerations may include site-specific protection should development occur in suitable nesting habitat.

4.6.3 Northern Goshawk

Inuit Name: Unknown
Scientific Name: *Accipiter gentilis*

Conservation Status

In the Inuit tree of life, Northern goshawk is classified among the uumajuit (the living), tingmiat (those that fly), and angunasuktiit (the hunters).

Northern goshawk was reviewed by COSEWIC in 1995 and found to be Not At Risk thus it is has not been reviewed under SARA (COSEWIC 1995a). Northern goshawk is classified as Sensitive in Nunavut as a result of its limited range and population, and its vulnerability to human disturbance and potential loss of limited habitat (GNDoE 2005).

Distribution

Northern goshawk has a widespread distribution across boreal and temperate forests of North America. Its range barely extends north into Nunavut, including only 3% of the territory’s area along the treeline in south Kivalliq and on the James Bay Islands (GNDoE 2005).

Ecology

Northern goshawk is a forest bird, and over most of its range it favours nesting in mature forests with dense canopy cover (Squires and Reynolds 1997). However, along the edges of the tundra it will nest in tall willows along riparian areas (Swem and Adams 1992). Though forests are preferred for nesting, Northern goshawks will often hunt in more open areas (Squires and Reynolds 1997). Main foods include ground and tree squirrels, rabbits and hares, large passerines, woodpeckers, game birds, and corvids (Squires and Reynolds 1997).

Issues/Concerns

Shooting and pesticide contamination were formerly significant sources of mortality, but both have been reduced to minimal threats (Squires and Reynolds 1997). Logging causes the greatest disturbances to Northern goshawk habitat over most of its range (Squires and Reynolds 1997), but is of minimal concern to the Nunavut population. There is some evidence suggesting that human activity near nest sites may lead to abandonment (Squires and Reynolds 1997).

Land Use Planning Considerations

The GN and the NWMB are responsible for Northern goshawk management in Nunavut. Northern goshawk eggs and nests are protected under section 72 of the NWA, and harvest quotas are established under associated regulations. Additionally, the GNDoE maintains a raptor nest site database that should be reviewed to determine if there are known nest sites in areas proposed for development, camps, and other human activities.

4.6.4 Peregrine Falcon

Inuit Name: Kiggaviarjuk, Kakkajuuq
Scientific Name: *Falco peregrinus tundrius*

Conservation Status

In the Inuit tree of life, peregrine falcon is classified among the uumajuit (the living), tingmiat (those that fly), and angunasuktiit (the hunters).

In its most recent review of the status of peregrine falcon, (COSEWIC 2007c) jointly assessed the *anatum* and *tundrius* subspecies as Special Concern, reflecting recent findings that genetic data do not support a distinction between them (Brown *et al.* 2007). In Nunavut, peregrine falcon is classified as Secure, as it is abundant and widespread in suitable habitat, and is not known to be facing any threats (GNDoE 2005). There is no population-level data available for peregrine falcons. However, based on repeated sightings in Nunavut, and general indices from southern observations, there is no apparent decline in numbers across the territory.

Distribution

Peregrine falcon has a broad global distribution, which in North America includes much of the north and west of the continent and parts of the northeast (White *et al.* 2002b). It occupies approximately 61% of Nunavut, including the entire mainland above the treeline, and most of Baffin and Victoria

Islands. Nest sites tend to be concentrated along coast and shore lines and south of 70°N (GNDoE 2005). A relatively stable population of 20 to 35 pairs nests around Rankin Inlet, while the total number of pairs known for Nunavut is at least 250 (GNDoE 2005). Peregrine falcons breeding in Nunavut are generally believed to overwinter in South America.

Ecology

Peregrine falcon occupies various types of habitat throughout its range, but typically the common features include proximity to water and abundant prey, and availability of high cliff ledges or comparable sites for perching, hunting, and nesting (White *et al.* 2002b; Sinclair *et al.* 2003). Nest sites are commonly used year after year (White *et al.* 2002a). In a study of 29 nests around Rankin Inlet, Court *et al.* (1988) found that all were on cliffs and within 300 m of a major body of water, but most had little overhead shelter and were easily accessible to mammalian predators. Although the majority of nests faced south or southwest, there was no difference in productivity between south- and north-facing nests (Court *et al.* 1988). In tundra habitat, peregrine falcons may also nest on the ground, especially on pingos or other raised areas of land (White *et al.* 2002b). Peregrine falcons breed in solitary pairs, raise nestlings for forty days, and continue to feed fledglings for three to six weeks. Peregrine falcons may nest in the same sites for decades. It is generally understood that peregrines nesting in Nunavut winter in South America, including central Chile and Uruguay. Prey species for peregrine falcon will vary depending on habitat; tundra, ptarmigan, shorebirds, small passerines, such as longspurs and snow buntings, and ducks; taiga, shorebirds, woodpeckers, passerines (jays, thrushes) (White *et al.* 2002b).

Ecological/Economic Importance

The peregrine falcon is regarded as an indicator species. There is a long-term monitoring program of peregrine falcons in Rankin Inlet that continues to provide data of national significance in the ongoing recovery efforts for the species. Like other raptors, peregrine falcons are a key predator and play an important ecological role. Their dependence on a variety of bird species for prey makes peregrine falcon a good indicator of overall ecosystem health and productivity.

Issues/Concerns

Various threats to peregrine falcon populations have been identified. Organochlorine contamination, especially DDT, was largely responsible for a significant decline in the North American population in the middle of the last century (Johnstone *et al.* 1996). Although considerable limits on chemical use were implemented and the population has recovered, contaminant loads in some populations persisted long after bans came into effect, suggesting that continued monitoring is warranted (Court *et al.* 1990). This is likely to be the main concern for peregrine falcons in Nunavut, which may continue to accumulate chemicals while on their wintering grounds (White *et al.* 2002b). Habitat loss is generally a minor issue for peregrine falcons (White *et al.* 2002b). This is likely to be especially true for Nunavut given the large areas available in relation to human activities. Some individuals are sensitive to human or industrial disturbance, especially during the breeding season, but responses are quite variable (White *et al.* 2002b). Human disturbance at nest sites, and illegal harvesting of eggs and nestlings for falconry remain threats to peregrine falcons in some areas (COSEWIC 2007b).

Land Use Planning Considerations

The GN and the NWMB are responsible for peregrine falcon management in Nunavut. Because the species is included on the SARA list (Special Concern), Environment Canada is also considered a responsible management agency for peregrine falcons. Peregrine falcon eggs and nests are protected under section 72 of the NWA, and harvest quotas are established under associated regulations. No harvesting of peregrine alcons is currently known to occur in Nunavut (Priest and Usher 2004a), and the GNDoE (2006) recommends a total allowable harvest of zero. Additionally, the GNDoE maintains a raptor nest site database that should be reviewed to determine if there are known nest sites in areas proposed for development, camps, and other human activities.

Based on its size, abundance of suitable habitats, and continuous discoveries of new nesting sites, Nunavut probably contains the majority of North America's breeding tundra peregrine falcon population. Given the current Special Concern status and previous decline of the species in other parts of North America, special consideration should be given to the conservation of the species in Nunavut. Identification of key habitats may be used as a basis for designating areas where human disturbance is to be avided or minimized. Key habitats for peregrine falcons include cliff faces and rocky outcrops, which serve as nesting sites, as well as surrounding shrub, sedge/tussock and heath habitats. Limiting road access to nesting areas to minimize the illegal capture of peregrine falcons is another important consideration in land use planning. Raptor nests should be avoided by exploration and development activities.

The Government of NWT Department of Renewable Resources (1995) identified a number of areas of importance to nesting falcons in Nunavut, including the Coppermine River, Melville Sound, Rankin Inlet, Ford Lake, Foxe Peninsula, and Meta Incognita Peninsula.

4.6.5 Gyrfalcon

Inuit Name: Qinnuajuaq, Kiggavik, Kiggaviarjuk, Qakuktaq
Scientific Name: *Falco rusticolus*

Conservation Status

In the Inuit tree of life, gyrfalcon is classified among the uumajuit (the living), tingmiat (those that fly), and angunasuktiit (the hunters). As some gyrfalcons remain in Nunavut throughout the year, they are also classified as ukiuqtait/ukiuliit (those that stay throughout the winter).

Gyrfalcon was reviewed by COSEWIC in 1987, and designated as Not at Risk. Gyrfalcon is considered Secure in Nunavut as they are common and widespread and no population declines or threats to their population have been identified, though population data is unavailable (GNDoE 2005).

Distribution

Gyrfalcons are uncommon but widespread in coastal and northern Nunavut, primarily south of 75°N. Gyrfalcons spend the entire year in Nunavut.

Ecology

Gyrfalcons breed in tundra habitat, favouring coastal and riparian areas, especially where there are steep cliffs and nearby concentrations of waterfowl or colonial seabirds (Clum and Cade 1994). Gyrfalcons nest on cliff ledges with considerable overhead cover and minimal access to mammalian predators, usually occupying stick nests originally built by common raven or golden eagle (Poole and Bromley 1988). These sites may be occupied year-round, and nest sites are often reused, but gyrfalcons may alternate among two or three nest sites over time (Clum and Cade 1994; Sinclair *et al.* 2003). Occasionally gyrfalcons along the treeline will nest in spruce trees (Obst 1994). Gyrfalcons are territorial and typically there are at least several kilometres between nests. Territory size is somewhat related to the abundance of ptarmigan, which constitute their primary prey, though ground squirrels, hares, lemmings, and other birds are also hunted (Department of Renewable Resources 1995; Sinclair *et al*. 2003; GNDoE 2006).

Ecological or Economic Importance

Gyrfalcon is Nunavut's territorial bird. Bird watching boat tours to view nesting sites on Nunavut's coastal cliffs are promoted as a tourist activity. Like other raptors, gyrfalcons are a key predator and play an important ecological role. Their dependence on ptarmigan and small mammals makes gyrfalcons a good indicator of overall ecosystem health and productivity. A total allowable harvest of five birds each in the Kivalliq and Kitikmeot, and 10 birds in the Baffin region (GNDoE 2006) may provide economic opportunities for some communities near fall movement areas (passage birds only to be harvested).

Issues/Concerns

Gyrfalcon numbers decreased between 1991 and 1996 around Kugluktuk and Hope Bay, but overall population estimates for Nunavut are too limited to identify trends (GNDoE 2005). Gyrfalcon and willow ptarmigan populations are correlated in Yukon Territory. In Nunavut, rock ptarmigan is more commonly preyed upon and it is unclear whether a similar relationship exists. Chemical contamination and persecution by humans have affected many North American raptor species. Due to the remoteness of its breeding habitat and relatively sedentary nature, gyrfalcons face relatively low risks from these threats (Clum and Cade 1994). Response to disturbance is variable, but there is some evidence to suggest that it reduces the suitability of nest sites (Clum and Cade 1994). In Alaska, gyrfalcons have shown an ability to adapt to disturbance by nesting on a variety of artificial structures (White and Roseneau 1970; Ritchie 1991). Illegal live capture and sale of gyrfalcons on the black market for falconry also poses a threat (GNDoE 2006).

Identification of key habitats may be used as a basis for designating areas where human disturbance is to be avoided or minimized. Illegal live capture and sale of gyrfalcons on the black market for falconry also poses a threat (GNDoE 2006).

Land Use Planning Considerations

The GN and the NWMB are responsible for gyrfalcon management in Nunavut. Gyrfalcon eggs and nests are protected under section 72 of the NWA, and harvest quotas are established under associated regulations.

Identification of key habitats may be used as a basis for designating areas where human disturbance is to be avoided or minimized. Key habitats for gyrfalcon include cliff faces and rocky outcrops, which serve as nesting sites, as well as surrounding shrub, sedge/tussock and heath habitats. Limiting road access to nesting areas to minimize the illegal capture of gyrfalcons is another land use planning consideration.

The Government of NWT Department of Renewable Resources (1995) identified a number of areas of importance to nesting falcons in Nunavut, including the Coppermine River, Melville Sound, Rankin Inlet, Ford Lake, Foxe Peninsula, and Meta Incognita Peninsula.

The GNDoE maintains a raptor nest site database that should be reviewed to determine if there are known nest sites in areas proposed for development, camps, and other human activities.

4.6.6 Short-eared Owl

Inuit Name: Unnuaqsiuti
Scientific Name: *Asio flammeus*

Conservation Status

In the Inuit tree of life, short-eared owl is classified among the uumajuit (the living), tingmiat (those that fly), and niqituqtiit (the meat/fish eaters).

Short-eared owl was assessed as a species of Special Concern by COSEWIC in 1994 (COSEWIC 2008a). Population trends for Nunavut are unknown, but in recognition of a national decline, its status is considered Sensitive (GNDoE 2005).

Distribution

Short-eared owl has a broad global distribution which in North America includes Alaska and all of Canada except the High Arctic (Wiggins *et al.* 2006). It occupies approximately 25% of Nunavut, chiefly the southern half of Kivalliq, and possibly also Southampton Island and the southern parts of Baffin and Victoria Islands (Wiggins *et al.* 2006).

Ecology

Short-eared owl is a bird of open country, ranging from grasslands to tundra and wetland complexes interspersed with dry patches suitable for nesting or roosting (Wiggins *et al.* 2006). Suitability of habitat is most strongly influenced by the abundance of small mammals, such as voles and lemmings. Nests are almost always built on the ground, usually on hummocks or other slightly raised areas, and at least moderately concealed by grasses and/or other vegetation (Holt 1992; Wiggins *et al.* 2006).

Issues/Concerns

Little is known about the extent or status of the Nunavut population. At a local scale, abundance of short-eared owls tends to be tightly associated with microtine (vole and lemming) population cycles. As a result the owl is believed to be highly nomadic, and determining overall population trends is challenging (Wiggins *et al.* 2006). Although Breeding Bird Survey data suggest a significant decline over much of the short-eared owl's North American range, the crepuscular (active during twilight) nature of the species and its low abundance even when present make it poorly suited to detection by the Breeding Bird Survey, and thus trend analysis may not accurately reflect population changes (Wiggins *et al.* 2006). However, a variety of other regional breeding bird summaries have indicated a decline in both the distribution and abundance of short-eared owl (Wiggins *et al.* 2006). The relative importance of factors in the decline has not yet been determined, but since short-eared owls require relatively large areas of undisturbed land, habitat loss is likely important (Wiggins *et al.* 2006). As threats to habitat are limited in Nunavut, there may be less pressure on the population than elsewhere. However, other factors may affect it, including vehicle collisions while migrating and on wintering grounds, and loss of wintering habitat (Wiggins *et al.* 2006). Based on tested samples and the relatively low position of short-eared owl on the food chain, bioaccumulation of toxins is not believed to pose a significant threat (Peakall and Kemp 1980; Wiggins *et al.* 2006).

Land Use Planning Considerations

The GN and the NWMB are responsible for short-eared owl management in Nunavut. Because the species is included on the SARA list (Special Concern), Environment Canada is also considered a responsible management agency for short-eared owls. Short-eared owl eggs and nests are protected under section 72 of the NWA, and harvest quotas are established under associated regulations. No harvesting of short-eared owls or their eggs is known to occur in Nunavut, and the Nunavut Department of Environment (2006) recommends a total allowable harvest of zero.

4.6.7 Snowy Owl

Inuit Name: Ukpigjuaq, Ukpik, Uppik, Aukpik, Ookpik, or Okpik
Scientific Name: *Bubo scandiacus*

Conservation Status

In the Inuit tree of life, snowy owl is classified among the uumajuit (the living), tingmiat (those that fly), and niqituqtiit (the meat/fish eaters). Snowy owl is also among the small group of ukiuqtait/ukiuliit (those that stay throughout the winter).

Snowy owl was reviewed by COSEWIC in 1995 and found to be not at risk, thus has not been assessed under SARA (COSEWIC 1995b). It is considered Secure in Nunavut on the basis of being an abundant and widely distributed species (GNDoE 2005).

Distribution

Snowy owl has a circumpolar breeding distribution (Parmelee 1992) including almost all of Nunavut except for the treed area in the western and southern limits of the territory (GNDoE 2005).

Ecology

Snowy owl breeds exclusively on open tundra; rolling terrain is preferred, as it provides vantage points used both for nesting and hunting (Wiklund and Stigh 1986; Parmelee 1992). Vegetation ranges from dense shrub meadows with hummocks to largely barren landscapes with patches of lichen, heather, saxifrage, and willow (Parmelee 1992). Nests are typically exposed to the wind, which limits snow and moisture from accumulating (Parmelee 1992). A review of nests on Baffin Island found most to be on hilltops or rocky ledges part way up slopes (Sutton and Parmelee 1956). Wetter habitats, including salt grass and freshwater wet meadows, are also used, but largely for hunting (Parmelee 1992). Snowy owls typically prey on mammals, from small rodents (e.g., lemmings) to large hares; they also prey on birds, ranging from small songbird nestlings to medium-sized geese (Parmelee 1992).

Issues/Concerns

Although the population fluctuates somewhat in relation to cyclical variation in lemming numbers, the Snowy owl population is believed to be stable overall (GNDoE 2005). Causes of mortality and potential population threats are likely greater during winter, when collisions with vehicles, electrical lines, or other objects account for a majority of known deaths (Kerlinger and Lein 1988). Shooting and trapping within the wintering range was formerly a concern, but prohibitions have been largely respected (Parmelee 1992).

Land Use Planning Considerations

The GN and the NWMB are responsible for snowy owl management in Nunavut. Snowy owl eggs and nests are protected under section 72 of the NWA, and harvest quotas are established under associated regulations. Harvesting of snowy owl is infrequent and mostly incidental (GNDoE 2005). Considering that there is some traditional use of snowy owls and their eggs by Inuit, the Nunavut Department of Environment (2006) suggests a total allowable harvest of five snowy owls in each of Kitikmeot, Kivalliq, and Baffin regions. Data from the Nunavut Wildlife Harvest Study indicate that the actual take is even lower, approximately two per year in total (Priest and Usher 2004). The total of 15 is conservative, as the status of the snowy owl population and the potential consequences of harvesting are poorly known. However, no restriction on hunting season is proposed (GNDoE 2006).

4.7 Shorebirds

4.7.1 Black-bellied Plover

Inuit Name: Todlivak or Tuulligaarjuk (Inuktitut: Tudliakdjuk or Anngilik)
Scientific Name: *Pluvialis squatarola*

Conservation Status

In the Inuit tree of life, black-bellied plover is classified among the uumajuit (the living), tingmiat (those that fly), and nunatuqtiit (eaters of the products of the Earth).

Black-bellied plover has not been assessed by COSEWIC, but is considered Sensitive in Nunavut due to a declining population trend in Canada and limited study in Nunavut (GNDoE 2005).

Distribution

The breeding range of black-bellied plover extends along the extreme northern edge and islands of North America's central and western Arctic (Paulson 1995). It occupies approximately 34% of Nunavut, including south Melville, Bathurst, Devon, Bylot, and west and south Baffin islands, south Victoria and Jenny Lind islands, north Kivalliq (Adelaide and Melville peninsulas), and Southampton and Coats islands (GNDoE 2005(Paulson 1995).

Ecology

Black-bellied plover breeds in a range of tundra habitats, from wet vegetated areas to dry ridges and high tundra (GNDoE 2005). However, typically black-bellied plover prefers nesting in higher and drier areas that are near or surrounded by wet/hummocky or marshy tundra (Paulson 1995). Nests are on the ground, consisting of a shallow scrape in a bed of lichens or moss made by the bill and feet of the male. The female may then line the nest with lichens, pebbles, willow twigs, or leaves. The incubating adult is usually entirely visible (Paulson 1995). During the breeding season in the open tundra, black-bellied plovers forage on insects (Paulson 1995).

Ecological or Economic Importance

Some species are used for subsistence (eggs). Shorebirds have strong cultural significance (i.e., Kiviuq, hero in the Inuit creation myth, embodied with the powerful spirit of the shore birds who always return home).

Issues/Concerns

Black-bellied plover is considered widespread and abundant in Nunavut (GNDoE 2005). Of the estimated population of 200,000 in Canada (Morrison *et al.* 2001a; Morrison *et al.* 2001b) a majority is believed to occur in Nunavut (GNDoE 2005). While detailed monitoring of northern shorebird populations has been limited, concern was raised by a comparison of populations in the Rasmussen Lowlands of Nunavut between 1975 – 1976 and 1994 – 1995 showing a significant decline of 87% for black-bellied plover (Johnston *et al.* 2000; Gratto-Trevor *et al.* 2001). However, surveys in other regions (Ontario, Quebec, Maritimes) show populations to be relatively stable (Morrison *et al.* 2001a), making it difficult to evaluate overall trends without further study. As well, the Canadian population estimate is based on broad-scale surveys and therefore is considered to have low overall accuracy, although it is likely to be in the right order of magnitude (Morrison *et al.* 2001b).

Numbers decreased in New England late in the nineteenth century due to hunting, but black-bellied plover was less impacted than many other species (because of wariness, high flight speed, and relatively small flocks) and no longer faces significant hunting pressure in North America (Paulson 1995). Although breeding habitat of black-bellied plover seems secure, threats to coastal wetlands and staging areas may apply to this species as it is ecologically wide-ranging but has definite concentration points. As well, non-breeding habitat is being lost in direct proportion to the filling and dredging of coastal tide flats (Paulson 1995).

Land Use Planning Considerations

Black-bellied plover is protected under the federal *Migratory Birds Convention Act* (1994). This act makes it an offense to disturb, kill, or collect adults, juveniles, and eggs. Black-bellied plover is common at several sites protected by the Western Hemisphere Shorebird Reserve Network (Paulson 1995 internet site). Although some hunting of black-bellied plover may occur in Nunavut, it was not specifically documented in the Nunavut Wildlife Harvest Study (Priest and Usher 2004a).

4.7.2 American Golden-Plover

Inuit Name: Qiirliajuk or Toodliq
Scientific Name: *Pluvialis dominica*

Conservation Status

In the Inuit tree of life, American golden-plover is classified among the uumajuit (the living), tingmiat (those that fly), and nunatuqtiit (eaters of the products of the Earth).

American golden-plover has not been assessed by COSEWIC, but is considered Sensitive in Nunavut due to a declining population trend in Canada and limited study in Nunavut (GNDoE 2005).

Distribution

The breeding range of American golden-plover extends across much of North America's central and western Arctic (Johnson and Connors 1996). It occupies approximately 76% of Nunavut, including most areas except for southwest Kivalliq, eastern Baffin Island, and Ellesmere and Axel Heiberg Islands (GNDoE 2005).

Ecology

American golden-plover breeds primarily on dry, rocky tundra such as vegetated uplands, beach ridges, and eskers (Johnson and Connors 1996) GNDoE 2005). Males of the closely related Pacific golden-plover appear to show some site fidelity from year to year (Johnson *et al.* 1993). Nests are on the ground, typically nestled among lichen, crowberry, and/or other low vegetation (Johnson and Connors 1996). Little is known about the degree to which nest placement influences success through factors such as exposure to weather or predation. Breeding golden-plovers forage on various types of tundra ranging from large expanses of low vegetation only a few centimetres tall (as on well-drained slopes) to wetter mosaics of low shrubs and grasses interspersed with openings (Johnson and Connors 1996). After their young hatch, American golden-plover families will move to moist shrub/grass areas for feeding and cover. Main foods taken by American golden-plovers are invertebrates, primarily terrestrial, some freshwater and marine; also berries, leaves, seeds (Johnson and Connors 1996).

Issues/Concerns

American golden-plover is considered widespread and abundant in Nunavut (GNDoE 2005). Of the population of 150,000 estimated to exist in Canada (Morrison 2001), a majority is believed to occur in Nunavut (GNDoE 2005). While detailed population monitoring of northern shorebird populations has been limited, concern was raised by a comparison of populations in the Rasmussen Lowlands of Nunavut between 1975 – 1976 and 1994 – 1995 showing a significant decline of 79% for American golden-plover (Gratto-Trevor *et al.* 2001). However, on Devon Island American golden-plover numbers increased over a 16-year period (Pattie 1990), while numbers staging in eastern Canada have remained fairly stable (Morrison *et al.* 1994). Therefore it is difficult to evaluate overall trends without further study. Extensive hunting in the early twentieth century reduced the population considerably, but since then habitat loss, especially on wintering grounds in South America, has been the greatest conservation concern (Johnson and Connors 1996).

Land Use Planning Considerations

Although some hunting of American golden-plover may occur in Nunavut, it was not specifically documented in the Nunavut Wildlife Harvest Study (Priest and Usher 2004a). American golden-plover is federally protected under the *Migratory Birds Convention Act*.

4.7.3 Eskimo Curlew

Inuit Name: Unknown
Scientific Name: *Numenius borealis*

Conservation Status

In the Inuit tree of life, Eskimo curlew is classified among the uumajuit (the living), tingmiat (those that fly), and nunatuqtiit (eaters of the products of the Earth).

Eskimo curlew is listed as Endangered by COSEWIC and listed on Schedule 1 of SARA (COSEWIC 2000b). In Nunavut it is considered At Risk, and believed to be extinct (GNDoE 2005).

Distribution

Historically the only known location for Eskimo curlew in Nunavut was in west Kitikmeot, along the Coppermine River (GNDoE 2005), though breeding in Nunavut was never confirmed (Environment Canada 2007). The majority of historical breeding records were in adjacent parts of Northwest Territories between Great Bear Lake and the Amundsen Gulf. The species may have also nested in northern Alaska, but was never confirmed there (Gill *et al.* 1998). Decades have passed since the last sightings in Nunavut, and several extensive searches of historical nesting areas since the 1970s have failed to produce evidence that Eskimo curlews survive (Environment Canada 2007). However, if the species does persist, it could occur anywhere that suitable habitat exists.

Ecology

The habitat at historically known breeding sites of Eskimo curlew are characterized as upland tundra, where vegetation is dominated by a variety of grasses and sedges, while trees are scarce or absent (Gill *et al.* 1998). Little additional information is known about the structure and location of nests. There is little information on the feeding habits of Eskimo curlews, however, it is assumed that upon arrival on breeding grounds, curlews probably foraged in ericaceous heath on overwintered berries (blueberry [*Vaccinium*], crowberry [*Empetrum*], bearberry [*Arctostaphylos*]), and also on insects (Gill *et al.* 1998).

Issues/Concerns

A combination of heavy hunting pressure and habitat loss at wintering areas and prairie migration stopover sites decimated the Eskimo curlew population in the late nineteenth century, and no nesting attempts have been confirmed since 1866 (Gratto-Trevor *et al.* 2001). The most recent population estimate is of fewer than 50 individuals (Morrison 2001), but as the last confirmed sighting occurred in 1963, the species may well be extinct (Gratto-Trevor *et al.* 2001). If any individuals do survive, they would remain vulnerable to habitat loss and the potential for indiscriminate shooting of mixed shorebird flocks during migration or at wintering grounds in South America (Gill *et al.* 1998).

Land Use Planning Considerations

Management of the Eskimo curlew is federally regulated under the *Migratory Birds Convention Act*, as well as under Schedule 1 of SARA, through which both individuals and their residences (i.e., nests) are protected from injury or damage. Additionally, Eskimo curlew is protected internationally by the Convention on CITES, the Convention for the Conservation of Migratory Species of Wild Animals (Bonn Convention), and the Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere. The Canadian Eskimo Curlew Recovery Team was put on indefinite hiatus as of 1995, pending confirmed documentation that the species persists (Gratto-Trevor *et al.* 2001).

4.7.4 Ruddy Turnstone

Inuit Name: Tuvvititiqiuq
Scientific Name: *Arenaria interpres*

Conservation Status

In the Inuit tree of life, ruddy turnstone is classified among the uumajuit (the living), tingmiat (those that fly), and nunatuqtiit (eaters of the products of the Earth).

Ruddy turnstone has not been assessed by COSEWIC, but is considered Sensitive in Nunavut due to rapid declines observed on Quebec migration surveys and in the United States (GNDoE 2005). The Canadian population is estimated at 235,000 (Morrison *et al.* 2000), most of which breed in Nunavut.

Ecology

Ruddy turnstone breeds in tundra regions of northern North America from Alaska to Greenland. In Nunavut, it breeds on the northern mainland, south Baffin Island, Victoria Island and Devon Island (GNDoE 2005). High Arctic Canadian and Greenland birds winter mainly along coastal shores in Britain and Ireland and south along the Atlantic coast of southwestern Europe and northwestern Africa. Those breeding south and west of north Devon Island, Nunavut, winter mostly in northern Brazil, but also along both coasts of North and Central America from Long Island, New York and coastal Gulf of Mexico and central California south through the West Indies and along coastal South America to Tierra del Fuego (Nettleship 2000).

Ruddy turnstones breed on rocky arctic coasts on open tundra flats and slopes near ponds, lakes, and streams. The nest is made in a scrape or depression on the ground or in vegetation. Ruddy turnstones are monogamous and territorial and display high site and mate fidelity (Nettleship 2000). On their breeding grounds, ruddy turnstones feed predominantly on flies, but on migration and during the winter their diet is diverse, ranging from coastal invertebrates to small fish, carrion, human garbage, and unattended eggs of other birds (Nettleship 2000).

Issues/Concerns

Although limited threats to ruddy turnstone exist in Nunavut, they are like most shorebirds vulnerable to loss of wetland habitat at key breeding, migration, and wintering habitat, and at potential risk from uptake of contaminants and other forms of pollution (Canadian Wildlife Services (CWS) 2008).

Land Use Planning Considerations

Ruddy turnstone and their nests are protected on their breeding grounds under the federally regulated *Migratory Birds Convention Act*.

4.7.5 Red Knot

Inuit Name: Tullik, Qajorlak
Scientific Name: *Calidris canutus*

Conservation Status

In the Inuit tree of life, red knot is classified among the uumajuit (the living), tingmiat (those that fly), and nunatuqtiit (eaters of the products of the Earth).

The *islandica* subspecies of red knot has been assigned a status of Special Concern by COSEWIC, while the *rufa* subspecies has been designated Endangered, but neither has been listed yet by SARA (COSEWIC 2007a). Red knot is considered Sensitive in Nunavut (GNDoE 2005). A number of studies suggest that populations of red knot breeding in North America have experienced a drastic decline in the past thirty years (National Audubon Society (NAS) 2008c; SARA Public Registry 2008b). The Canadian red knot population in 2000 was estimated at 256,000, mostly in Nunavut (Morrison *et al.* 2000). However, the *rufa* population in particular has continued to decline rapidly, with a population estimate in 2007 of just 14,800 individuals, down over 70% in just seven years (Environment Canada 2008b).

Ecology

Red knot breeds in extreme northern Alaska and Canada as well as in northern Greenland and Russia. Its range includes 22% of Nunavut, from northern Ellesmere Island south through the middle and High Arctic islands to northern Hudson Bay. Breeders from Greenland and northeastern Canada migrate across the Atlantic and winter in western Europe. Most of the remaining North American breeders undertake a long-distance migration to South America, though small numbers winter along the Atlantic and Pacific coasts of North America (Harrington 2001).

Red knots use different habitats for breeding and wintering/migration. In the Arctic, red knots nest on barren habitats (often < 5% vegetation) such as windswept ridges, slopes or plateaus. Nest are simple scrapes usually placed in small patches of vegetation sites and are usually in dry, south-facing locations, but may be located near wetlands or lake edges, where the young are led after hatching. Densities are usually low, with nests often 0.75 – 1 km apart. Red knots are monogamous and often return to the same general breeding area from year to year, though little is known concerning the details of site or mate fidelity. Foraging habitats can be considerable distances (up to 10 km) from the nest, and are usually in damp or barren areas (COSEWIC 2007a).

During migration and on wintering grounds, red knots gather in large flocks, feeding in coastal intertidal areas and roosting on nearby beaches, marshes or fields, where open undisturbed habitat is available (Harrington 2001).

Issues/Concerns

There are no identified threats to individuals in Canada. Habitat on the Canadian breeding grounds is likely stable; however migratory stopover sites along both the Pacific and Atlantic coasts of North American have been reduced in quantity and quality (COSEWIC 2007a). Additionally, harvesting of shellfish, whose eggs provide a primary food source for the northbound migration in particular, presents an ongoing threat (Harrington 2001; COSEWIC 2007a). In 2007, 1,300 dead red knots were found in Uruguay, representing nearly 10% of the remaining population (Environment Canada 2008b). Numerous studies have shown that repeated disturbance can negatively affect shorebirds, disrupting behaviour patterns and affecting their energy balance (Davidson and Rothwell 1993; Gill *et al.* 2001; West *et al.* 2002). Long-term changes resulting from climate change are likely to affect knots, probably in a negative fashion (Meltofte *et al.* 2007).

Land Use Planning Considerations

The red knot is protected under the federal *Migratory Birds Convention Act*. This law makes it an offence to disturb, kill, or collect adults, juveniles, and eggs. Additionally, some of the red knot’s most important habitats have been recognized by the Ramsar Convention, an international intergovernmental treaty that provides a framework for national action and international cooperation for the conservation and sound management of wetlands (COSEWIC 2007a).

This species was heavily hunted in the United States during the late 1800s and early 1900s, and while it no longer faces hunting pressure in North America, it appears that knots are still commonly hunted in South America (National Audubon Society (NAS) 2008b).

4.7.6 Sanderling

Inuit Name: Sigjariarjuk qaulluqtuq
Scientific Name: *Calidris alba*

Conservation Status

In the Inuit tree of life, sanderling is classified among the uumajuit (the living), tingmiat (those that fly), and nunatuqtiit (eaters of the products of the Earth).

Sanderling has not been assessed by COSEWIC, but is considered Sensitive in Nunavut due to declines observed on migration in the eastern United States and limited knowledge of population trends in Nunavut (GNDoE 2005). The Canadian breeding population is estimated at 300,000, with 75% of the breeding population in Nunavut (Morrison *et al.* 2000).

Ecology

The breeding range of the sanderling is circumpolar, with the highest numbers in the Canadian Arctic archipelago, Greenland, and high-arctic Siberia (Macwhirter *et al.* 2002). In Nunavut, sanderlings breed on northeastern Kivalliq, Southampton Island, Bylot Island, Victoria Island, Somerset Island and Prince of Wales Island (GNDoE 2005). Most North American sanderlings winter in Central and South America, however relatively small numbers also winter along the Atlantic, Pacific, and Gulf coasts of North America (Macwhirter *et al.* 2002).

Sanderlings breed on islands and coastal tundra of High Arctic, building nests in shallow scrapes on the ground, typically in exposed, well-drained sites, either alone or in loose colonies (Macwhirter *et al.* 2002). Mating systems appear to vary among populations, ranging from monogamy to serial polyandry. During the breeding season sanderlings feed on insects on damp tundra or at edges of streams, ponds, lakes, and sandy beaches (Macwhirter *et al.* 2002). On migration and in winter, preferred foraging habitat is sandy beach.

Issues/Concerns

Although limited threats to sanderlings exist in Nunavut, like most shorebirds they are vulnerable to the disturbance of wetlands on breeding, migration, or wintering grounds, and are at risk of accumulating contaminants through their diet (Canadian Wildlife Services (CWS) 2008).

Land Use Planning Considerations

Sanderlings and their nests are protected on their breeding grounds under the federally regulated *Migratory Birds Convention Act*.

4.7.7 Semipalmated Sandpiper

Inuit Name: Unknown
Scientific Name: *Calidris pusilla*

Conservation Status

In the Inuit tree of life, semipalmated sandpiper is classified among the uumajuit (the living), tingmiat (those that fly), and nunatuqtiit (eaters of the products of the Earth).

Semipalmated sandpiper has not been assessed by COSEWIC, but is considered Sensitive in Nunavut due to rapid declines in numbers of migrants in Quebec and the eastern United States, believed to be birds from Nunavut (GNDoE 2005).

Distribution

Semipalmated sandpiper breeds along the northern fringe of Alaska and the Canadian mainland, and the lower Arctic islands (Gratto-Trevor 1992). Its breeding range covers approximately 62% of

Nunavut, including most of Kitikmeot and Kivalliq, as well as Hudson Bay, central Baffin Island, and southern Victoria Island (GNDoE 2005).

Ecology

Breeding habitat for semipalmated sandpiper is low moist tundra (GNDoE 2005). Nests are located on the ground, most commonly in grass or sedge-dominated areas along ponds or streams, but sometimes among small willows and dwarf birch (Gratto-Trevor 1992). In similar habitat, semipalmated sandpipers will forage on benthic invertebrates (small arthropods, molluscs, and annelids), also some terrestrial invertebrates (insects and spiders) (Gratto-Trevor 1992). Little is known about the degree to which nest placement influences success through factors such as exposure to weather or predation.

Issues/Concerns

Semipalmated sandpiper is numerous and widespread in Nunavut, which supports a majority of the 3.5 million individuals, estimated to exist in Canada (Morrison 2001; GNDoE 2005). Migrants surveyed in Ontario showed a statistically significant annual decline of 5% (cumulative loss of 66%) between 1976 and 1997 (Ross *et al.* 2001), and a significant decline since the 1970s has also been recorded among migrants in Atlantic Canada (Morrison *et al.* 1994; Morrison and Hicklin 2001). Therefore while declines have not been documented in Nunavut (GNDoE 2005), this may reflect a lack of monitoring more than true population stability.

Land Use Planning Considerations

Although some hunting of semipalmated sandpiper may occur in Nunavut, no take of shorebirds was specifically documented in the Nunavut Wildlife Harvest Study (Priest and Usher 2004a). Semipalmated sandpiper is federally protected under the *Migratory Birds Convention Act*.

4.7.8 Buff-breasted Sandpiper

Inuit Name: Aklaktak
Scientific Name: *Tryngites subruficollis*

Conservation Status

In the Inuit tree of life, buff-breasted sandpiper is classified among the uumajuit (the living), tingmiat (those that fly), and nunatuqtiit (eaters of the products of the Earth).

Buff-breasted sandpiper has not been assessed by COSEWIC, but is considered Sensitive in Nunavut due to unique behaviour (lek mating system [where males will perform displays in order to attract females] and extreme tameness), substantial decreases in population historically, some indication that this species may still be in decline, and limited study in Nunavut (Lanctot and Laredo 1994).

Distribution

The breeding range of buff-breasted sandpiper extends along the extreme northern edge and islands of North America's central Arctic (Lanctot and Laredo 1994). It occupies approximately 10% of Nunavut; including Victoria, King William, Prince of Wales, Bathurst, Devon, Jenny Lind, and

Somerset Islands, as well as the Boothia Peninsula (Lanctot and Laredo 1994). There are estimated to be at least 21 known traditional lek sites in Nunavut (GNDoE 2005).

Ecology

The buff-breasted sandpiper breeds in wet tundra and sedge-graminoid meadows, usually close to streams or open water wetlands (GNDoE 2005, (Lanctot and Laredo 1994). Nests are on the ground, consisting of a shallow scrape made by the bill and breast of the female in a flattened moss hummock. The female may then line the nest with lichens, dead willow leaves, sphagnum moss, dead horsetail, and sedges (Lanctot and Laredo 1994). Buff-breasted Sandpiper is the only North American shorebird to exhibit true lek behaviour (Johnsgard 1981), referred to as having an “exploded” lek mating system because of the large size of display territories (1 – 4 ha). Lek locations change annually, although they may occur at traditional locations along river bends and junctions (Lanctot and Laredo 1994).

Foraging for invertebrates during the breeding season occurs primarily on areas of dry, elevated tundra with sparse vegetation as well as along the banks of rivers and streams (Lanctot and Laredo 1994).

Issues/Concerns

The population of buff-breasted sandpiper in Nunavut is considered stable (GNDoE 2005). Of the population of 15,000 estimated to exist in Canada (Morrison *et al.* 2001b), approximately 75% is believed to occur in Nunavut (GNDoE 2005). However, the Canadian population estimate is based on broad-scale surveys and is considered to have low overall accuracy, although it is likely to be in the right order of magnitude (Morrison *et al.* 2001b). While detailed monitoring of northern shorebird populations has been limited, a comparison of populations in the Rasmussen Lowlands of Nunavut between 1975 – 1976 and 1994 – 1995 showed an insignificant decline of buff-breasted sandpiper of a magnitude difficult to estimate (Johnston *et al.* 2000; Gratto-Trevor *et al.* 2001). Therefore, it is difficult to assess the current status and population of buff-breasted sandpiper without further study.

Numbers of buff-breasted sandpiper decreased in 1800s and early 1900s due to commercial hunters in the central US and to a lesser degree on wintering grounds. Their extreme tameness and tendency to return to a wounded flock member make these birds particularly vulnerable to hunting. Although the breeding habitat of buff-breasted sandpiper seems secure, alteration of grassland communities on wintering and staging grounds by agriculture, cattle ranching, overgrazing, and fire may be contributing to a long-term decline of this species (Lanctot and Laredo 1994).

Land Use Planning Considerations

Buff-breasted sandpiper is protected under the federal *Migratory Birds Convention Act* (1994). This act makes it an offense to disturb, kill, or collect adults, juveniles, and eggs. Although some hunting of buff-breasted sandpiper may occur in Nunavut, it was not documented in the Nunavut Wildlife Harvest Study (Priest and Usher 2004a).

4.7.9 Wilson's Snipe

Inuit Name: Unknown
Scientific Name: *Gallinago delicata*

Conservation Status

In the Inuit tree of life, Wilson's snipe is classified among the uumajuit (the living), tingmiat (those that fly), and nunatuqtiit (eaters of the products of the Earth).

Wilson's snipe (formerly common snipe) has not been assessed by COSEWIC (2008b), but is considered Sensitive in Nunavut due to possible population declines in the southern parts of its range, and limited knowledge about its status in the north (GNDoE 2005).

Distribution

Among North American shorebirds, Wilson's snipe has an unusually widespread distribution, occurring throughout Alaska and most of Canada except the High Arctic and the coast of British Columbia (Mueller 1999). It occupies approximately 11% of Nunavut, mostly in central and southern Kivalliq and southern Kitikmeot (GNDoE 2005).

Ecology

Wilson's snipe nests in a variety of wetland types, including bogs, fens, swamps, and along ponds or rivers (Mueller 1999). Habitat featuring clumps of vegetation for cover are preferred, as are sites that have rich soft soil providing easy access to an abundance of prey such as larval insects, small crustaceans, and earthworms (Mueller 1999). Nests are typically located on the ground. Little appears to be known about variability in success with respect to location, weather, or predation (Mueller 1999).

Issues/Concerns

The GNDoE 2005 considers Wilson's snipe to be Sensitive on the basis of population declines in the southern part of its range, and a significant negative trend was documented during fall migration in Ontario between 1976 and 1997 (Ross *et al.* 2001). However, the Canadian and American breeding populations both showed a significant increase between 1966 and 1979, and were stable between 1980 and 1999 (Morrison 2001). Loss of wetland habitat is likely the greatest conservation concern, both within its breeding range, and its wintering range which extends across most of the contiguous United States (Mueller 1999). With an estimated Canadian population of approximately two million (Morrison *et al.* 2001b), Wilson's snipe is among the most abundant shorebird species. Based on its distribution in Nunavut and typical breeding density, at least 1,000 individuals are expected to live in Nunavut (GNDoE 2005).

Land Use Planning Considerations

Wilson's snipe is one of only two shorebird species considered game birds in Canada (Levesque and Bateman 2001). Hunting pressure has declined over the past couple of decades, but was historically high, with over 500,000 individuals taken annually in the 1960s, though no noticeable population declines were reported in relation to hunting (Mueller 1999). Although some hunting of Wilson's snipe may occur in Nunavut, it was not documented in the Nunavut Wildlife Harvest Study (Priest and Usher 2004a). While nesting, Wilson's snipe is protected under the *Migratory Birds Convention Act*.

4.7.10 Red Phalarope

Inuit Name: Auksruak or Saurraq (Inuktitut: Shutgak or Kajuaraq)
Scientific Name: *Phalaropus fulicarius*

Conservation Status

In the Inuit tree of life, red phalarope is classified among the uumajuit (the living), tingmiat (those that fly), and nunatuqtiit (eaters of the products of the Earth).

Red phalarope has not been assessed by COSEWIC (2008b), but is considered Sensitive in Nunavut due to apparent declining trends noted earlier in Nunavut and elsewhere and no recent studies of this species in Nunavut (GNDoE 2005).

Distribution

The breeding range of red phalarope extends along the extreme northern edge and islands of North America's Arctic, from Alaska to Greenland (Tracy *et al.* 2002). It occupies approximately 42% of Nunavut; including western Hudson Bay, northern Melville Peninsula, Boothia Peninsula, Victoria, Somerset, west Devon, and Ellesmere Islands (Tracy *et al.* 2002).

Ecology

Red phalaropes prefer to nest on hummocks on poorly drained coastal tundra, often selecting areas where snow melt is earlier than average. This preference can result in a clumped distribution of nests at a landscape level (Tracy *et al.* 2002). Nests are usually situated under vegetation sufficiently tall to provide some overhead shelter from weather and protect it from the view of predators (Tracy *et al.* 2002). Nests are only rarely reused in subsequent years (Tracy *et al.* 2002). Foraging by red phalaropes during the breeding season focuses primarily on adult and larval insects, and crustaceans in shallow, wading-depth water (< 5 cm) at edges of shallow ponds (Tracy *et al.* 2002).

Issues/Concerns

Red phalarope is considered widespread and abundant in Nunavut with a population that is likely stable (GNDoE 2005). Of the population of 920,000 estimated to exist in Canada (Morrison *et al*. 2001b), approximately 85% are believed to breed in Nunavut (GNDoE 2005). While detailed population monitoring of northern shorebird populations has been limited, concern was raised by a comparison of populations in the Rasmussen Lowlands of Nunavut between 1975 – 1976 and 1994 – 1995 showing a significant decline of 76% for red phalarope (Johnston *et al.* 2000; Gratto-Trevor *et al.* 2001). As well, the Canadian population estimate is not based on scientific survey efforts but rather on professional opinion and is, therefore, considered to have poor overall accuracy (Morrison *et al.* 2001b). Migrants have shown a susceptibility to collisions with power lines, and ingestion of plastic (Tracy *et al.* 2002).

Land Use Planning Considerations

Red phalarope is protected under the federal *Migratory Birds Convention Act* (1994). This act makes it an offense to disturb, kill, or collect adults, juveniles and eggs.

Although some hunting of red phalarope may occur in Nunavut, it was not documented in the Nunavut Wildlife Harvest Study (Priest and Usher 2004).

4.8 Seabirds

Conservation Status

Seabirds are generally those species that live partially or exclusively at sea, including jaegers, gulls, terns, and alcids. In the Inuit tree of life, seabirds are generally classified among the uumajuit (the living), tingmiat (those that fly), and niqituqtiit (the meat/fish eaters).

Seabirds in Nunavut include: double-crested cormorant, pomarine jaeger, parasitic jaeger, long-tailed jaeger, Northern fulmar, little gull, Bonaparte's gull, mew gull, ring-billed gull, herring gull, thayer's gull, Iceland gull, glaucous gull, lesser black-backed gull, great black-backed gull, black-legged kittiwake, Ross's gull, Sabine's gull, ivory gull, Caspian tern, common tern, Arctic tern, black tern, dovekie, Atlantic puffin, thick-billed murre, razorbill, and black guillemot. Of these, Ross's gull (Section 4.5.4), ivory gull (Section 4.5.5), dovekie (Section 4.5.2), and Atlantic puffin (Section 4.5.3) are treated separately due to their conservation status. The remaining species are considered Secure and are summarized briefly in this section.

Distribution

While some gulls, terns, and cormorants have inland breeding populations, North American seabirds are largely restricted to the Pacific, Atlantic, and Arctic coastlines. For many species, the extensive rocky coasts of Arctic islands represent a significant portion of their breeding range.

The double-crested cormorant is the only member of its family to nest in Nunavut. While the breeding range of the species ranges from Alaska and Newfoundland south to California and Florida, the subspecies *P.a. auritus* found in Nunavut is generally restricted to areas east of the Rockies (Hatch and Weseloh 1999). There is limited knowledge about the northern distribution of the species, being primarily recorded as a vagrant; however, a small breeding population has been confirmed on the James Bay Islands (GNDoE 2005).

Jaegers and Northern fulmars breed in Alaska and the Canadian arctic, including mainland Nunavut and many of its islands. They are also found in Greenland, Iceland, Scandinavia, and northern Russia. Generally, jaegers spend winter on tropical oceans of the southern hemisphere, while Northern fulmars remain along North American coasts (Harrison 1983).

Various species of gulls and terns breed throughout Nunavut. Most winter in the United States, but some such as the ivory, Ross's, iceland, and glaucous gull remain further north, staying mostly in Canadian waters (Harrison 1983).

The three alcid species found in Nunavut breed along arctic coasts and islands and winter along the Atlantic coast of north and central United States (Harrison 1983).

Ecology

Double-crested cormorants establish nesting colonies along lakes, rivers, swamps, and sea coasts, often favouring cliffs in marine habitat. They forage by diving from the surface and swimming underwater to prey on fish, crustaceans and sometimes amphibians (Hatch and Weseloh 1999).

Jaegers and fulmars usually stay offshore except for breeding. Nests are colonial and made in a shallow ground depression lined with grass, moss, and leaves. Jaegers eat small mammals, fish, squid, insects, birds, bird eggs, berries, carrion, and refuse. Both the long-tailed and pomarine jaegers feed heavily on lemmings and voles on their breeding grounds (Harrison 1983).

Gulls and terns nest alone or in colonies on lakes, rivers, marshes, tidal estuaries, or coastal cliffs, preying on fish, smaller birds, eggs, and occasionally small mammals, as well as scavenging opportunistically (Harrison 1983).

Alcids nest on the ground on cliffs, often favouring protective crevices. They may feed far from breeding colonies and forage by diving from the surface and swimming underwater. Their diet consists of small fish and planktonic crustaceans (Harrison 1983).

Ecological or Economic Importance

Waterfowl are of high socio-economic value in Nunavut and are sensitive because they nest in colonies and occur in large congregations. Ecological and population processes are affected by large-scale climatic fluctuations, and top predators such as seabirds can provide an integrative view on the consequences of environmental variability on ecosystems. Seabirds are also a key off shore indicator of anthropogenic disturbance. Seabirds have strong cultural significance and are often featured in carvings.

Issues/Concerns

Seabirds are susceptible to human disturbances, contaminants, oil spills and pollution, especially for those species that are colonial nesters. However these threats are minimal in the Nunavut portion of their range. Hunting and incidental catch in fishing nets can pose a threat to seabird populations in Nunavut (Canadian Wildlife Services (CWS) 2008).

Land Use Planning Considerations

Seabirds are protected on their breeding grounds under the federally regulated *Migratory Birds Convention Act*. Seabirds are subsistence harvested in Nunavut for meat, feathers and eggs (Canadian Wildlife Services (CWS) 2008). Small numbers of murre eggs are taken at some communities in Nunavut, while adults are subject to significant harvesting in their winter quarters off Newfoundland and Labrador, as well as Greenland.

4.8.1 Dovekie

Inuit Name: Akpaliarjuk
Scientific Name: *Alle alle*

Conservation Status

In the Inuit tree of life, dovekie is classified among the uumajuit (the living), tingmiat (those that fly), and niqituqtiit (the meat/fish eaters).

Dovekie has not been assessed by COSEWIC, but is considered Sensitive in Nunavut, on the basis of being restricted to a single confirmed breeding colony of fewer than 1,000 pairs on East Baffin Island (GNDoE 2005).

Distribution

Dovekie breed primarily along the coast of Greenland. There is one known colony in Canada at Home Bay on East Baffin Island, and potentially a colony on Ellesmere Island (Montevecchi and Stenhouse 2002). However, up to 7,000,000 dovekie winter along the Atlantic coast of North America, mostly from Newfoundland south to the Gulf of Maine (Montevecchi and Stenhouse 2002; Mallory and Fontaine 2004).

Ecology

Dovekie breed in large colonies on steep coastal slopes, where they lay one egg in crevices or beneath large rocks (Montevecchi and Stenhouse 2002). Dovekie winter offshore in the north Atlantic, but may be carried further south by late autumn storms (Montevecchi and Stenhouse 2002).

Issues/Concerns

No specific threats to the Canadian dovekie population are known, but it is considered vulnerable due to its small size and limited distribution, which make it particularly susceptible to human disturbance or pollution affecting nesting colonies. Dovekie are also susceptible to getting caught in fishing nets. Increasing water temperatures as a result of climate change could threaten dovekie populations which rely on cool water.

Land Use Planning Considerations

Dovekie and their nests are protected on their breeding grounds under the federally regulated *Migratory Birds Convention Act.* Dovekie are not known to have any substantial harvest in Nunavut.

4.8.2 Atlantic Puffin

Inuit Name: Oilanngaq
Scientific Name: *Fratercula arctica*

Conservation Status

In the Inuit tree of life, Atlantic puffin is classified among the uumajuit (the living), tingmiat (those that fly), and niqituqtiit (the meat/fish eaters).

Atlantic puffin has not been assessed by COSEWIC, but is considered Sensitive in Nunavut, based on previous pressure from egg gathering and hunting and uncertainty about the current size and distribution of the population (GNDoE 2005). However, several locations in Nunavut are known to support at least 30 pairs (Mallory and Fontaine 2004).

Distribution

Atlantic puffin breeds along both the North American and European coasts of the north Atlantic, and into the arctic. During winter they largely remain far offshore, generally somewhat south of their breeding range (Lowther 2002). Approximately 95% of Atlantic puffins in North America breed along the Newfoundland coast (Lowther 2002). Nunavut represents the northern limit of the Atlantic puffin's range, with breeding records known from Prince Charlotte Monument off Coburg Island at the entrance to Jones Sound, on a small island off the southeast cost of Resolution Island, and on two small islands in Digges Sound off the northwest tip of the Ungava Peninsula (Lowther 2002).

Ecology

Puffins spend most of their time swimming, diving, and feeding at sea (Lowther 2002). They return to breeding colonies in Newfoundland and Labrador around mid-April, but may be slightly later further north. Most puffins nest in colonies on small, rugged islands that are free of mammal predators such as mink and foxes. A few nest along mainland shores where they gain protection from predators by choosing locations on cliffs. Thousands and sometimes hundreds of thousands nest together at large colonies (Canadian Wildlife Service (CWS) 1996). Atlantic puffins nest on grassy slopes in burrows 50 to 200 cm long, which they dig with their bills and the sharp claws on their feet. Some birds may also nest in cracks under boulders or in crevices on cliff faces, especially in arctic colonies where there is little soil or where the soil remains frozen for much of the summer. Puffins normally keep the same mate and the same burrow from year to year (Canadian Wildlife Service (CWS) 1996).

Issues/Concerns

Most of the large puffin colonies in Canada are protected as provincial reserves or federal migratory bird sanctuaries and there are few threats to Atlantic puffin in Nunavut (GNDoE 2005). However puffins are also vulnerable to fishing nets, oil pollution, overfishing and global warming (Canadian Wildlife Service (CWS) 1996).

Land Use Planning Considerations

Atlantic puffins and their nests are protected on their breeding grounds under the federally regulated *Migratory Birds Convention Act*. There are only several locations in Nunavut known to contain breeding Atlantic puffins. Those locations may require site-specific measures to ensure protection those breeding pairs (Canadian Wildlife Service (CWS) 1996).

4.8.3 Ross's Gull

Inuit Name: Naajannquaq
Scientific Name: *Rhodostethia rosea*

Conservation Status

In the Inuit tree of life, Ross's gull is classified among the uumajuit (the living), tingmiat (those that fly), and niqituqtiit (the meat/fish eaters).

Ross's gull was most recently assessed by COSEWIC in April 2007, and determined to be Threatened (COSEWIC 2007d). It is considered At Risk in Nunavut on the basis of very limited distribution and small population size (GNDoE 2005). Globally the species is considered vulnerable or apparently secure (*Environment Canada 2007).

Distribution

Ross's gull is a circumpolar species, found primarily in Siberia, Greenland, and Svalbard, and with a small population in Canada. Its Canadian distribution is very limited, with breeding documented only at Churchill, Manitoba, and at Cheyne Islands, Prince Charles Island, and Penny Strait in Nunavut, though even these few locations are not all used annually (Bechet *et al.* 2000; Mallory and Gilchrist 2003; COSEWIC 2007d). Other undiscovered breeding areas may exist. Wintering distribution is less well documented, but believed to be primarily within the northern Bering Sea, Sea of Okhotsk, and open areas of the Arctic Ocean.

Ecology

Typical breeding habitat ranges from marshy wetland to boreal tundra along coasts (Blomqvist and Elander 1981), with nests located on barren gravel reefs on the Cheyne Islands and in Penny Strait, and on grassy hummocks among dwarf willows and shallow pools near Churchill (COSEWIC 2007d). The most critical feature appears to be proximity to open water for feeding, whether lakes, ponds, or polynyas (COSEWIC 2007d). The species is only loosely colonial, with no more than 20 pairs reported at any Canadian breeding site, but it often associates with larger Arctic Tern colonies (COSEWIC 2007d). Outside of the breeding season, Ross's gulls spend much of their time along drift ice and shelf breaks as these are associated with an upwelling of nutrients and hence high food productivity (COSEWIC 2007d).

Issues/Concerns

The principal threats facing Ross's gull in Canada include disturbance and alteration of habitat and predation, while low reproductive output and weather also limit the population (Environment Canada 2007). Human disturbance of Ross's gulls has been known to cause nest abandonment, and a small black market for the sale of their eggs has existed in the past (Environment Canada 2007). Reproductive success is low, as both eggs and young are vulnerable to predation by Arctic fox, weasels, jaegers, and larger gulls; adults are occasionally taken as prey by peregrine falcons (Environment Canada 2007). Some nestlings may also die of hypothermia. As Ross's gull is dependent on the availability of open water near bare nest sites early in the breeding season, the species may also be vulnerable to changes in ice and snow distribution in relation to climate change (Environment Canada 2007).

The known breeding population in Canada ranges from 0 to 10 pairs per year, preventing any assessment of population trends (Environment Canada 2007). The global population has also not been monitored sufficiently to assess stability (Environment Canada 2007).

Land Use Planning Considerations

Due to its rarity, subsistence harvest of Ross's gull by Inuit is believed to have always been minimal and incidental (Environment Canada 2007). Under the *Migratory Birds Convention Act* (1994), no collection of either individuals or eggs is permitted. Ross's gull is listed on Schedule 1 under SARA, through which its residence (i.e., nest) is also protected from damage or destruction. The few known breeding locations in Nunavut may require site-specific management to ensure continued nesting in those areas.

4.8.4 Ivory Gull

Inuit Name: Naujavaaq, Naajavaarsuk, or Kaniq
Scientific Name: *Pagophila eburnea*

Conservation Status

In the Inuit tree of life, ivory gull is classified among the uumajuit (the living), tingmiat (those that fly), and niqituqtiit (the meat/fish eaters).

Ivory gull was most recently assessed by COSEWIC in April 2006, at which time its status was upgraded from Special Concern to Endangered (COSEWIC 2006c). It is considered May be at Risk in Nunavut on the basis of restricted distribution, small and declining population, and potential sensitivity to disturbance (GNDoE 2005).

Distribution

Ivory gull has a polar distribution ranging from the central Canadian Arctic to western Russia, with breeding sites in Canada limited to Nunavut (COSEWIC 2006c), but accounting for 20 – 30% of the global population (Stenhouse *et al.* 2004). Its breeding range includes approximately 3% of Nunavut, primarily southeastern Ellesmere Island, eastern Devon Island, northern Baffin Island, and Seymour Island along the Penny Strait polynya (GNDoE 2005, (COSEWIC 2006c) The Inglefield Mountains of Ellesmere Island have consistently supported 30 – 40% of the Canadian ivory gull population over the past two decades (Latour *et al.* 2008), while the importance of the Seymour Island colony has increased over time to a similar level (Gilchrist and Mallory 2005). Most of the remaining individuals are on the Brodeur Peninsula of Baffin Island, but within the past decade ten colonies near the coast have been abandoned, while only three new ones further inland have been documented (Latour *et al.* 2008). The Sydkap Ice Field on southern Ellesmere Island was formerly home to a large colony of up to 300 ivory gulls, but was abandoned during surveys in 2002 and 2003 (Latour *et al.* 2008). The colonies on eastern Devon Island were always relatively small, and have also been largely abandoned (Latour *et al.* 2008).

Ecology

Ivory gulls have very restrictive requirements for breeding sites, primarily isolation from terrestrial predators, especially arctic fox, and relative proximity to areas of ocean that are regularly open by late May (Haney and Macdonald 1995). Colonies are typically located on steep rocky cliffs providing limited access to mammalian predators, including islands, edges of limestone or basalt plateaus, or nunataks (Haney and Macdonald 1995). Most nest sites on Ellesmere and southeast Devon Island are on granite nunataks 20 – 50 km inland, while on west Devon, Baffin, Cornwallis, and Somerset Islands, the colonies are 20 – 40 km inland on large barren limestone plateaus where the lack of vegetation in turn results in an absence of lemmings and foxes (Gilchrist and Mallory 2005; COSEWIC 2006c). Other parts of the Canadian Arctic offer similar nesting habitat, but appear unsuitable as they are over 100 km from polynyas, which provide critical foraging habitat for Ivory Gull during the early part of the breeding season (COSEWIC 2006c).

Ivory gull is somewhat unusual in that it also winters in the arctic and subarctic, mostly along the edge of the pack ice in the north Atlantic or at arctic polynyas (Haney and Macdonald 1995). This is the habitat they occupy most of the year, as they disperse to offshore foraging areas as soon as breeding is completed (Haney and Macdonald 1995).

Issues/Concerns

Based on intensive aerial surveys of breeding colonies and local ecological knowledge, the Canadian breeding population is estimated to have declined by 80% over the past 20 years to approximately 500 – 600 individuals (COSEWIC 2006c). A continued decline at this rate would reduce the population to under 200 within the next decade (COSEWIC 2006c). A recent population modeling exercise suggests that all breeding colonies except those on Ellesmere Island are likely to become extirpated within the next ten to 20 years (Robertson *et al.* 2007).

Several threats to the ivory gull population have been recognized. Mercury concentrations in ivory gulls on Seymour Island have increased steadily since 1976, to the point that five of six eggs tested in 2004 met or exceeded the threshold believed to impair reproductive success (COSEWIC 2006c). Illegal shooting of adults in Greenland has accounted for the vast majority (81%) of band recoveries (Stenhouse *et al.* 2004). Most breeding colonies are remote and undisturbed, but on the Brodeur Peninsula of Baffin Island there has recently been a considerable increase in diamond mine exploration, coincident with a significant decline in colony occupation (COSEWIC 2006c). In addition to the physical and sensory disturbance associated with human activities, they may attract previously scarce or absent mammalian and avian predators that will also prey on other local sources of food including gull colonies (COSEWIC 2006c). However, there is also evidence to suggest that ivory gull is more tolerant to disturbance than other northern seabirds, suggesting that further research into their sensitivity to disturbance is needed (COSEWIC 2006c). Climate change may also have an impact on ivory gull depending on how it affects the distribution of open water early in the breeding season (COSEWIC 2006c).

Land Use Planning Considerations

Under the *Migratory Birds Convention Act* (1994) and Migratory Bird Regulations, collection of ivory gull individuals or eggs is prohibited. Ivory gull is also listed on Schedule 1 under SARA, which extends protection from damage or destruction to its residence (i.e., nest). Canadian Inuit remain permitted to harvest ivory gulls at any time, but rarely do so (COSEWIC 2006c). It is believed that they were never more than opportunistically harvested, and Inuit have expressed concern that the decline of the ivory gull population is reflective of a broader environmental deterioration (Mallory and Gilchrist 2003). The few known breeding locations in Nunavut may require site-specific management to ensure continued nesting in those areas.

4.9 Songbirds

4.9.1 American Tree Sparrow

Inuit Name: Unknown
Scientific Name: *Spizella arborea*

Conservation Status

In the Inuit tree of life, American tree sparrow is classified among the uumajuit (the living), tingmiat (those that fly), and nunatuqtiit (eaters of the earth).

The American tree sparrow has not been assigned a conservation status by either COSEWIC or SARA. It is considered Sensitive in Nunavut on the basis of an apparent downward trend in population (GNDoE 2005).

Distribution

The American tree sparrow breeds across northern Canada and Alaska. This range includes approximately 21% of Nunavut, from Kitikmeot to Bathurst Inlet, the southern part of mainland Kivalliq, and the Bay Islands (GNDoE 2005).

Ecology

Ideal breeding habitat consists of a patchy mix of tundra with shrub thickets and stunted spruce, often near wetlands (Naugler 1993). At least a few small trees are usually present, serving as singing posts for the males. The nest is usually located among grass at the base of small trees or shrubs, or on mossy hummocks in more open tundra. Only occasionally are nests built low in spruces or willows (Naugler 1993).

Ecological or Economic Importance

Some species are used for subsistence (eggs). Songbirds have strong cultural significance (i.e., Inuit legends describe how Raven brought light to the far north for his people).

Issues/Concerns

The size of the American tree sparrow population in Nunavut is unknown, but based on local abundances, it is believed to be fairly common, with a population likely in excess of 3,000 (GNDoE 2005). Naugler (1993) noted that disturbance on breeding grounds is likely of minimal concern due to the abundance of remote habitat available. Dunn and Downes (1998) reported a potential population decline for American tree sparrow based on Christmas Bird Count data, but Downes *et al.* (2000) cautioned that the trend needs to be confirmed for the north.

Land Use Planning Considerations

American tree sparrows are protected under the *Migratory Birds Convention Act*, and are not known to be hunted or otherwise exploited for traditional uses.

4.9.2 White-crowned Sparrow

Inuit Name: Inuit name unknown
Scientific Name: *Zonotrichia leucophrys*

Conservation Status

In the Inuit tree of life, white-crowned sparrow is classified among the uumajuit (the living), tingmiat (those that fly), and nunatuqtiit (eaters of the earth).

The white-crowned sparrow has not been assigned a conservation status by either COSEWIC or SARA. It is considered Sensitive in Nunavut on the basis of an apparent downward trend in population (GNDoE 2005).

Distribution

The white-crowned sparrow has a widespread breeding distribution across northern and western North America. It is estimated to extend across approximately 33% of Nunavut, including primarily mainland Kitikmeot and central Kivalliq, and limited occurrences on Victoria, Somerset, Bathurst, and Baffin Islands (GNDoE 2005).

Ecology

Breeding habitat is typically patchy, with critical features including grass and bare ground for foraging, and dense cover in the form of shrubs or small conifers in which to nest or seek shelter (Chilton *et al.* 1995). On the tundra, nests are usually on the ground, nestled into moss and/or lichen, and often underneath partial cover from hummocks or small shrubs such as dwarf birch or Labrador tea. Detailed habitat associations are unavailable for Nunavut, but in the Northwest Territories, white-crowned sparrows typically nest on the ground in moist vegetation among dwarf birch, or less commonly among spruce (Norment 1993).

Issues/Concerns

Chilton *et al.* (1995) identified no specific conservation concerns. Dunn and Downes (1998) reported a potential population decline for white-crowned sparrow based on Christmas Bird Count data, but

Downes *et al.* (2000) noted that the trend needs to be confirmed for the north. Across its range, the white-crowned sparrow shows varying levels of adaptability to human disturbance (Chilton *et al.* 1995), but considering that it has small territory requirements and nesting requirements are easily met across most of its range in Nunavut, any local disturbances would likely have only a minor impact.

Land Use Planning Considerations

White-crowned sparrows are protected under the *Migratory Birds Convention Act*, and are not of interest for harvesting.

4.9.3 Harris's Sparrow

Inuit Name: Unknown
Scientific Name: *Zonotrichia querula*

Conservation Status

In the Inuit tree of life, Harris's sparrow is classified among the uumajuit (the living), tingmiat (those that fly), and nunatuqtiit (eaters of the products of the Earth).

Harris's sparrow has not been assessed by COSEWIC, but is considered Sensitive in Nunavut due to a declining trend nationally and little data from Nunavut by which to assess population status (GNDoE 2005).

Distribution

Harris's sparrow is the only songbird with a breeding range restricted entirely to Canada (Dunn 2005). It occupies approximately 23% of Nunavut including the entire mainland (GNDoE 2005), but is not known to occur on any of the Arctic islands (Norment 1993). Nunavut represents the majority of the species' breeding range (Norment 1993).

Ecology

Harris's sparrow nests primarily in the transition zone between forest and tundra (Norment 1993). In the core of its breeding range, Harris's sparrow favours habitat where trees are typically limited to scattered and stunted black and white spruce, located within a tundra vegetation mosaic consisting of lichen and dwarf birch/willow shrubs (Norment 1992). Nests are built on the ground, usually under the cover of a low shrub, but sometimes in more exposed situations in open tundra habitat (Norment 1993). Most nests are located on the side of small hummocks, and often face southeast, providing some shelter from the prevailing direction of storms (Norment 1993). Harris's sparrows often occur in the same area as white-crowned sparrows, but tend to nest in somewhat more open habitat, with less tree cover (Norment 1993).

Issues/Concerns

The breeding range of the Harris's sparrow is too far north to be monitored reliably by the Breeding Bird Survey. Therefore the only large-scale trend data available for the species is through the Christmas Bird Count database, which over the full range of the species showed significant mean annual declines of 2.2% between 1959 and 1988 (Dunn 2005) and 1.7% between 1988 and 2007

(National Audubon Society (NAS) 2008c). Reasons for this change are unclear, as breeding habitat is largely remote and has undergone little development, while on migration and during winter Harris's sparrow frequents edge habitat and is therefore expected to be minimally affected by human activities (Norment and Shackleton 1993). In the absence of monitoring programs, the status of the Nunavut population remains unknown, but it is believed to probably be stable (GNDoE 2005).

Land Use Planning Considerations

Harris's sparrows and their nests are protected on their breeding grounds under the federally regulated *Migratory Birds Convention Act*. The species is not known to be hunted or otherwise exploited for traditional uses.

4.9.4 Snow Bunting

Inuit Name: Kopenuak
Scientific Name: *Plectrophenax nivalis*

Conservation Status

In the Inuit tree of life, snow bunting is classified among the uumajuit (the living), tingmiat (those that fly), and nunatuqtiit (eaters of the products of the Earth).

Snow bunting has not been assessed by COSEWIC, but is considered Sensitive in Nunavut due to a declining trend nationally, with little data available by which to assess the Nunavut population status specifically (GNDoE 2005).

Distribution

Snow bunting breeds across northern North America, Greenland, Iceland, and northern Eurasia. Its Nunavut range covers the entire territory except for areas below the treeline (GNDoE 2005). North American snow buntings winter from northwestern and southern Canada south as far as the central United States.

Ecology

Snow buntings nest primarily on tundra and other bare ground, seeking out cracks or cavities in rocks (Lyon and Montgomerie 1995). In winter, snow buntings flock in winter, frequenting various open habitats in northern temperate areas, typically sandy coasts, steppes, prairies, low mountains, or agricultural stubble (Lyon and Montgomerie 1995).

Issues/Concerns

Global warming in the breeding areas of this species causes earlier thawing of the tundra and allows more woody plants to grow, reducing the area's suitability for snow buntings, while making it more attractive for avian and mammalian predators (National Audubon Society (NAS) 2008c).

Land Use Planning Considerations

Snow buntings and their nests are protected on their breeding grounds under the federally regulated *Migratory Birds Convention Act*.

4.9.5 Rusty Blackbird

Inuit Name: Unknown
Scientific Name: *Euphagus carolinus*

Conservation Status

In the Inuit tree of life, rusty blackbird is classified among the uumajuit (the living), tingmiat (those that fly), and nunatuqtiit (eaters of the products of the Earth).

Rusty blackbird was recently assessed by COSEWIC for the first time and assigned a status of Special Concern, but has not yet been designated under SARA. The Canadian population, representing 70% of the global population, is estimated at 1.4 million individuals or fewer, having declined at an average annual rate of 10.3% between 1968 and 2002 (COSEWIC 2006a). Rusty blackbird is considered Sensitive in Nunavut on the basis of the COSEWIC ranking and limited data on breeding numbers and distribution (GNDoE 2005).

Distribution

The breeding range of rusty blackbird corresponds closely to the boreal forest and taiga terrestrial ecozones (Avery 1995; Sinclair *et al.* 2003; COSEWIC 2006a). Rusty blackbird breeds across much of northern North America with its northern range ending at the tree line of wet forests in southwest Kivalliq and the Bay Islands, representing approximately 1% of Nunavut. It winters in mixed flocks in woodlands and open areas across the central and eastern United States, although a few individuals winter irregularly in southern Canada (Avery 1995).

Ecology

Rusty blackbirds nest in the boreal forest as isolated pairs in trees or other riparian vegetation along the shores of slow-moving streams, peat bogs, marshes, swamps, or beaver ponds (SARA Public Registry 2008c). Rusty blackbirds rarely enter the forest interior, and therefore may benefit from disturbance caused by fires or beavers (COSEWIC 2006a; National Audubon Society (NAS) 2008c).

Issues/Concerns

Canada's boreal forest accounts for over 70% of the breeding range of rusty blackbird, though only a small fraction of this is within Nunavut. The severe decline observed over recent decades appears to have slowed somewhat, but there is no evidence to suggest it will be reversed naturally. Known threats occur primarily on the winter range, and include habitat conversion and blackbird control programs in the United States (COSEWIC 2006a). In Canada, the conversion of wetlands into farmland or land suitable for human habitation is the primary cause of habitat loss (SARA Public Registry 2008c). However, any land use that degrades wetlands, such as flooding for hydroelectric reservoirs and drainage and pumping associated with oil and gas extraction, may negatively affect rusty blackbirds. Additionally, rising temperatures caused by climate change could affect northern wetlands by melting permafrost and drying peatlands (COSEWIC 2006a).

Land Use Planning Considerations

In Canada, the rusty blackbird is not protected under the *Migratory Birds Convention Act* and is under the jurisdiction of the GN and the NWMB.

4.10 Gamebirds

4.10.1 Willow Ptarmigan/Rock Ptarmigan

Inuit Name: Aqiggivik/Aqiggiq atajulik
Scientific Name: *Lagopus lagopus/Lagopus muta*

Conservation Status

In the Inuit tree of life, ptarmigan are classified among the uumajuit (the living), tingmiat (those that fly), and nunatuqtiit (eaters of the earth).

Neither willow nor rock ptarmigan have been assigned a conservation status by COSEWIC, and both are considered Secure in Nunavut, with populations of over 10,000 individuals each (GNDoE 2005). However, while the willow ptarmigan population is believed to be stable, a rapid and significant decline of 86% was observed for the rock ptarmigan near the centre of its range around Hope Bay, between 1987 and 1996.

Distribution

Rock ptarmigan and willow ptarmigan are found in all countries ringing the North Pole. Many ptarmigan are resident throughout the year, but far northern populations migrate south to some extent in winter. Rock ptarmigan, particularly those from northern Ellesmere Island, can migrate up to 800 km (Canadian Wildlife Service (CWS) 1994). Rock ptarmigan are found throughout 99% of Nunavut, absent only from the forested part of southwest Kivalliq (GNDoE 2005). Willow ptarmigan have a more limited distribution, occupying 68% of Nunavut, primarily south of 70°N (GNDoE 2005). However, willow ptarmigan has recently been extending its range northward into parts of the Arctic formerly inhabited only by rock ptarmigan.

Ecology

In North America, ptarmigan live in almost all vegetated arctic and alpine habitats (Canadian Wildlife Service (CWS) 1994). In the summer, willow ptarmigan inhabit treeline areas, arctic valleys, and coastal tundra where vegetation is relatively lush and tall. They favour moist areas, such as pond edges, streamside thickets, and marshy tundra, which they sometimes share with waterfowl and shorebirds (Hannon *et al.* 1998).

Rock ptarmigan live at higher elevations and latitudes, in areas where it is dry and with sparse, very low vegetation (Montgomerie and Holder 2008). In the southern and western parts of their North American range, they also frequent low-shrub vegetation, more typically occupied by willow ptarmigan. In late fall, ptarmigan seek more protected areas, moving down slopes or southward into the taller vegetation of dense shrubs and forested areas. Willow ptarmigan may move well into the treed zone (Hannon *et al.* 1998).

Issues/Concerns

Threats to ptarmigan stem from both hunting mortality and habitat loss. In North America, ptarmigans live in areas rarely visited by humans, but that is changing rapidly. Despite the relative remoteness of ptarmigan ranges, poor land-use practices have already degraded or destroyed some of their habitat. Tundra fires set by people have increased, particularly near the treeline, temporarily reducing the amount and variety of available food, but also stimulating the growth of palatable shrubs used by ptarmigans in winter. Although oil exploration activities seem to have little negative effect on ptarmigan, any land use that leads to progressive erosion, destruction of vegetation, pollution of soil, water, and air, or melting of permafrost can endanger ptarmigan. Global warming and long-range movement of pollutants may also affect ptarmigan and their habitat (Canadian Wildlife Service (CWS) 1994).

Land Use Planning Considerations

Ptarmigan and their nests are protected on their breeding grounds under the federally regulated *Migratory Birds Convention Act*. Ptarmigan are hunted throughout their range.

4.11 Caribou: General Information

Inuit Name: Tuktu (caribou), nogat, nurraq (caribou calf), pagniq (caribou bull), kulavak (caribou cow)
Scientific name: *Rangifer tarandus* subspecies *groenlandicus*, *pearyi, groenlandicus x pearyi*

Introduction

The ranges of over twenty caribou herds or populations occur within the boundaries of Nunavut (Government of Nunavut 2007). The subspecies of caribou (*Rangifer tarandus*) that occur in Nunavut include barren-ground caribou (*R. t. groenlandicus*) and Peary caribou (*R. t. pearyi*). Caribou occurring on Arctic Islands other than Baffin Island and the islands in Foxe Basin and Hudson Bay are sometimes referred to as Arctic-Island caribou (Miller 2003a) or as Peary-type caribou (McFarlane *et al.* 2009). Considered Arctic-Island caribou, the Dolphin-Union population can also be considered a separate sub-species (*R. t. groenlandicus x pearyi*) [e.g., (Poole *et al.* 2010)]. These subspecies differ in appearance, distribution and movement patterns (Miller 2003a). For the purposes of this report, all caribou herds and populations will be divided into the following four groups based on distribution, ecology or taxonomy: mainland populations (barren-ground), island populations (barren-ground) (Coats, Southampton and Baffin Islands), Peary and Arctic-Island populations (Arctic Islands), and the Dolphin-Union population. Groups will be assessed on a landscape scale and, where information allows, on a herd by herd basis.

Conservation Status

In Nunavut, barren-ground caribou are considered Secure by COSEWIC and are not listed under SARA. COSEWIC lists Peary caribou as Endangered and Dolphin-Union caribou as Special Concern (COSEWIC 2004c).

Distribution

Nunavut includes the ranges (either in whole or in part) of several caribou herds/populations. The ranges of eight barren-ground herds/populations occur on the mainland (Bluenose West, Bluenose East, Ahiak, Bathurst, Beverly, Qamanirjuaq, Lorillard and Wager Bay) while five herds/populations occur on the islands (Coats Island, Southampton Island, North Baffin, South Baffin and Central Baffin). Barren-ground caribou also occur in the Northwest Territories, and northern Manitoba and Saskatchewan. In addition to the barren-ground caribou, there are several caribou populations on the Arctic Islands (including the Dolphin-Union population) and high arctic islands (Peary caribou), The ranges of many of these herds/populations overlap which can make the delineation of discrete herds difficult (Government of Nunavut 2007). Spatial data on the distribution of caribou in Nunavut is not available at this time for inclusion in this report, therefore a figure summarizing caribou distribution is not provided.

Ecology

Some of the largest caribou herds in the world occur in Nunavut (Table 4.11-1); approximately 1.8 million barren-ground caribou occur in Nunavut and the Northwest Territories (Miller 2003a). The barren-ground Qamanirjuaq population is the largest, most recently estimated at 348,661 caribou (Table 4.11-1) (Campbell *et al.* 2010). However, most of these populations, possibly with the exception of Bluenose East (Government of Northwest Territories 2010), are in decline.

All caribou populations in Nunavut make migrations or seasonal movements, governed in part by seasonal changes such as food availability, weather, and insect avoidance (Miller 2003a), but the scale can vary greatly. Also, depending on the population, not all individuals may display the same movement rates, as in Peary caribou (COSEWIC 2004c). Migratory barren-ground caribou can sometimes travel great distances between wintering and calving grounds (800 to 5,055 km) (Fancy *et al.* 1988; Ferguson and Messier 2000). Arctic-Island caribou also migrate seasonally, but on a much smaller scale (300 to 500 km) (Gunn and Fournier 2000; Poole *et al.* 2010). Peary caribou display seasonal movements among the Arctic Islands, occasionally travelling up to 200 to 500 km (Miller *et al.* 1977b in Miller 2003). Both Peary and Arctic-Island caribou make use of the sea ice to move between islands (Miller *et al.* 2005; Poole *et al.* 2010).

Table 4.11-1: Population Status and Estimates for Caribou Populations in Nunavut

Herd/Population	Subspecies	Jurisdiction	Population size (year of estimate)	Status
Bluenose West	*R. t. groenlandicus*	Shared – NU, NT	17,897 ± 1,310 (2009) [1]	Declining[2]
Bluenose East	*R. t. groenlandicus*	Shared – NU, NT	98,600 ± 7,100 (2010) [3]	Increasing[3]
Bathurst	*R. t. groenlandicus*	Shared – NU, NT	31,900 ± 11,000 (2009) [4]	Declining[2]
Ahiak	*R. t. groenlandicus*	Shared – NU, NT, SK	200,000 (1996)[5]	Declining[2]
Beverly	*R. t. groenlandicus*	Shared – NU, NT, SK, MB, AB	27,600 ± 106,000 (1994)[6]	Declining[7a]
Qamanirjuaq	*R. t. groenlandicus*	Shared – NU, NT, SK, MB	348,661 ± 44,861 (2008)[8]	Declining[8]

Herd/Population	Subspecies	Jurisdiction	Population size (year of estimate)	Status
Lorillard	*R. t. groenlandicus*	NU	1,400 ± 390 (1977)[9b]	
Wager Bay	*R. t. groenlandicus*	NU	2,900 ± 500 (1977)[9b]	
Coats Island	*R. t. groenlandicus*	NU	2663 (1986)[10c]	
Southampton Island	*R. t. groenlandicus*	NU	13,956 (2009)[11e]	Declining[11]
North Baffin	*R. t. groenlandicus*	NU	50,000-150,000 (1991) [11e]	Declining[11]
South Baffin	*R. t. groenlandicus*	NU	60,000-180,000 (1991)[11e]	Declining[11]
Central Baffin	*R. t. groenlandicus*	NU	>10,000 (1991) [11e]	Declining[11]
Dolphin-Union	*R.t. groenlandicus x pearyi*	Shared – NU, NT	21,753 ± 2,343 to 27,739 ± 2520 (2007)[12]	Stable or Declining[12]
Peary	*R. t. pearyi*	NU	7,890 (2001)[13]	Declining[13]

NOTES:

[a] The last population estimate for the Beverly herd was in 1994. Calving ground surveys located 93 caribou in 2009, compared to 189 in 2007 and 5,737 in 1994. This indicates a decline since the last census (Miltenberger 2010).

[b] Surveys of the calving grounds estimated 12,156 ± 3,697 caribou on the Lorillard calving grounds in 2003, and 28,129 ± 5,962 caribou on the Wager Bay calving grounds in 2004 (Campbell 2005).

[c] Compiled from Table 4 in Gates *et al.* (1986)

[d] 'Statutory report on wildlife to the Nunavut Legislative Assembly, Section 176 of the Wildlife Act' states that the 1980 estimate of 1672 ± 224 (Gates *et al.* 1986) "is the only accessible published figure on the status of the Coats Island Population." (Wildlife Research Section 2007b)

[e] Surveys of the entire Baffin Island are planned for 2011 (GNDoE 2009).

[1] PCMB 2010
[2] Nesbitt and Adamczewski 2009
[3] GNT-DENR 2010
[4] GNT-DENR 2009
[5] GNT-DENR 2006
[6] Williams 1995
[7] Miltenberger 2010
[8] Campbell *et al.* 2010
[9] Donaldson 1981
[10] Gates *et al.* 1986
[11] GNDoE 2009
[12] Poole *et al.* 2010
[13] COSEWIC 2004c

Although there are several species and sub-species of caribou, there are some commonalities among caribou in Northern Canada. Terrestrial and arboreal lichens are the primary winter forage item for caribou (Thomas and Hervieux 1986; Klein 1990; Russell *et al.* 1993; Miller and Gunn 2003b) although in areas where lichens may be scarce, such as the Arctic Islands, they may be of lesser importance (Thomas *et al.* 1999 in Miller 2003). In addition to lichens, summer diet also includes new growth vegetation such as evergreen and deciduous shrubs, graminoids and forbs (Klein 1990; Russell *et al.* 1993; Johnstone *et al.* 2002).

Economic and Cultural Importance

Caribou are deeply engrained in the cultures of many Northern Aboriginal people. The caribou harvest has a great social, cultural and economical value in Nunavut. The annual net value of the 2005 to 2006 harvest of the Beverly and Qamanirjuaq caribou populations was estimated at $19.9 million (InterGroup Consultants Ltd. 2008). This figure includes the domestic harvest ($14.7 million), harvest by outfitters and their clients ($4.1 million), and the commercial and licensed harvests ($1.0 million each) (InterGroup Consultants Ltd. 2008). Of the net total, Nunavut accounts for 59% or $11.8 million of the Beverly and Qamanirjuaq harvest (InterGroup Consultants Ltd. 2008). The cultural importance of caribou to the residents of Nunavut is much harder to quantify. Caribou are an integral part of the identity of northern Aboriginal cultures and have been traditionally relied on not only for food, but also for supplies such as clothing, rope, shelter, arts, and crafts. The persistence of caribou and the caribou harvest is essential for maintaining traditional skills, knowledge and ways of life, and learning about cultural norms (principles/laws) (InterGroup Consultants Ltd. 2008).

Issues/Concerns

There are several factors that can limit caribou populations including predation, severe weather, insect harassment, disease, hunting mortality, food limitation and habitat disturbance, destruction or fragmentation (Klein 1991; Seip 1991; Smith *et al.* 2000; Dyer *et al.* 2001; Oberg 2001). Due to their low reproductive potential, caribou are susceptible to and recover slowly from population declines. Both natural and anthropogenic disturbances can have direct and indirect effects on caribou populations. Caribou have been shown to avoid cut-overs (Vors *et al.* 2007) and infrastructure (Vistnes and Nellemann 2008), and caribou in close proximity to linear features or harvested forests may have a higher risk of predation (Seip and Cichowski 1996; James and Stuart-Smith 2000). Resource development on sensitive caribou range may result in increased harvest pressure and extent facilitated by the access provided by road and trail construction (Bergerud *et al.* 1984; Cumming and Beange 1993; Dyer *et al.* 2002; Boulanger *et al.* 2004) thereby prolonging the depth and duration of declines even further.

Wolves are considered one of the major predators of caribou (Bergerud 1988; Bergerud and Elliot 1996), both of adults and calves (Miller 2003a). In the arctic, wolves rely almost exclusively on caribou (Kuyt 1972). Caribou have evolved predator-avoidance behaviours to reduce their risk of predation such as using open areas for resting, or calving in areas with fewer predators (Miller 2003a). Wolves will usually not follow migratory caribou but have been shown to do so in years where alternate prey species (e.g. moose) are scarce (Ballard *et al.* 1997). Other predators of caribou include the grizzly bear (*Ursus arctos*), black bear (*Ursus americanus*), wolverine (*Gulo gulo*), lynx (*Lynx Canadensis*), coyote (*Canis latrans*) and golden eagle (*Aquila chrysaetos*) (Miller 2003a).

Caribou will likely be negatively affected by climate change in the arctic. Climate change is predicted to cause warmer, wetter winters, warmer summers with earlier spring melt, increases in extreme weather events and thawing of the perma-frost (Anisimov *et al.* 2001; Christensen *et al.* 2007). These changes may result in earlier spring plant growth, northerly shifts in the ranges of plant communities, and increases in insect and parasite density and range, all of which may have negative impacts on caribou populations (Vors and Boyce 2008). There is the potential for trophic mismatch between the availability of preferred forage on the calving grounds and caribou arrival at their calving sites (Post and Forchammer 2008). Warmer, wetter winters may result in reduced calf weights (Weladji and Holand 2003), which could in turn affect vital rates of the population through higher calf mortality and reduced calf growth (Reimers 1997). As temperatures warm, the composition of plant communities could change producing vegetation that is less favourable for caribou forage (Lenart *et* *al.* 2002). There is already evidence that severe weather events such as icing can have devastating effects for caribou populations on the High Arctic Islands (Gates *et al.* 1986; Gunn and Dragon 2002a; Miller 2003a); an increase in icing events across the Arctic through increased winter rainfall could precipitate future mass die-offs. Finally, parasite and insect populations may increase due to increased temperatures and moisture. Increased insect harassment could lead to less time feeding and more time engaged in avoidance activities (Toupin *et al.* 1996; Moerschel and Klein 1997; Weladji *et al.* 2003). Increased temperatures in the Arctic are already leading to faster development and increased larval survival in nematodes (Kutz *et al.* 2005).

The following discussion outlines the “state of knowledge” for each population within Nunavut. Because caribou pose a unique situation in respect to Land Use planning issues, they will be dealt with for all caribou groups at the end of the section.

4.11.1 Mainland Caribou Population

Inuit Name: Tuktu
Scientific Name: *Rangifer tarandus groenlandicus*

Conservation Status

Mainland barren-ground caribou have a rank of Secure in Nunavut by the National General Species Status in Canada Working Group (CESCC 2006) although most of Nunavut’s mainland populations are declining.

Distribution

The mainland caribou population in Nunavut consists of the barren-ground caribou species. Barren-ground caribou are found mainly in Nunavut and the Northwest Territories. About half of all caribou in Canada are barren-ground caribou. They spend much of the year on tundra ranging from Alaska to Baffin Island. Most of the barren-ground caribou populations are considered migratory, moving seasonally between the tundra and the taiga.

The range of the Beverly population occurs in Nunavut, the Northwest Territories, northeastern Alberta, northern Saskatchewan, and northwestern Manitoba while the range of the Qamanirjuaq population occurs in Nunavut, southeastern Northwest Territories, northern Manitoba and northeastern Saskatchewan.

The Lorillard and Wager Bay populations occur in eastern Nunavut. Generally, the Lorillard population range occurs between Baker Lake, Wager Bay and Chesterfield Inlet while the Wager Bay population range extends from the base of Melville Peninsula to Chesterfield Inlet, and inland west of Brown Lake to Hayes River. The Wager Bay population also has some areas of use near Ellice River and Shepherd Bay (Journey of the Caribou). The ranges of the Lorillard and Wager Bay populations overlap.

The range of the Ahiak population occurs in Nunavut, eastern Northwest Territories, and northeastern Saskatchewan. The Ahiak population range can overlap with the Bathurst population range during calving and winter and with the Beverly population range in winter. The Bathurst population ranges from Bathurst Inlet in the north to Great Slave Lake in Northwest Territories in the southwest and Lake Athabasca in Saskatchewan in the southeast.

The ranges of the Bluenose West and Bluenose East population are in close proximity to each other and overlap at certain times of year. Prior to 1996 these populations were considered together as the Bluenose caribou herd and included the Cape Bathurst herd, which resides in NWT (Nagy *et al.* 2005).

Ecology

The size of the barren-ground populations on mainland Nunavut varies greatly although most populations are in decline (Table 4.11-1). The last survey conducted for the Beverly herd was in 1994 though recent reconnaissance surveys (2007 to 2009) indicate a severe decline. The Qamanirjuaq herd was last estimated in June 2008 and results indicate a significant decline (Campbell *et al.* 2010). The Beverly and Qaminirjuaq populations use different summer and calving grounds, but share winter range (Russell *et al.* 2002) south of the tree line. The traditional calving area for the Beverly population ranges from the Back River in the north, to Dubawnt Lake in the south east and the Thelon River in the southwest (BQCMB 1999). The traditional Qaminirjuaq calving area is between Baker Lake to the north and the Henik Lakes to the south (BQCMB 1999). The combined winter range occurs to the south and overlaps with Nunavut, the Northwest Territories, Alberta, Saskatchewan and Manitoba (BQCMB 1999). A collaring program has been on-going on the Qamanirjuaq caribou since 1993 and spatial analysis of these data has been completed for seven seasonal periods. Several collars were placed on Beverly caribou in 2006 however the data has not been compiled to determine distribution. The results of the collaring program have been recently published (Nagy *et al.* 2011). The key finding of the research was that the populations of caribou likely change calving grounds, contrary to previous understanding (i.e., high site fidelity to calving areas).

Caribou populations of the northeastern mainland (Lorillar and Wager Bay populations) declined significantly from 119,800 ± 13,900 animals in 1983 to 73,994 ± 11,670 caribou in 1995 (Campbell 2005). In 2003, 12,156 ± 3,697 adult caribou were estimated on the Lorillard population calving grounds while a 2004 survey of Wager Bay population calving area estimated 28,129 ± 5,962 adult caribou (Campbell 2005). Calving grounds are relatively diffuse for the Wager population with no strong evidence of annual calving areas. Calving areas were identified at the north shore of Wager Bay near the vicinity of the Piksimanik River, the south shore of Repulse Bay near Panalik and Beach points, and the north and south shores of Lyon Inlet west to Norman Inlet during calving ground surveys in 2000 and 2002 (Campbell 2005). Lorillard caribou tend to show aggregations in the northern and one in the southeastern corner of the range as well as north of Wager Bay. This herd has calving areas at the headwaters of the Lorillard River just south of Wager Bay and another near the confluence of the Lorillard River with Hudson Bay (Calef and Helmer 1981; Donaldson 1981; Heard et al. 1986, 1987; Ferguson and Vincent 1992; Campbell 2005). Both the Lorillard and Wager caribou are not consistent in their movements. Collared cows have moved north and west of Baker Lake sharing the same general areas during winter. Calving in 2004 saw a continued movement of three Wager cows onto Boothia Peninsula while Lorillard cows remained within previously documented calving areas. Movements are thought to be strongly related to environmental conditions such as snow conditions or could be related to the short growing season (Calef and Helmer 1981; Donaldson 1981; Heard *et al*. 1986, 1987; Ferguson and Vincent 1992; Campbell 2005).

The Ahiak population was last estimated at approximately 200,000 caribou in 1996 (GNDoE 2006). The calving grounds of the Ahiak population occur along the Queen Maud Gulf (based on 1986 and 1996 surveys) overlapping with the eastern edge of the Bathurst populations calving grounds (Gunn *et al.* 2000). However in 2002 the calving ranges were separate with the Ahiak population calving between the east side of Bathurst Inlet and Queen Maud Gulf (Gunn and D'Hont 2002). The Ahiak population has wintered on the tundra in the Northwest Territories and Nunavut, however may be shifting the winter range to the tundra-taiga transition zone (south of the tundra) and has wintered as far south as Rennie Lake in the Northwest Territories (Gunn *et al.* 2000) that falls within the winter ranges for the Beverly and Bathurst populations (Gunn and D'Hont 2002).

The Bathurst population was estimated at 31,900 ± 11,000 in 2009 (GNT-DENR 2009) and is currently declining (Nesbitt and Adamczewski 2009). Calving grounds have shifted and now occur west of Bathurst Inlet; calving grounds occurred east of Bathurst Inlet in the 1960s to 1980s (Russell *et al.* 2002). Winter grounds extend to the southern limits of the overall range (Boulanger *et al.* 2004).

The most recent estimates for the Bluenose West and Bluenose East populations are 17,897 ± 1,310 (2009) and 98,600 ± 7,100, respectively (Nesbitt and Adamczewski 2009; Porcupine Caribou Management Board (PCMB) 2010). Although the Bluenose West population is declining (Nesbitt and Adamczewski 2009), the Bluenose East appears to be increasing (GNT-DENR 2010). The Bluenose West population calves southeast of the community of Paulatuk, NT and partially within Tuktut Nogait National Park but has several winter areas ranging northwest from Great Bear Lake to just south of Tuktoyaktuk (Russell *et al.* 2002; Nagy *et al.* 2005). The Bluenose East population calves west of the community of Kugluktuk, NU and winters around Great Bear Lake (Nagy *et al.* 2005).

The main fall and winter food source of mainland barren-ground caribou is lichen, both fruticose and foliose (Thomas and Hervieux 1986; Miller 2003a). Caribou feed on sedges and other grasses along with twigs, such as *Vaccinium spp*. (Miller 2003a). Caribou have also been observed to eat antlers, seaweed and will lick salt deposits. As caribou crater in snow to expose terrestrial lichens, snow depth and hardness affect feeding site selection (Pruit 1959). In Alaska, caribou continued to crater until snow hardness reached 6500 to 9000 g/cm^2 and maximum depth in the tundra may be 75 cm (Miller 2003b).

Issues/Concerns

Many limiting factors have been suggested for caribou populations including predation, hunting, forage availability, disease and parasites, insect harassment, extreme weather events and interspecific competition (Klein 1991). Factors that may be particularly important in barren-ground caribou population declines are habitat loss (through displacement and/or habitat alteration), degradation and fragmentation, increased hunting through increased access to sensitive ranges, and predation. Caribou are particularly susceptible to population declines and tend to recover slowly because of their low rate of reproduction.

Wolves are the major predator of barren-ground caribou. Some wolf packs will follow migrating herds of caribou from summer to winter range and back. Other predators of caribou include grizzly and black bears, wolverines, lynx, and golden eagles.

Partly as a result of habitat changes caused by humans, white-tailed deer have expanded into caribou areas from Alberta to Quebec, transmitting meningeal brain worm, which is fatal to caribou, although it does not harm the deer. Other insects such as warble flies, mosquitoes, and black flies also transmit disease to caribou (Gunn *et al*. 1991a) while internal parasites affect their health and condition.

Habitat loss, which is permanent, occurs when forest and/or tundra is cleared for development while habitat degradation refers to a reduction in the amount or quality of habitat, such as following events like wildfires or through human disturbance. Habitat fragmentation is the division of habitat areas by linear features such as roads, pipelines and geophysical exploration lines, and by oil and gas well sites and other developments.

Climate change is a concern for all northern caribou including the mainland barren-ground populations. Possible effects of climate change are discussed in greater detail in the introductory section.

As the ranges of many of these populations (Beverly, Qamanirjuaq, Bluenose West, Bluenose East and Ahiak) overlap with jurisdictions other than Nunavut (e.g., Northwest Territories, Alberta, Saskatchewan and Manitoba), issues and concerns that occur in any of these jurisdictions should be considered when assessing the threat to these populations.

4.11.2 Island Caribou Populations

Inuit Name: Tuktu
Scientific Name: *Rangifer tarandus groenlandicus*

Conservation Status

The Nunavut island caribou populations consist of the barren-ground caribou species. All barren-ground caribou populations have a General Status Ranking of Secure in Nunavut by the National General Species Status in Canada Working Group (CESCC 2006). The status of Nunavut's island populations of barren-ground caribou are declining or uncertain.

Distribution

Within Nunavut, there are number of southern islands in the Canadian Arctic Archipelago occupied by barren-ground caribou (Baffin, Southampton and Coates Islands). The important characteristic that distinguishes Island Caribou populations apart from barren-ground populations in Nunavut is that they do not, or cannot, migrate south. Secondly, these caribou are defined by their rutting and wintering areas, not by their calving areas. Calving is dispersed with some caribou calving on or near their wintering areas. Both Southampton and Coats Islands are predator free.

Of the three islands considered in this section, Baffin Island is the largest. There are three groups or populations of caribou on Baffin Island: North Baffin, South Baffin and Central Baffin (sometimes called Northeast Baffin). The Central Baffin population occupies the area on the northeastern coast from the community of Pond Inlet to the eastern tip of the peninsula north of Cumberland Sound, extending inland to the mid-line of the island. The North Baffin population occupies the area west from Pond Inlet to Ikpik Bay, while the South Baffin population occurs from Ikpik Bay to the mid-line of the peninsula north of Cumberland Sound (Ferguson 1997). On Southampton Island, the areas of highest caribou use are the center of the island north of Coral Harbour, the coast near Cape Low and Bell Peninsula, and in some years, portions of the coast of the peninsula north of the Bay of Gods of Mercy and across from Roes Welcome Sound (Heard and Ouellet 1994). The caribou on Coats Island tend to be solitary, especially during winter with maximum aggregations occurring during the rut (Adamczewski and Hudson 1993).

Ecology

Population estimates from the late 1980s indicated 50,000 to 150,000 caribou in the North Baffin population, 60,000 to 180,000 caribou in the South Baffin population and greater than 10,000 caribou in the Central population (Ferguson and Gauthier 1992 in Ferguson 1997). Research on the South Baffin population indicate that it is composed of "subpopulations", each demonstrating fidelity to separate portions of the range over the short term (10 to 30 years); over longer time periods (70 to 90 years) the subpopulations seem to interact (Ferguson *et al*. 2001a). Inuit traditional knowledge suggests that the South Baffin population cycles, each cycle occurring within the life of an elder (Ferguson and Messier 2000). An island-wide survey is proposed for 2011 (GNDoE 2009). The most recent population estimate for the Southampton population is 13,956 caribou (2009) which indicates a decline since 2007 (15,452 caribou) (GNDoE 2009). The indigenous caribou population was extirpated from Southampton Island by the mid-1950s and the current population was reestablished in 1967 by moving 48 caribou from nearby Coats Island (Ouellet *et al.* 1996b). The population increased steadily after reintroduction and reached 30,381 ± 3,982 in 1997 indicating a growth rate of 27% until the peak (Campbell 2006b) and a 55% decline since 1997. The most recent estimate for Coats Island is 2,663 caribou in 1983 (Gates *et al.* 1986). The Coats Island population has fluctuated considerably in the past; there have been several major die-offs such as in 1974 – 1975 where there was 71% mortality, and in 1979 – 1980 (Gates *et al.* 1986).

Caribou in the South Baffin population exhibit seasonal movements, with some individuals travelling up to 400 km to the calving areas while others remain near their wintering areas (Ferguson *et al.* 1998; Ferguson and Messier 2000).

On Southampton Island, winter grazing sites are most concentrated on windswept sites that are nearly snow-free (Ouellet *et al.* 1993). Surveys in 1991 and 1992 indicated overgrazing in some areas (Ouellet *et al.* 1993). Mosses were the most prevalent food item in rumen samples in 1998 and 2005, years when extreme weather may have made preferred forage sites inaccessible (Campbell 2006b). The estimated carrying capacity on Southampton Island (40,000 caribou), has been questioned by some as it was based on a range type that may not be used heavily by Southampton caribou (Ouellet *et al.* 1996a). Winter movements to the coast may be driven by deep snow conditions (Heard and Ouellet 1994). Caribou did not expand their range on Southampton between 1983 and 1991 and appeared to be using the same general areas in both winter and summer (Heard and Ouellet 1994). As seen in other Arctic island, lichens are not abundant on Coats Island (Gates *et* *al.* 1986). Therefore Coats Island caribou forage primarily on vascular plants which are scarce throughout their range (Gates *et al.* 1986).

Issues/Concerns

Issues facing Island barren-ground caribou are much the same as those facing all northern and Arctic caribou. Some of these concerns are discussed in greater detail in the introductory section. Increasing development and disturbance, greater access into caribou range, overhunting and changing climate may all threaten caribou populations in addition to disease and forage limitation.

The harvest rate on the South Baffin population was estimated at 6,000 to 8,000 caribou in the mid-1980s (GNDoE 2006). On Southampton Island an estimate of 38,750 caribou were harvested between 1997 and 2003 (Campbell 2006b). As these island populations are declining, current harvest levels may be unsustainable. No TAHs were determined for any of the Baffin, Coats or Southampton populations (GNDoE 2007).

A major concern for Southampton Island populations is brucellosis which is one of the factors causing the current population decline (Campbell *et al.* 2010). Over 80% of Southampton caribou sampled in 2007 carried brucellosis (GNDoE 2009).

Overgrazing has been identified on some parts of Southampton Island (Ouellet *et al.* 1993) but has not been observed on Coats Island (Adamczewski *et al.* 1988; Adamczewski and Hudson 1993). Perhaps more important is forage inaccessibility through snow conditions and icing events (Gates *et al.* 1986; Campbell 2006b); body condition values for caribou on Southampton Island were lowest following winters with serious icing events (Campbell 2006b).

4.11.3 Peary and Arctic-Island Caribou Populations

Inuit Name: Tuktu
Scientific Name: *Rangifer tarandus pearyi*

Conservation Status

COSEWIC currently lists Peary caribou as Endangered (COSEWIC 2004c). When first assessed in 1979, it was assigned the status of Threatened. It was reassessed in 1991 and listed as Endangered in 2004. Peary and Dplphin-Union caribou were recently reassed and have been added to Schedule 1 of SARA; Peary caribou were reclassified as Endangered and Dolphin-Union caribou were reclassified as Special Concern (Government of Canada 2011).

Distribution

The distribution of Peary caribou is restricted to the islands of the Canadian Arctic archipelago, more specifically Banks Island, northwest Victoria Island, Queen Elizabeth Islands, Prince of Wales Island, Somerset Island, the Boothia Peninsula and a number of smaller islands (COSEWIC 2004c). Although there are a number of smaller populations of Peary caribou, at least four geographically separate populations occur: 1) the Queen Elizabeth Islands; 2) Banks Island and northwestern Victoria Island; 3) Prince of Wales Island and Somerset Island; and, 4) the Boothia Peninsula (COSEWIC 2004c). Although not considered migratory, Peary caribou make seasonal movements both within and between their seasonal ranges (Miller 2003a). The understanding of Peary caribou populations on the Boothia Peninsula is somewhat complicated by the fact that there are also barren-ground caribou present on the peninsula (COSEWIC 2004c). Peary caribou on the lower Arctic Islands are genetically differentiated from Peary caribou found on the High Arctic Islands (Eger *et al*. 2009).

Ecology

Peary caribou are the smallest subspecies of caribou. The latest estimate for the total Peary caribou population is 7,890 (compiled from surveys completed between 1995 and 2001) (COSEWIC 2004c). The population is thought to have been greater than 30,000 at one time (COSEWIC 2004c). However, analysis indicates that the population has declined by approximately 72% over the last three generations (COSEWIC 2004c). There is limited information regarding the abundance of Peary Caribou (Jenkins 2008). Surveys of the Peary caribou population have been inconsistent and have only surveyed portions of the overall range at a time; hence there has not been a population wide survey completed in any year (COSEWIC 2004c). This has created difficulties in determining population trends over time. Population estimates since 1961 and estimated trends are presented in depth in the Status Report (COSEWIC 2004c).

Peary caribou are not considered migratory but have been documented to make seasonal movements around one island or among islands (Miller 2003b). There seems to be a great deal of variability among Peary caribou as some individuals travel long distances between seasonal ranges while others maintain small home ranges except during severe winters when they expand their ranges (COSEWIC 2004c). There also seem be to some individuals that make “long, irregular movements” beyond their normal travel routes (COSEWIC 2004c). Peary caribou tend to move near calving time (Miller 2003a). In the Queen Elizabeth Islands, some caribou move from Prince Patrick Island to Eglinton or Melville Islands for the summer season (Gunn and Dragon 2002a) while others in the complex of islands west of Bathurst Island continue to move a great deal among islands throughout the year (Miller 2002). While migrations in the Bathurst population have been up to 100 – 200 km (COSEWIC 2004c), a single caribou in the Melville Island population was reported to move 450 km during the spring migration (Miller *et al.* 1977). The Banks Island population moves to the northwest of the island to calve; there is also some evidence of a second calving area along the east coast (COSEWIC 2004c). On northwestern Victoria Island, the population travels in a north-south direction moving to the north of the island prior to calving season and south to the Minto Inlet area during winter (Gunn and Fournier 2000). Caribou movement on Prince of Wales and Somerset Islands seems to be east-west with calving areas on Prince of Wales Island and winter areas on Somerset Island (Gunn and Dragon 1998; Gunn 2005; Miller *et al.* 2005) while Peary caribou populations on the Boothia Peninsula calving on the northwest side of the peninsula, summering on the northwest side of the peninsula, southern Somerset Island or Prince of Wales Island, and wintering near Spence Bay (COSEWIC 2004c). Within the Prince of Wales Island, Somerset Island and Boothia Peninsula area some migrations have been up to 300 – 500 km (COSEWIC 2004c). Peary caribou cross either ice or open water to move between islands; ice crossing can be 30 to 84 km (Miller *et al.* 2005) and swims across open water can be 1.6 to 2.5 km (Miller 1995).

Peary caribou occur in areas of polar desert with little vegetation (Miller 2003a) and select for vegetated uplands (Wilkinson *et al.* 1976; Larter and Nagy 1997). They are versatile grazers, consuming many grass and forb species as well as woody plants such as willow (Shank *et al.* 1978). As lichens are very sparse in the Arctic Islands, lichen use is rare (Shank *et al.* 1978; Thomas *et al.* 1999 in Miller 2003). In both summer and winter, the diet of Peary caribou on Banks Island was predominantly willow (*Salix* spp.), forbs, grasses and sedges (Larter and Nagy 1997); milk-vetch (*Astragalus alpinus*) was also eaten (Wilkinson *et al.* 1976; Shank *et al.* 1978). Icing or hard-packed or heavy snow conditions can limit the amount of forage available to caribou (Tucker *et al.* 1991). If the availability of forage is restricted by snow or icing conditions the amount of poorly digestible forage consumed by Peary caribou increases (Gates *et al.* 1986), thereby leading to the selection of areas that are snow-free or have shallow snow (Gates *et al.* 1986).

Peary caribou pregnancy rates vary greatly and up 80% of adult females may produce calves in a given year (COSEWIC 2004c). Calving and pregnancy rates have been best studied on the western Queen Elizabeth Islands. In the 1970s pregnancy rates increased from 6 – 7% (1975 – 1976) to 88% (1997) on Melville and Prince Patrick Islands (Miller 2003b; COSEWIC 2004c) and from 73% (1975 – 1977) to 100% (1978) on Somerset and Prince of Wales Islands (COSEWIC 2004c). The proportion of calves in the Peary caribou populations on the western Queen Elizabeth Island varied from 27.8% in 1993 to 34.9% in 1998 (Miller and Gunn 2003c). On Banks Island, the proportion of calves in the total population varied from 3.2% in 1991 to 31.1% in 1992 (Nagy *et al.* 1996a), while the proportion on Bathurst Island was 19% (1981) (Ferguson 1987).

Issues/Concerns

Many issues and concerns have been identified for Peary caribou including severe weather events, development and anthropogenic disturbance, and climate change (COSEWIC 2004c). Access to winter forage may be the most important limiting factor for Peary caribou populations. Extreme die-offs in the western and south-central Queen Elizabeth Islands have been well documented. A decline of up to 98% over five years was recorded in the western Queen Elizabeth Islands population (Miller and Gunn 2003b) while losses from 33% (1994 – 1995) to 83% (1996 – 1997) were recorded in the south-central Queen Elizabeth Islands (Miller and Barry 2009). The cause of the die-offs was not the amount of forage on the landscape, but the amount available to the caribou (Miller and Gunn 2003b). Extreme icing conditions or deep or hard-packed snow limit the opportunity for Peary caribou to forage (Miller and Gunn 2003b). Other work has shown that caribou will stop cratering in favour of open areas when the snow depth or hardness becomes too great (Adamczewski *et al.* 1988; Tucker *et al.* 1991).

In areas where caribou and muskoxen occur on the same range, competition is minimal (Gunn and Adamczewski 2003). Although there is normally little competition for food (Parker and Ross 1976), there is an increase in the amount of overlap between caribou and muskox diets in areas of high muskox density, and winter conditions such as deep or hard snow may cause additional overlap (Larter and Nagy 1997; Gunn et al. 2006). Increasing muskox populations paired with an increase in extreme weather events, icing and snow depth and hardness could limit access to forage for caribou populations.

Although wolf predation has not been identified as a major threat to Peary caribou populations, it is a factor. Wolf populations may be supported by increasing muskox populations creating an opportunity for increased caribou predation as the alternative prey species (Seip 1991; Nagy *et al.* 1996a; Miller and Gunn 2003b). As Peary caribou are hunted in Nunavut, overharvest has the potential to be a concern as Peary caribou populations are already in serious decline (COSEWIC 2004d; Miller and Barry 2009). Total Allowable Harvest (TAH) levels for Peary caribou populations in Nunavut range from 0 (Somerset and Prince of Wales Island population, North Devon Island population and some populations in the Queen Elizabeth Islands) to 50 (Ellesmere/Axel Heiberg Island population); no TAH has been determined for the Boothia Peninsula population (GNDoE 2007). The large decline in caribou numbers on Banks Island in the 1980s and 1990s may have been caused, in part, by a combination of overharvest, competition with the increasing muskox population and wolf predation (Nagy *et al.* 1996b).

All caribou populations, including Peary caribou, are sensitive to disturbances caused by development. Some of these concerns were outlined in the introduction section. As access to forage is a limiting factor for Peary caribou, any avoidance behaviour that may further limit their access to forage in winter would be problematic, especially under extreme weather conditions. Additionally, increased shipping in waters used by Peary caribou could interfere with inter-island movements (COSEWIC 2004c).

Peary caribou will be vulnerable to many of the effects of climate change previously discussed. The Arctic is predicted to receive more snow, wetter snow, and an increase in extreme weather events (Anisimov *et al.* 2001; Christensen *et al.* 2007). As snow conditions and icing are already a concern for Peary caribou populations, increases in extreme winter weather events may limit access to forage even further causing mass die-offs (Miller and Gunn 2003b; Miller and Barry 2009). Of additional concern is that changes in temperature and moisture will alter plant communities thereby reducing the size of suitable winter ranges and forage accessibility in winter (Heggberget *et al.* 2002).

4.11.4 Dolphin-Union Caribou Population

Inuit Name: Tuktu
Scientific Name: *Rangifer tarandus groenlandicus*

Conservation Status

The Dolphin-Union caribou population was designated as Special Concern by COSEWIC in May 2004 due to concerns regarding hunting, development, and climate change (COSEWIC 2004c). The population is listed under SARA as a Schedule 1 species of Special Concern (Government of Canada 2011).

Distribution

The Dolphin-Union population spends much of the year on Victoria Island, occurring in both Nunavut and the Northwest Territories. Calving occurs on much of Victoria Island spanning areas from southern, central and eastern Victoria Island (Nishi 2000). Dolphin-Union caribou migrate south across sea ice to wintering grounds (COSEWIC 2004d; Poole *et al.* 2010).

Ecology

The taxonomy of the Dolphin-Union caribou population remains unclear. Recent genetic studies have demonstrated that although this population is *R. t. groenlandicus*, or barren-ground caribou, it is genetically distinct from the barren-ground populations on the mainland (Eger *et al.* 2009). Some have suggested Dolphin-Union caribou be classified as "*R.t. groenlandicus* (*groenlandicus* x *pearyi* below the subspecies)" (Miller *et al.* 2007). As caribou from the Dolphin-Union population share some characteristics with Peary caribou (e.g. antler velvet colour), there remains much debate over how this population should be classified (McFarlane *et al.* 2009).

The latest survey of the Dolphin-Union population (October 2007) estimated up to 27,739 caribou (± 2,520) (Poole *et al.* 2010), very similar to the previous estimate in 1997 (27,948 ± 3,367) (Nishi and Gunn 2004). The Dolphin-Union population was first estimated at 100,000 (Manning 1960). Results from infrequent surveys since 1980 indicate that the population has increased, however due to uncertainty surrounding one of the early estimates the rate of increase is unclear (COSEWIC 2004d). The current trend is unknown, but is thought to be stable or declining (Poole *et al.* 2010).

The Dolphin-Union population is considered migratory, although not at the scale of barren-ground caribou; annual movements can be 300 to 500 km (Gunn and Fournier 2000). Calving occurs from south-central Victoria Island (Gunn and Fournier 2000; Gunn 2005) and areas south of Prince Albert Sound (Gunn and Fournier 2000; Gunn 2005) to Collinson Peninsula (eastern Victoria Island) (Nishi 2000) and Storkerson Peninsula (northeast Victoria Island) (Nishi 2000). Aboriginal traditional knowledge suggests that the Dolphin-Union population have also used areas north of Prince Albert Sound for calving (Gunn 2005). Winter areas include southern and south-western Victoria Island and the mainland south of Coronation Gulf (Gunn and Fournier 2000). Many Dolphin-Union caribou migrate south from Victoria Island to the mainland during the fall often travelling 21 to 70 km across the sea ice (Poole *et al.* 2010).

The conditions on Victoria Island (e.g. weather, vegetation, snow conditions) are comparable to other Arctic Islands. Therefore the forage available to Dolphin-Union caribou is similar to that of Peary Caribou. Winter diet of Dolphin-Union caribou has been reported to include *Dryas,* willow and dry upland sedges *Carex* spp*.* (Gunn and Fournier 2000).

Issues/Concerns

The issues and concerns facing Dolphin-Union caribou are much the same as those facing Peary caribou. As the Dolphin-Union caribou range overlaps with muskoxen, certain conditions such as an increase in muskox populations paired with an increase in extreme weather events (icing and deeper, harder snow) could limit access to forage for Dolphin-Union caribou. Similar to wolf-moose-woodland caribou interactions further south, an increased muskox population on Victoria Island could support greater wolf numbers which could lead to increased predation of caribou (Gunn 2005). No TAH has been identified for the Dolphin-Union population (GNDoE 2007) although there is a 'high rate' of harvest (COSEWIC 2004d). Data collected between 1983 and 1989 (Gunn 2005) indicated that the harvest rate on the Dolphin-Union population was 2,000 to 3,000 caribou (COSEWIC 2004d). There is also increased hunting pressure on Dolphin-Union caribou as the mainland barren-ground caribou populations decline (M. Dumond, GNDoE, pers. comm.). In addition, Dolphin-Union caribou are sometimes hunted with barren-ground caribou during the commercial hunt. In 2004 it was estimated that fewer than 100 Dolphin-Union caribou were hunted during the commercial harvest (COSEWIC 2004d).

A particular concern identified for Dolphin-Union caribou is the risk caused by the population migrating south to the mainland across newly formed sea ice during the late fall (Nishi and Gunn 2004; Poole *et al.* 2010). The date of sea-ice formation is already 8 to 10 days later than in 1982 (Poole *et al.* 2010) and may become later still as Arctic temperatures increase. Nishi and Gunn (2004) found that a sizeable proportion of the herd concentrated along the southern coast of Victoria Island while waiting for ice conditions to allow migration to the mainland which could make them vulnerable to additional hunting or predation (Poole *et al.* 2010). The unstable ice conditions could pose a drowning risk to caribou that attempt to cross (Nishi and Gunn 2004; Poole *et al.* 2010). There may also be less immediate effects from a delay in late-fall migration such as reduction in forage availability on southern Victoria Island (Poole *et al.* 2010) or reduced fitness as caribou cannot reach suitable winter range (Nishi and Gunn 2004). An additional risk identified for Dolphin-Union caribou during migration is the effects of increased shipping in Coronation Gulf between Victoria Island and the mainland (COSEWIC 2004c). Caribou in Cambridge Bay were unable to cross sections of open water created by barges (Poole *et al.* 2010) indicating the importance of continuous sea-ice. Other disturbances threatening Dolphin-Union caribou include increased mineral exploration on the winter grounds (M. Dumond, GNDoE, pers. comm.).

4.11.5 Land Use Planning Considerations

Caribou pose a unique situation in respect to Land Use planning because they are highly mobile largely due to the relatively low productivity of northern ecosystems in terms of forage quantity and quality. Most mainland populations show use of multiple areas and more than one population may use the same area at different time periods. Caribou can show varied responses to disturbance, some mainland caribou herds occur in more than one jurisdiction, and most management strategies have based population estimates only on annual harvest statistics or population survey but have not determined the ecological reasons behind population changes. Although several studies have documented the potential impacts of disturbance on caribou, the long term population effects of disturbance or the potential for cumulative effects on caribou are not fully understood. What is understood is that any development increasing human access to seasonal caribou range that has not previously been accessible could increase harvest and harvest-related disturbance (Fischer and Keith 1974; Bergerud *et al.* 1984; Fuller 1990; Unsworth *et al.* 1993; Rempel *et al.* 1997; Gratson and Whitman 2000; Boulanger *et al.* 2004; Stankowich 2008).

Caribou have benefited indirectly from the establishment of special wildlife management areas, sanctuaries, preserves and parks. However, because of the lower status of wildlife management areas, sanctuaries and preserves and the ability for these designations to be rescinded (High Arctic Island Game Reserve was rescinded in 1966), caribou herds will likely be exposed to increased northern development. The Thelon Game Sanctuary, established in 1927, has offered minimal protection to the calving and post-calving ranges of the Beverly caribou herd; the mineral industry has lobbied to rescind the sanctuary or to change its boundaries so that exploration and development can occur. Caribou cannot be effectively protected by reserves except seasonally or locally because of the larger areas over which they range. However, protection of calving grounds, post-calving areas, winter ranges and migration routes by special land reserve status or land use regulations could be beneficial in giving maternal cows and calves added protection during these time periods.

Inuit concerns over increased uranium exploration in the 1970s prompted the Department of Indian Affairs and Northern Development (Government of Canada) in 1978 to implement Caribou Protection Measures within designated Caribou Protection Areas to protect the calving and post-calving caribou of the Beverly and Qamanirjuaq herds of barren-ground caribou. The Caribou Protection Measures essentially imposed space between land use activities and the caribou through a series of controls on where and when Land Use Permits were active. As well as Caribou Protection Areas, the Department of Indian and Northern Development (DIAND) recognizes three other designations for the distribution of calving. Traditional Calving Grounds and Critical Wildlife Areas have long been designated, while Extent of Calving (Russell *et al.* 2002) was recently added.

The Caribou Protection Measures impose seasonal controls on land use operations inside Caribou Protection Areas. These regions used to be determined annually based on areas used by caribou during calving and post-calving periods in the previous five years. As these regions are no longer determined annually, Caribou Protection Areas currently in use are based on outdated information (Duquette 1985; Mychasiw 1984; Bradley 1985; Liepins 1986; Ogilvie 1987; Chalmers 1989; Ogilvie 1989). Even when in place, the Measures were meant to minimize disturbance to caribou, not to provide habitat protection, and to minimize disturbance resulting only from exploration—not development. There is a need to update the Caribou Protection Areas to include habitat and incorporate the potential disturbances of development. This would offer greater protection to caribou not just on the calving grounds but during migration and on winter ranges as well.

The Caribou Protection Measures are attached to Land Use Permits only. However, prospecting permits, quarry permits or leases, mineral claims and surface land leases are also potential sources of human activity on calving and post-calving ranges. Mineral leases give rights to minerals and on their own do not have any associated land use or activity. The extent of what this means within the caribou calving and post-calving ranges in terms of people, camps and air and ground transport is seemingly unrecorded, although the same issues were raised in 1978. Recent research suggests that the cumulative effects of relatively small-scale disturbances should not be assumed to be harmless (Phillips and Alldredge 2000). Additionally, the findings of some of the original research on calving grounds associated with the development of the Caribou Protection Measures (Gunn *et al.* 1983) described that cows and calves were responsive to helicopter landings and people on the ground. Therefore expansion of the Caribou Protection Measures to include prospecting permits, quarry permits or leases, mineral claims and surface land leases is necessary.

Fire suppression on winter ranges could become necessary if the rates of wildfires increase and large areas are burned. Protection of winter ranges should therefore be considered as well as calving and post calving ranges.

Although protecting calving and wintering habitat is important, a stronger emphasis should be placed on the migration routes of caribou. Increased fragmentation of the landscape by roads and developments on the mainland and island crossing areas for Dolphin Union and Peary caribou could cause detrimental effects to populations. Known migratory routes and crossing areas for all caribou populations (and especially for the Dolphin Union and Peary caribou) should be confirmed and receive special land status if there is fidelity to those particular areas. The Beverly and Qaminjuriak Caribou Management Board recognized and has ranked (based on importance both culturally and ecologically) traditional water crossings used by both herds, yet no protection has been designated to these areas.

An important consideration for Land Use Planning for Island herds is disturbance during winter. The importance of human-caribou interactions should be considered at all times. Harassment from human-induced novel stimuli can range from energy expenditure to reduced reproduction or calf survival to declines in populations.

4.12 Muskox

Inuit Name: Umingmak, Oomingmak
Scientific Names: *Ovibos moschatus*

Conservation Status

Muskoxen in Nunavut are ranked as Secure by the National General Species Status in Canada Working Group (CESCC 2006). Unsustainable commercial harvest rates in the late 19th century contributed to widespread declines in muskox populations (Gunn and Forchhammer 2008). Subsequently, the Canadian Government implemented control measures on muskox hunting and trading (Urquhart 1981 *in* Jenkins *et al.* 2011). Muskox populations have increased since that time and Inuit in Northern Canada have been hunting muskox under a quota system since 1969 (Jenkins *et al.* 2011).

Distribution

The natural distribution of muskoxen is limited to tundra regions with some groups ranging below treeline (Appendix B, Figures 4.12-1 and 4.12-2). Muskoxen were once found throughout the Arctic, but were extirpated from much of their range except for remnant populations in Greenland and northern Canada.

In 1992 seventeen populations of muskoxen were identified in Canada with 14 occurring in Nunavut (Ferguson and Gauthier 1992), however the GNDoE currently recognizes 19 populations for hunting management purposes that occur in Nunavut based on distribution, traditional Aboriginal knowledge, movement patterns and boundaries to movement such as the ocean or mountains, topography or forage availability (GNDoE 2007). Muskoxen are present on the majority of islands in the Arctic Archipelago and on the mainland from the Mackenzie River in the west to the coast of Hudson Bay in the east (Gunn and Adamczewski 2003). Muskox populations occur in all three regions of Nunavut (Table 4.12-1): Qikiqtani (Bathurst Island, Cornwallis Island, Central Ellesmere Island, Southern Ellesmere Island, North Devon Island, South Devon Island, West Devon Island and Somerset

Island); Kitikmeot (Prince of Wales Island, King William Island, Victoria Island, Western Coppermine, Central Mainland, Queen Maud Gulf and Eastern Mainland); and Kivalliq (Northern Kivalliq, Southern Kivalliq and the Thelon Game Sanctuary). Muskox populations, however, have not established on Baffin Island or on associated islands in Hudson Bay (Gunn and Adamczewski 2003).

Table 4.12-1: Population Status and Estimates for Muskox Populations in Nunavut

Population[a]	Island Group[b]	Jurisdiction	Nunavut Region[c]	Population size (year of estimate)[d]	Status
Bathurst Island (MX/01)	Bathurst Island	NU	Qikiqtani	82 (2001)[1e]	Stable or Increasing[1]
Cornwallis Island (MX/02)	Bathurst Island	NU	Qikiqtani	22 (2002)[1e]	Stable[1]
	Axel Heiberg Island	NU	Qikiqtani	4,237 (3,371 – 5,325) (2007)[1]	Increasing[1]
	Ringnes Island	NU	Qikiqtani	21 (2007)[1e]	Unknown[1, f]
Central Ellesmere Island (MX/03)[g]	Northern Ellesmere Island[g]	NU	Qikiqtani	8,115 (6,632 – 9,930) (2006)[1]	Decreasing[1f]
Southern Ellesmere Island (MX/04)[g]	Southern Ellesmere Island[g]	NU	Qikiqtani	456 (312 – 670) (2005)[1]	May be increasing[1f]
North Devon Island (MX/05)[g]	Devon Island[g]	NU	Qikiqtani	513 (302 – 8,640) (2008)[1]	Decrease in northeast; Increase in east and southeast[1f]
South Devon Island (MX/06)[g]	Devon Island[g]	NU	Qikiqtani		
West Devon Island (MX/07)[g]	Devon Island[g]	NU	Qikiqtani		
Somerset Island (MX/08)	Prince of Wales/ Somerset Island	NU	Qikiqtani	1,910 (962 – 3,792) (2004)[1]	Stable[1] or Increasing[2]
Prince of Wales Island (MX/09)	Prince of Wales/ Somerset Island	NU	Kitikmeot	2,086 (1,582 – 2,746) (2004)[1]	Decreasing[1, 2]
Boothia Peninsula (MX/10)	—[h]	NU	Kitikmeot	1,100 (2006)[3]	Increasing[3]
King William Island (MX/11)	—	NU	Kitikmeot	317 (2002)[4]	Increasing[2, 4]
Victoria Island (MX/12)	—	Shared – NU, NT	Kitikmeot		
Western Coppermine (MX/13)	—	Shared – NU, NT	Kitikmeot	589 (± 121 S.E.) (2007)[5]	Stable[2]
Central Mainland (MX/14)	—	Shared – NU, NT	Kitikmeot	2,560 (± 604 S.E.) (2005)[6]	
Queen Maud Gulf (MX/15)	—	NU	Kitikmeot	2,200 (1996 and 2000)[4]	Decreasing[2, 4]
Eastern Mainland (MX/16)	—	NU	Kitikmeot	165 (2000)[4]	Re-colonizing[4]
Northern Kivalliq	—	NU	Kivalliq	843-2,011 (1999)[7d]	

Population[a]	Island Group[b]	Jurisdiction	Nunavut Region[c]	Population size (year of estimate)[d]	Status
(MX/17)					
Southern Kivalliq (MX/18)	—	Shared – NU, NT	Kivalliq	1,747-2,539 (1999)[7d]	Increasing[7i]
Thelon Game Sanctuary (MX/19)	—	Shared – NU, NT	Kivalliq		

NOTES:
The identification numbers given to muskox populations (e.g. MX/01) differ between "Recommendations on Total Allowable Harvest (TAH) Rates for the Terrestrial Wildlife Populations in Nunavut" (GNDoE 2007) and reports such as Dumond (2007b, c).
[a] "Population" defined in GNDoE (2007)
[b] "Island Groups" defined in Jenkins *et al.* (2011)
[c] Occurrence of population by region described in GNDoE (2007)
[d] Both study area boundaries and population name (e.g. Central Mainland) were used to determine population estimates. As population boundaries and study areas differed between studies, the population estimates given may not be entirely applicable to the population as described in GNDoE 2007.
[e] Minimum count
[f] Incomplete information to make determination of status (e.g., sample size too small to make population estimate, survey area very different than previous surveys).
[g] Note the delineations for Ellesmere Island populations differ between GNDoE (2007) and Jenkins *et al.*2011. The delineation and population estimates from Jenkins *et al.* (2011) are used in this table.
[h] "— " = not applicable
[i] – based on 1999 data

[1] Jenkins *et al.* 2011
[2] Dumond 2006
[3] Dumond 2007c
[4] GNDoE 2007
[5] Dumond 2007a
[6] Dumond 2007b
[7] Campbell 200

Ecology

The total muskoxen population in Nunavut is estimated at approximately 45,300 (Gunn and Forchhammer 2008). Although many muskox populations in Nunavut are considered stable or increasing (Table 4.12-1), few are demonstrating the density or distribution experienced historically (GNDoE 2007).

Within the Qikiqtani region, the most recent estimate of the overall muskox population on the High Arctic Islands is 17,500 (Jenkins *et al.* 2011). The island populations range from less than 100 muskoxen (e.g., Bathurst, Cornwallis and Ringnes Islands) to more than 8,000 muskoxen (e.g. Ellesmere Island). Currently, most populations are stable or increasing (Table 4.12-1). Although animals will migrate seasonally within the islands (Gunn and Adamczewski 2003), few seem to migrate between islands (Gunn and Adamczewski 2003; Jenkins *et al.* 2011).

Muskox populations have generally increased in the Kitikmeot Region over the last 30 years. Currently population sizes range from less than 200 muskoxen (e.g., Eastern Mainland) to more than 2,500 muskoxen (Central Mainland) (Table 4.12-1). Although some populations are increasing, others may be in decline. However, these declines may be due to actual declines in the populations or may be the result of changes in muskox distribution (Dumond 2007b, a).

There is little current information on muskox populations in the Kivalliq region. Due to changes in the management boundaries it is difficult to apply previous survey results to the currently recognized boundaries. In 1999, the muskox population in the Central Kivalliq region of was estimated at 4,022 to 5,854 (Campbell 2007).

Although there are some distinguishable genetic differences between Arctic Island and mainland muskoxen (Van Coeverden de Groot 2001), they are insufficient for subspecies designations (Gunn and Adamczewski 2003).

Although muskoxen may be described as migratory, the distances travelled between seasonal feeding areas are often small. One study from Banks Island reported over a two year period, the majority of collared cows remained within 80 km of their capture location (Gunn and Adamczewski 2003). Wintering areas tend to have shallow snow conditions either through amount of snow fall or wind conditions (e.g. areas of elevation) (Gunn and Adamczewski 2003). Although muskoxen will winter in areas of deep snow when the conditions are such that cratering is easy (Larter and Nagy 2001), the threshold for snow depth for muskox cratering is between 20 and 50 cm, depending on conditions (Thomas and Edmonds 1984). Summer range consists of river valleys, meadows or coastal planes rich in willows and sedges (Parker and Ross 1976; Larter and Nagy 1997).

Muskoxen herds consist primarily of cows, calves and young males. Older males may be harem-bulls, singles or in bachelor herds (Reynolds *et al.* 2002). The proportion of single bulls and bachelor herds are greatest in areas where herds are large (Gunn 1992). Herd size varies seasonally with larger herds forming during winter (12-30 muskoxen) than in summer (5 – 12 muskoxen) (Reynolds *et al.* 2002). The increase in herd size in winter may be a defence against predators (Heard 1992).

The reproductive strategy of muskoxen means that herd growth may be slow. Most females have their first calf at age three (Adamczewski *et al.* 1997) while males may not breed until 4 to 8 years (Gunn and Adamczewski 2003). Additionally, cows have single calves with twins occurring very rarely (Gunn and Adamczewski 2003).

Muskox diet consists mostly of sedges, grasses and deciduous shrubs, especially willow, in all seasons, varying only in relative amounts (Larter and Nagy 1997). Winter diet is dominated by graminoids and sedges (Larter and Nagy 1997). Summer diet includes large proportions of willow with graminoids and forbs (Gunn and Adamczewski 2003) although the use of willow may be a result of its availability (Larter and Nagy 1997).

Wolves are the main predator of muskoxen in Nunavut. Although both muskoxen and caribou are predated by wolves, muskoxen may be considered the alternate prey (Nagy *et al.* 1996a; Miller and Gunn 2003b). Muskox predation may increase when alternative prey species (i.e., caribou) are scarce (Gunn and Adamczewski 2003).

Ecological or Economic Importance

Muskoxen have great cultural and economic importance in Nunavut (Campbell 2006a). Inuit harvest muskoxen for their meat, hide, bone, horn and fat. Traditionally, muskoxen components have been used for bedding, blankets, shelter, clothing, food, tools (such as for eating), drinking and storage vessels, bow components and lamp oil, and for recreational games (Lent 1999). The undercoat of the muskox, known as qiviut, is similar to cashmere and vicũna and is harvested for the fibre market.

The quota system for muskoxen in Nunavut began in 1967 (Gunn and Adamczewski 2003). The community decides if commercial hunting will be allowed on the quota. Visitors pay upwards of $5000 for a guided muskox hunt by local hunters (2005 Nunavut Muskox Internet Site).

Issues/Concerns

There are many factors that could affect muskoxen populations, In addition to predation (discussed in a previous section), severe weather, disease, overharvest, interspecific competition and habitat disturbance, destruction or fragmentation may also affect muskoxen populations. Due to their low reproductive potential, muskoxen would be susceptible to, and recover slowly from, population declines.

Severe weather and icing events have been suggested as factors in extreme die-offs or rapid declines in certain muskox populations. Poor winter conditions can limit or eliminate forage opportunities through deep or hard crusty snow or icing from freezing rain or winter thaw (Gunn *et al.* 1991b). Banks Island in the North West Territories has experienced increased calf mortality during severe winters while Bathurst Island suffered a population crash following several consecutive winters with record high snowfall (Gunn and Adamczewski 2003). Massive die-offs were reported in the Southern Queen Elizabeth Islands in the winter of 1973 – 1974 due to exceptionally difficult conditions (Gunn and Adamczewski 2003).

Climate change and its effects in the Arctic may impact muskox populations. Some predicted changes to the Arctic include warmer and wetter winters, warmer summers with earlier spring melt, increases in extreme weather events and thawing of the perma-frost (Anisimov *et al.* 2001; Christensen *et al.* 2007) which could result in earlier spring plant growth, northerly shifts in the ranges of plant communities, and increases in insect and parasite density and range. As temperatures warm, the composition of plant communities could change producing vegetation that is less favourable for muskox forage. There is already evidence that severe weather events such as icing can have devastating effects for caribou populations on the High Arctic Islands (Gunn and D'Hont 2002; Miller 2003b); an increase in icing events across the Arctic through increased winter rainfall could precipitate future mass die-offs. Finally, parasite and insect populations may increase due to increased temperatures and moisture. Increased insect harassment could lead to less time feeding and more time engaged in avoidance activities (Toupin *et al.* 1996; Moerschel and Klein 1997; Weladji *et al.* 2003). Increased temperatures and wetter conditions in the Arctic are already leading to faster development and increased larval survival in nematodes (Kutz *et al.* 2005).

There are several diseases and parasites that affect muskoxen in Nunavut. Although *Brucella suis IV* (Gates *et al.* 1986) and *Yersinia pseudotuberculosis* (Larter and Nagy 1999) bacterial infections are present in some populations, *B. suis* appears to be rare (Gunn and Adamczewski 2003) while *Y. pseudotuberculosis* is more prevalent (e.g. 20% of sampled muskoxen on Banks Island had been previously exposed to *Y. pseudotuberculosis*) (Larter and Nagy 1999). Muskoxen are also susceptible to a number of internal parasites including abomasal nematodes (e.g., *Ostertagia*, *Nematodirus*), lungworm nematodes (*Dictylocaulus*, *Umingmakstrongylus pallikuukensis*), protozoans (e.g., *Eimeria*, *Bestnoitia*) and tapeworms (e.g. *Moniezia*) (Gunn and Adamczewski 2003). The life cycle of some of these parasites, such as *U. pallikuukensis*, which is already very prevalent in some populations (Gunn and Wobeser 1993), has already been accelerated due to changes in the Arctic climate (Kutz *et al.* 2005). This could augment the impact of the nematode infection on muskoxen populations.

Overharvest is a concern for muskoxen populations. Overhunting in the late 19th century contributed to widespread declines in muskoxen populations (Gunn and Forchhammer 2008). The GNDoE has determined that a harvest rate of 7% creates a slow decline in population while 3% encourages slow growth (GNDoE 2007). While many of the recommended quotas are near 3% of herd size, the quotas for some of the smaller populations (i.e. Bathurst Island) may be unsustainable (Jenkins *et al.* 2011).

Interspecific competition with caribou may affect muskoxen populations. Although the ranges of both species may overlap, their different diets (Larter and Nagy 1997) result in minimal overlap (Parker 1978). Risk of resource competition may be greatest when conditions (e.g., deep snow) force muskoxen and caribou into the same areas (Larter and Nagy 1997). Overlap between muskoxen and caribou could also affect the predation rates. As described by Seip (1991) predation rates can be affected by changes in either the primary or alternate prey populations. In areas where caribou are scarce, muskoxen may be predated more heavily (Gunn and Adamczewski 2003) which could contribute to population declines.

Disturbance and habitat loss and/or degradation as a result of development or exploration activities (e.g., mining, oil and gas exploration and extraction) could have impacts on muskoxen populations. Muskoxen possess several characteristics that make them vulnerable to disturbance: small range, small population sizes and their energy storage requirements (Reynolds *et al.* 2002). The effects of forage limitation caused by icing events have caused substantial declines in muskoxen populations indicating that disturbance behaviours that would limit feeding opportunities over prolonged periods could have serious implications. Additionally, the effects of disturbance would year-long as muskoxen tend to have small ranges (Reynolds *et al.* 2002). Certain muskoxen population may also be vulnerable as they are already small populations. The “small population paradigm” suggests that declining populations may face additional risks created by their small size and may be more susceptible to factors such as stochasticity (Caughley 1994). The effects disturbance and habitat loss and/or degradation could also have greater impacts on the smaller muskoxen populations. Finally, much of the muskoxen life history (seasonal range selection, timing of migrations) are designed to obtain the highest quality forage with the least energy expenditure. Activities on the landscape that would cause muskoxen to migrate at different time or more frequently, or select less productive areas to forage would be at risk of receiving low quality food and greater energy use could in turn result in decreased fitness (Reynolds *et al.* 2002).

Land Use Planning Considerations

Current management practices only assess muskox harvest rates. Total Allowable Harvests for each muskox population are based on harvest rates between 3 and 7%. Management Units were designed to reflect traditional hunting patterns and muskox distribution (Appendix B, Figure 4.12-2). There is currently no sex selective harvest and the proposed muskox season is designated as

October 1 – April 15 for all populations with the exception of Victoria Island. Mandatory reporting and sampling of all muskox harvested has been recommended. Any telemetry/satellite collar found is to be returned to a conservation officer (Wildlife Research Section *et al.* 2006).

In respect to land use planning, current telemetry information needs to be analyzed to determine key habitats and movements by muskoxen both on the islands and on the mainland. The determination of population boundaries, muskoxen distribution and home range sizes are critical before any land use decisions and plans can be made. Although muskoxen can habituate to humans (Miller and Gunn 1980a), little is known about how much human activity muskoxen can tolerate before becoming stressed. Very little is known about the individual effects of roads, increased access and development on muskoxen let alone the potential cumulative effects. The Government of Nunavut lists several muskoxen research projects in their list of current programs (2011 Internet Site) and has produced a number of reports in the last several years (e.g., Campbell and Hope 2006; Jenkins 2006; Dumond 2007a, c; Jenkins 2008; Jenkins *et al.* 2011). Because of the uncertainties in the understanding of muskox ecology and population dynamics it would be prudent to integrate precautionary strategies into land use planning.

4.13 Barren Ground Grizzly Bear

Inuit Name: Akłak, Akła
Scientific Name: *Ursus arctos*

Conservation Status

The grizzly bear is designated as a Species of Special Concern by COSEWIC (COSEWIC 2002a). The grizzly bear population in Nunavut is also listed as Sensitive by the National General Status Working Group (2005 internet site). Grizzly bear populations are believed to be growing in Nunavut (GNDoE 2006). Grizzly bears have also been reported further north and east in recent years (Wolfden Resources Inc 2006).

Distribution

Grizzly bears are distributed in various habitats throughout the Kivalliq and Kitikmeot regions of Nunavut (McLoughlin 2001). The GN recognizes four populations of grizzly bears within the Territory. There is no estimate of grizzly bear numbers in Nunavut but based on study area specific estimates and relative densities deducted from anecdotal information and local and professional knowledge, the overall population in Nunavut is likely to be between 800 and 2000, with the majority residing in the Kitikmeot region (McLoughlin 2001). Grizzly bears are distributed throughout most of the mainland area of Nunavut, except the Boothia Peninsula, Melville Peninsula, and the coastal area of Chesterfield Inlet where polar bear occur (McLoughlin 2001). No grizzly bears are found on Baffin Island or the Arctic Islands, except for Victoria Island (McLoughlin 2001; GNDoE 2006).

Ecology

Preferred habitats for grizzly bears include areas where food availability is higher, such as eskers, tussock/hummock tundra, lichen veneer (flat islands and low peninsulas), birch seep and riparian tall shrub. Riparian areas with horsetails and sedges and caribou feeding areas are also preferred habitats. Nunavut grizzly bears have large home ranges that average 2,239 km^2 for females with young and 7,245 km^2 for males (McLoughlin *et al.* 2002a).

Grizzly bear diet is predominantly comprised of caribou, supplemented in the summer by green plant foods, birds and small mammals such as lemmings, red-backed voles and arctic ground squirrels, as well as berries in late summer. Grizzly bears may also use fish and marine food resources, such as ringed seals and beached whales (Gau *et al.* 2002; Anand-Wheeler 2006). It should be noted that studies on grizzly bears in Nunavut has been limited and additionally, local knowledge does not necessarily reflect the situation in the entire range. For example, the food habitat study by Gau *et al.* (2002) was conducted in a limited area, inland and north of the tree line and therefore the importance of food items in other areas is not well known.

Grizzly bears are primarily solitary animals that occasionally feed in small groups (McLoughlin 2001). They generally enter their dens in the last two weeks of October and emerge in early May. Most dens are located in sandy soils on slopes in heath tundra and heath boulder habitats, esker habitats, tall shrub riparian areas or birch seep (McLoughlin *et al.* 2002b). Female barren ground grizzly bears on average have their first cubs at eight years of age, which is later than other grizzly bear populations in Canada (McLoughlin 2001).

Ecological or Economic Importance

Grizzly bears are considered indicators of ecological integrity because they are sensitive to disturbance, have large land area requirements, use a wide range of habitats, and have complex interactions with other species (Ross 2002). Grizzly bears are included in the list of species which Nunavummiut have a right to harvest, with total harvest levels to be established by the NWMB (Tungavik and DIAND 1993). The recommended total allowable annual harvest by the Wildlife Research Section of the Government of Nunavut has been set at eight bears for the Kugluktuk area (GB/01), six bears for Bathurst Inlet (GB/02), and six bears for GB/03 (Kivalliq and east Kitikmeot)(GNDoE 2007), however no TAH has currently been established by the Nunavut Wildlife Management Board.

Issues/Concerns

Grizzly bears in Nunavut have low natural population densities and are vulnerable to disturbance in open tundra habitats. Small increases in the level of human-caused bear mortality may greatly increase the risk of population declines (McLoughlin *et al.* 2003). Attractiveness of garbage at camps and other human activity centres increases potential human-bear interaction. Impacts of human activity on bear den habitat are a particular concern. Development of roads and other linear features increases the risk of human-caused mortality and reduces the value of adjacent habitat (Ross 2002).

Land Use Planning Considerations

There are landscape and site level land use planning considerations for maintaining grizzly bear populations. At the landscape level, managing human activities in known areas of greater bear concentration (e.g., mainland west Kitikmeot), as well as minimizing access and activities that degrade habitat, are important considerations. Human disturbance and developments should be planned to prevent the creation of barriers to movement and the isolation of populations that depend on in-migration and out-migration. Minimizing the density of roads and access to grizzly bear habitat can also help to limit the potential for human-bear encounters. At the site level, minimizing human disturbance of den sites is important.

In reference to the Nunavut grizzly population, Ross (2002) states that "the potential for sudden and intense growth in resource extraction activities requires that adequate protection be implemented for grizzly bear populations and habitat". Consideration should be given to establishing a connected network of protected areas and/or grizzly bear management areas that include core grizzly bear habitat, and limiting development and human disturbance within these areas. A similar approach has been proposed in British Columbia through the BC Grizzly Bear Conservation Strategy (Ministry of Environment 1995). To address the cumulative effects of development, maximum disturbance thresholds for management areas within the planning region can be established. A similar approach has been recommended in the recently completed North Yukon Land Use Plan (North Yukon Planning Commission 2008). The five grizzly bear population management zones identified by the GNDoE (2007) may be used as a basis for considering grizzly bear populations in land use planning. Additionally, once ecological land classification is available at a suitable level for analyses, habitat suitability and effectiveness modelling can be applied to identify core grizzly bear habitat and aid in land use planning and decision-making.

At present, there are no active region-wide research programs on grizzly bears being conducted by the GN. There is no species-specific management plan upon which to base land use planning objectives. Additional research could include both science and Inuit Qaujimajatuqangit to identify known denning areas, determine values associates with grizzly bears, and to clarify population and harvest objectives. In addition, long-term population and habitat monitoring studies are important to provide a basis for evaluating the effectiveness of land use plans.

4.14 Tundra/Timber Wolf and High Arctic Wolf

Inuit Name: Amaruq
Scientific Name: *Canus lupus occidentalis, Canus lupus arctos*

Conservation Status

The tundra wolf population is considered Not at Risk by COSEWIC and the Arctic wolf is designated as Data Deficient (COSEWIC 1999). Large populations, high growth rates, freedom of movement across the landscape, and large source populations in the Northwest Territories, Saskatchewan and Manitoba, contribute to this status. No status ranking for the high arctic wolf is given by COSEWIC due to lack of data. However, anecdotal information suggests that high arctic wolves may require some protection (see threats below, GNDoE 2006).

Distribution

Wolves are found throughout Nunavut. Wolf distribution is associated with the distribution of their primary prey, which includes caribou and muskoxen. There is limited information on wolf populations in Nunavut. However, the population of tundra/timber wolves is believed to be large (Government of Nunavut 2006).

Ecology

The habitats used by barren ground wolves vary seasonally with caribou migration. At the landscape scale, wolves prefer esker habitats, as these habitat types are used for denning. Within their home ranges; however, wolves use a wide variety of habitats (McLoughlin *et al.* 2004). Annual average ranges for wolves are 45,000 km^2 for females and 63,000 km^2 for males. Summer ranges are 1,100 to 2,000 km^2 (Walton *et al.* 2001).

Wolves are the predominant predators of caribou and muskoxen. Wolves form packs of two to 16 related individuals that travel, hunt, breed, and raise pups together throughout their home ranges. They use the same denning areas year after year, arriving in April to mid-May and leaving again in late October or early November. Denning often occurs near treeline in the tundra, so that the maturing wolf pups are able to travel with adults at the time of fall caribou migration. During denning, wolves may travel long distances to caribou calving grounds for food (Walton *et al.* 2001; Frame *et al.* 2004; Anand-Wheeler 2006; Frame *et al.* 2008). Wolves have relatively high natural rates of population increase (GNDoE 2006).

Ecological or Economic Importance

Wolves play an integral role in the Arctic food web. As top predators, wolves support a host of scavengers that feed on the remains of wolf-killed caribou and muskoxen. Wolf fur is valued commercially. Statistics Canada (2006 internet site) reports the sale of 393 wolf pelts at a total value of $70,933 in Nunavut in 2005. This represents a considerably higher total value than any other province or territory in Canada. It is also important to note that a significant number of pelts are used locally for clothing and art and craft and are not included in the pelt sale statistics.

Issues/Concerns

The primary threat to wolves is human persecution, especially when they are considered a threat to other populations of animals such as caribou. Disruption of caribou distribution and migration patterns also has the potential to impact wolves. Human activity near den sites is also disruptive to tundra and high arctic wolves (Walton *et al.* 2001).

Land Use Planning Considerations

There are landscape and site level land use planning considerations for maintaining wolf populations. Wolves are intimately linked to their prey, predominantly caribou and muskoxen. At the landscape level, land use planning should be integrated to sustain core habitats and predator-prey dynamics of wolves and caribou (Cluff and Paquet 2003 internet site). At the site level, minimizing human activity near den sites from April/mid-May to October/early November is advisable.

General management principles for large carnivores (e.g., grizzly bear) should apply to wolves. Consideration should be given to establishing a network of protected areas that includes core wolf habitat, particularly migration routes and winter range refugia (Cluff and Paquet 2003 internet site).

Complementary approaches include limiting human access and disturbance within wolf habitat areas, and establishing thresholds of disturbance within planning regions. Once ecological land classification is available at a suitable level for analyses, habitat suitability and effectiveness modelling can be applied to identify core wolf habitat and aid in land use planning and decision-making.

At present, there are no active wolf management programs being conducted by the GN. There is no species-specific management plan upon which to base land use planning objectives. Additional research could include both science and Inuit Qaujimajatuqangit to identify known denning areas, determine values associates with wolves, and to clarify population and harvest objectives. In addition, long-term population and habitat monitoring studies are important to provide a basis for evaluating the effectiveness of land use plans.

4.15 Wolverine

Inuit Name: Qavvik, Qavvigarjuk
Scientific Name: *Gulo gulo*

Conservation Status

The western wolverine population is listed as Special Concern by COSEWIC (2003). The Nunavut wolverine population is listed as Secure by the National General Status Working Group (2005 internet site), based largely on hunter information that populations are stable or increasing (Cardinal 2004). There is regional monitoring limited to recording harvested animals in the Kitikmeot region. There is some research-level monitoring using genetic mark-recapture techniques near Kugluktuk (Mathieu Dumond, Kitikmeot Regional Biologist, GNDoE, pers. comm.), and similar methods have been proposed for monitoring at some Kitikmeot mine sites (e.g., High Lake, Doris North; monitoring plans are available on the NIRB FTP site).

Distribution

Wolverines are found throughout Nunavut, except in the most northerly parts of the Arctic Islands. Three areas of wolverine distribution were identified by the GN. Core wolverine habitat includes mainland west Kitikmeot and the western Kivalliq region, where wolverines are abundant and there are several breeding populations. Colonization habitat includes eastern mainland Kitikmeot and insular Kitikmeot, and northeastern Kivalliq, where wolverines are common but do not regularly breed. The remainder of Nunavut is marginal habitat, where population densities are low and no viable breeding population exists (GNDoE 2006).

Ecology

As scavengers and predators, wolverines require habitats with a year-round supply of carrion and prey. Wolverine habitat is linked to the movement patterns of caribou and wolves, as scavenged caribou and large carrion constitute the bulk of the wolverine diet in the Arctic (Dalerum *et al.* 2009). Rocky outcrops and extensive snowdrifts are often used for denning sites. Wolverine home ranges are estimated at 126 km^2 for adult females and 404 km^2 for adult males (Mulders 2000).

Wolverines are solitary animals. They do not breed until they are two years old, and do not breed every year. They have low reproductive rates and low growth rates, breeding in the summer and denning during the winter under rocks and under snow cover (COSEWIC 2003b; Krebs *et al.* 2004; Anand-Wheeler 2006).

Ecological or Economic Importance

Wolverines, although still harvested for domestic consumption in some communities, are mainly harvested for their fur, which is locally valued for its frost-resistant properties. Most of the pelts are used locally. Wolverines are considered good indicators of ecosystem health, since they are intimately connected to wolf and caribou populations and are vulnerable to human disturbance (COSEWIC 2003b).

Issues/Concerns

Wolverines are susceptible to human-caused mortality (trapping, hunting, problem kill) where access and visibility are good. Transportation corridors can impede the movement of wolverine populations and fragment habitat. Disruption to key ecosystem components, such as wolves and caribou, and disturbance of denning areas, can also pose a threat to wolverines (COSEWIC 2003b).

Land Use Planning Considerations

There are landscape and site level land use planning considerations for maintaining wolverine populations and habitats. At the landscape level, conservation biologists recommend integrating conservation of wolverine habitat with that of other large carnivores, including grizzly bears and wolves. Harvest management through a system of trapping areas and untrapped refugia is also recommended (Krebs *et al.* 2004). The three wolverine management areas identified by the GNDoE (2006) may be used as a basis for consideration of wolverines in land use planning. At the site level, minimizing human activity near den sites into late spring is advisable.

At present, there is no wolverine-specific management plan for Nunavut upon which to base land use planning objectives. Additional research could include both science and Inuit Qaujimajatuqangit to identify known denning areas, determine values associates with wolverines, and to clarify population and harvest objectives. In addition, long-term population and habitat monitoring studies are important to provide a basis for evaluating the effectiveness of land use plans.

4.16 Arctic Fox

Inuit Name: Tiriganiaq
Scientific Name: *Alopex lagopus*

Conservation Status

Information on population status in Nunavut is limited. Adjacent populations in the Northwest Territories are relatively large and are not believed to be at risk. At present, there is no COSEWIC status ranking for arctic fox. The status of the arctic fox in Nunavut is currently listed as Secure by the National General Status Working Group (2005 internet site).

Distribution

The arctic fox has a widespread distribution throughout Nunavut, including the Arctic Islands (Carmichael *et al.* 2007).

Ecology

Arctic foxes require habitats with abundant lemmings and voles, which are their primary prey throughout most of their range. They adapt to prey availability by switching prey opportunistically based on abundance (Samelius 2004). Arctic foxes are opportunistic scavengers and prey on carrion left by larger predators, including carrion left on sea ice from polar bears and caribou left over from wolf kills. Denning habitats are found on eskers and sandy, well-vegetated gentle slopes, including soft ground along the banks of rivers and higher ground free of permafrost (MacPherson 1969).

Arctic fox populations fluctuate widely, following three to five year lemming and vole population cycles. Arctic foxes live an average of four years. They den in late winter, breed in March or April, and bear pups in May or June. In addition to preying on lemmings and voles, arctic foxes also feed on ground squirrels, arctic hares, birds, eggs, berries and other prey, and scavenge ungulate meat. The home ranges of arctic foxes are generally between 16 and 25 km^2, although they may travel much farther (MacPherson 1969; Anand-Wheeler 2006).

Ecological or Economic Importance

Arctic foxes are valued for their pelts. Trapping is an important subsistence activity in Nunavut. As key predators of lemmings and voles, and waterfowl and eggs, arctic foxes play an important ecological role in the arctic ecosystem. Fluctuations in arctic fox populations are an indicator of lemming and vole population cycles.

Issues/Concerns

The northward movement of red fox populations may be leading to competition for resources. Foxes carry rabies throughout the Arctic and the interaction between rabies foxes and dogs or humans is a health concern for communities with substantial and susceptible dog populations (Castrodale *et al.* 2007). Any land use activity that creates a favourable environment for local concentrations and habituation of foxes should be taken into consideration.

Land Use Planning Considerations

Habitat management for caribou and larger carnivores should address habitat and food requirements for arctic fox.

5 SPATIAL DATABASE

All spatial data collected for Nunavut wildlife and wildlife habitat values is compiled in digital files that accompany this report. All figures summarizing wildlife habitat are presented in Appendix B.

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6 HABITAT ANALYSIS

6.1 Mechanisms to Conserve Wildlife

6.1.1 Regulatory Agencies

Nunavut Planning Commission

The NPC was established under Article 11 of the NLCA. Article 11.4.1, describes the role of the NPC as establishing broad planning policies, objectives and goals for the NSA in conjunction with Government, and to develop land use plans that guide and direct resource use and development in the NSA, Article 11.2.1 describes the general principles that guide the development of planning policies, priorities and objectives, and as they relate to wildlife and habitat management include:

- Considering people as a functional part of the environment and as central to land use planning and implementation (11.2.1 [a])
- The primary purpose of land use planning shall be to protect and promote existing and future well-being of Nunavummiut[5] (11.2.1 [b])
- The planning process shall ensure land use plans reflect the priorities and values of the residents of the planning regions (11.2.1 [c])
- Plans shall provide for the conservation, development and use of land (11.2.1 [e]).

Importantly, “land” is defined in Article 11 as including water and resources including wildlife (11.1.2).

The objective of the planning process is to develop planning policies, priorities and objectives regarding the conservation, development, and use of land, and to prepare land use plans that guide and direct resource use and development in the NSA (11.2.2 [a] and [d]). In developing planning policies, priorities and objectives, environmental protection and management needs, including wildlife conservation, protection and management shall be considered (11.2.3 [d]).

In particular reference to wildlife resources and habitat values, a land use plan shall document the natural resource base and existing patterns of natural resource use (11.3.1 [b]), and environmental considerations, including Parks and Conservation Areas, and wildlife habitat (11.3.1 [g]). The NLCA emphasises that land use planning policies should consider both local and national interests in wildlife (NLCA 11.3.2).

Land use plans must be developed consistent with Article 5 (Wildlife), and thus consistent with the wildlife management system established within Nunavut (involving the NWMB and the GN). Considering that Government retains ultimate responsibility for wildlife management in Nunavut (NLCA 5.2.33, 5.2.36), the NPC plays a key role in incorporating wildlife management objectives during the development and implementation of land use plans. Given that land use plans provide for the conservation, development and use of land, it is particularly important that the NPC function in

[5] Nunavummiut here considered those persons ordinarily resident and communities of the Nunavut Settlement Area.

close association with Government (and the NWMB) to establish planning policies, objectives and goals and that land use plans are consistent with wildlife management and conservation objectives of Government and the NWMB.

Nunavut Wildlife Management Board

The NWMB was established under Article 5 of the NLCA. The primary functions of the NWMB are to be the “main instrument of wildlife management and the main regulator of access to wildlife in the NSA (NLCA 5.2.33)”. The NWMB is comprised of nine voting members, four of which are designated from Regional Inuit Organizations, one designate each from DFO, CWS, and INAC, one appointment from the Commissioner-in-Executive Council, and a chairperson is nominated by the NWMB (and approved by the Governor in Council).

Responsibilities of the NWMB include participating in research, determining levels of total allowable harvest, ascertaining the basic needs level, and conducting the Nunavut Wildlife Harvest Study (NLCA 5.2.33). The NWMB also approves the boundaries of Conservation Areas related to management and protection of wildlife and habitat, and approval of management plans for wildlife and wildlife habitat throughout the NSA (NLCA 5.2.34 [a, c, d]). In direct relationship to functions of the NPC, the NWMB identifies wildlife management zones and areas of high biological productivity and provides recommendations to the NPC with respect to planning in those areas (NLCA 5.2.34 [b]).

The Government of Nunavut, Department of Environment

Primary responsibility for the management of lands, including flora, is the responsibility of the Federal and Territorial Governments, excepting Inuit Owned Lands (Through implementation of the NWA, the GN has a legislated mandate for the management of plants, wild animals and invertebrates (excluding fish and marine mammals which are covered by federal legislation) in Nunavut. The NWA establishes the GN’s mandate for wildlife management in the territory. It provides the basis of a system for which wildlife and habitat management could have impacts on land use and land use planning in Nunavut. Some sections of the NWA place specific legal obligations on the GN in terms of its involvement in land use planning. Some sections of the NWA that apply directly to land use planning are summarised in Table 6.1-1.

Table 6.1-1: Sections from the NWA Relevant to Land Use Planning

Section	Text	Relevance to Land Use Planning and Policy
1(1) Purpose of this Act	*"The purpose of this Act is to establish a comprehensive regime for the management of wildlife and habitat in Nunavut, including the conservation, protection and recovery of species at risk…"*	Wildlife management requires the management of habitat, and thus the management of land use
1(2) Values	*"To fulfill its purpose, this Act is intended to uphold the following values:* *Wildlife and habitat should be managed comprehensively since humans, animals and plants in Nunavut are all inter-connected* *c) The biological diversity of Nunavut should be maintained and wildlife resources should be used in a sustainable manner* *d) The management of wildlife and habitat should provide optimum protection to the renewable resource economy"*	Wildlife management requires the combined management of human use and habitats (and thus land use) Land use planning policies should incorporate biodiversity considerations by referring to specific obligations under the *Canadian Biodiversity Strategy* In land use planning policies, the renewable resource economy may take precedence over other forms of land-use
3(1) Interpretation	*"The GN, NWMB and all persons…shall interpret and apply this Act in accordance with the purpose, values and principles of this Act"*	Land use planning policies must encompass the purpose, values and principles of the NWA
66(1) Prohibited Activities in Critical Habitats	*"…no person shall at any time, within critical habitat,*"… [includes a list of prohibited activities]	Designation of an area as critical habitat will have impacts on land use. Land use plans must therefore identify all known Critical Habitats
73(1) Significant Disturbance	*"No person shall, unless authorized by a license,* *a) engage in any activity, other than harvesting, that is likely to result in a significant disturbance to a substantial number of wildlife"*	Without further direction from the GN, Land use plans must consider what constitutes a "*significant disturbance*" and "*a substantial number of wildlife*"
135 (1) Contents of Recovery Policy	*"A recovery policy must,…* *e) Identify the species' critical habitat…and examples of activities that are likely to result in its destruction;…* *h) Identify any portions of the species' critical habitat that have not been protected under legislation or under an agreement"*	Land use plans must identify all known critical habitat, as well as provide a means or proposal to protect that habitat. Failure to do so will result in conflict between the legislation and land use plans
137. Ecosystem Management	*"A recovery policy and management plan may include provisions respecting one or more species and the management of ecosystems"*	Land use planning policies should promote planning according to ecosystems. Doing so will help to fulfill obligations towards species at risk, biodiversity, etc.

Section	Text	Relevance to Land Use Planning and Policy
140. Compensation	*"The Minister shall in accordance with the regulations, provide fair and reasonable compensation to any person for losses suffered as a result of any substantial impact from the creation of critical habitat"*	Land use plans must identify all known critical habitat. Identifying these areas in plans will help to direct land use away from them thereby reducing the likelihood of required compensation
198. Habitat	*"The Commissioner in Executive Council may make regulations respecting critical habitats, wildlife sanctuaries and special management areas, either generally or specifically, including regulations respecting:…* *e) any activity in or use of those places, including the exploration, prospecting, claims staking and production of metals, minerals, oils or gas and the construction, operation and maintenance of any building, structure or thing"*	This section supports the GN's role as a regulatory authority in land use planning Land use plans must consider the requirements of the NWA and its regulations

The GNDoE is responsible for fulfilling the GN's responsibilities under a wide range of federal legislation (e.g., SARA, CITES, *Migratory Birds Convention Act*, *Wild Animal and Plant Protection and Regulation of International and Interprovincial Trade Act*) including on-going responsibility for the co-management of Nunavut wildlife as obligated under the NLCA. Responsibilities are shared with partners such as the NWMB, RWO and HTOs. The NLCA places a number of specific obligations on the GN, with respect to wildlife management. The DoE is the lead GN agency responsible for implementing these obligations, many of which are have direct implications on land use planning and policy, and are summarised in Table 6.1-2.

Table 6.1-2: An Overview of National and International Wildlife Management Obligations Related to Land Use Planning and Policy

International and National Obligations	Summary	Relevance to Land Use Planning
International Obligations		
Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES)	Ensures that international trade in wild animals and plants does not threaten their survival. GN is designated as the CITES Management Authority and Scientific Authority for Nunavut. Responsibility includes ensuring that there is adequate information available to prove that export of a listed species is not detrimental to the survival of the species.	Through policy and planning, the GN and co-management partners work to ensure that land use in NU does not occur in a manner that creates potential for unregulated trade and export of CITES listed species. Land use plans should consider the impacts of certain activities on CITES listed species; the DoE should be required to provide the necessary information.

International and National Obligations	Summary	Relevance to Land Use Planning
International Agreement on the Conservation of Polar Bears and their Habitat	This 1973 agreement obligates Canada to "…*take appropriate action to protect the ecosystem of which polar bears are a part, with special attention to habitat components such as denning and feeding sites and migration patterns*"	While the locations of many of these sites are known, no special protection has been extended too much of the habitat. Land use plans will have to identify important polar bear habitats, and document appropriate land uses within those areas to ensure protection.
Arctic Council Conservation of Arctic Flora and Fauna (CAFF)	The CAFF program is a working group of the Arctic Council under the Arctic Environmental Protection Strategy. One of the guiding principles of CAFF is the use of a broad, ecosystem-based approach to conservation and management. The federal government is a member of the Council.	The Arctic Council notes the importance of land use planning by stating that "*While protected areas remain important, most of the Arctic territory will remain without formal protection. Proper ecosystem management and conduct of activities in these areas is a key element in conserving overall Arctic biodiversity*".
National Obligations		
Canadian Biodiversity Strategy	Nunavut's commitment to the biodiversity strategy is reflected in the provisions of the NWA.	The strategy places emphasis on the use of ecosystem approach to conserving biodiversity and managing resource use ("*Use integrated and ecological management approaches with more emphasis on landscape/ waterscape level planning to integrate economic and social objectives with biodiversity conservation objectives*").
SARA	SARA is a federal government commitment to prevent wildlife species from becoming extinct and secure the necessary actions for their recovery. It provides for the legal protection of wildlife species and the conservation of their biological diversity.	Both the SARA and NWA require the identification and protection of critical habitat for endangered or threatened species. Failure to properly incorporate SARA/NWA considerations in land use plans can lead to conflict between the plans and legislation.
Wild Animal and Plant Protection and Regulation of International and Inter-provincial Trade Act (WAPPRIITA)	WAPPRIITA is the legislative tool by which Canada meets its obligations under CITES. The NWA was designed to provide systems for environment, licensing and permitting that address those required under WAPPRIITA.	As part of land use plans, points of entry and exit into NU (e.g., roads, waterways, ports, airstrips) must be planned in a way that allow the GN to meet its responsibilities under the NWA (and thus equivalency to WAPPRIITA).
Migratory Birds Convention Act	The MBCA is Canada's legislative tool by which Canada meets its obligations under the Convention for the Protection of Migratory Birds.	Migratory birds occupy significant portions of Nunavut on seasonal basis. Land use plans must consider the habitat needs of those species.
Beverly and Qamanirjuaq Caribou Management Board Agreement (BQCMBA)	Intergovernmental agreement between Manitoba, Saskatchewan, NWT, Nunavut and the federal governments for the joint management of the Beverly and Qamanirjuaq caribou herds.	The calving grounds and other important habitats for both herds are located in Nunavut. The activities of the BQCMB and associated management plans must be considered in land use plans affecting the herds range.

Environment Canada/Canadian Wildlife Service

In Nunavut, Environment Canada's CWS manages 16 Migratory Bird Sanctuaries (MBS) and one National Wildlife Area (NWA). CWS establishes bird sanctuaries to control and manage areas of importance for the protection of migratory birds, their nests and eggs. The sanctuaries can include a range of habitat types such as terrestrial, wetland, or marine. CWS establishes regulations determining what activities can be carried out within these areas. Prohibited activities include the harassment or killing of birds, and disturbing, destroying, or possessing nests or eggs. Primary management activities include the development of management plans, the review of permit applications and the production of public information. The NLCA requires management plans for all CWS protected areas in the NSA, and the negotiation of Inuit Impact and Benefit Agreements (IIBA) for many of them. CWS issues permits with regard to activities within MBSs and NWAs, and the salvage or collection of birds when used in the course of scientific studies. Applications are reviewed in cooperation with impact review boards and other institutions under the various land claims. Partners include the NWB, RWOs HTOs and Nunavut Tunngavik Inc. (NTI).

In Nunavut several federal legislative tools are available to protect wildlife habitat. SARA protects residence and critical habitat for species identified as Schedule 1 species. Under this Act the CWS can invoke measures immediately to protect critical habitat of species at risk. CWS can also protect habitat through the *Migratory Birds Convention* Act (1994) and the *Canadian Wildlife Act*.

Three other legislations that offer some minor forms of protection include the Federal Policy on Land Use (Government of Canada 1981), the Northern Mineral Policy (Indian and Northern Affairs 1986), and the Mineral and Metal Policy of the Government of Canada (Natural Resources Canada 1996).

Department of Fisheries and Oceans

DFO is responsible for developing and implementing policies and programs in support of Canada's scientific, ecological, social and economic interests in oceans and fresh waters. The Department's guiding legislation includes the *Oceans Act*, which charges the Minister with leading oceans management and providing coast guard and hydrographic services on behalf of the Government of Canada, and the *Fisheries Act*, which confers responsibility to the Minister for the management of fisheries, habitat and aquaculture. DFO also licenses fisheries related research in Nunavut.

Fish Closures

Fish closures can be established through the *Fishery Act* but are used only where an existing fishery occurs. The purpose of fishery closures is to regulate human fishing activities where fish stocks are becoming depleted. The fishery can be subsistent, sport or commercial. Fish closures must be established through regulations under the *Fishery Act.*

Fish Timing Windows

Fish timing windows have been developed for Nunavut freshwater systems. Fish timing windows are meant to be used in conjunction with DFO Operational Statements. Fish timing windows have no regulatory effect themselves nor do Operational Statements. However, if activities identified in the Operational Statements are to occur during a restricted period identified in the fish timing windows then that activity must go through an environmental screening assessment by the Department of Fisheries and Oceans. For activities not addressed in Operational Statements the fish timing windows do highlight times when activities in an area should not occur or require more stringent scrutiny and possible mitigation. These activities generally must pass through the regulatory process in Nunavut.

6.1.2 Nunavut Areas of Ecological Interest

Important Bird Areas

IBAs program is a science-based initiative to identify, conserve, and monitor a network of sites that provide essential habitat for Canada's bird populations. The IBA program is an international conservation initiative co-ordinated by BirdLife International. The Canadian co-partners for the IBA program are Bird Studies Canada and Nature Canada (Formerly the Canadian Nature Federation). Figure 6.1-1 (Appendix B) provides the location of the IBAs found in Nunavut. A description of each IBA can be found on the Canadian IBA Sites Catalogue (http://www.bsc-eoc.org/iba/IBAsites.html). Recent important bird area additions in Nunavut provided by the Canadian Wildlife Service can be found in Appendix D.

Key Migratory Bird Marine and Terrestrial Habitat Sites

The CWS has identified key marine and terrestrial habitat areas that are essential to the welfare of various migratory bird species in Canada (Mallory and Fontaine 2004; Latour *et al.* 2008). These sites are lands that CWS has identified where special wildlife conservation measures may be required and act as a guide to the conservation and land use planning efforts of other agencies (e.g., NPC) having interests in the Northwest Territories and Nunavut (Latour *et al.* 2008). As such, not all sites are targeted to become protected areas (Mallory and Fontaine 2004). Figure 6.1-2 (Appendix B) provides the name and location of the various key marine and terrestrial habitat sites throughout Nunavut (refer to Mallory and Fontaine 2004 and Latour *et al.* 2008, respectively, for a description of each site).

International Biological Programme

IBP sites are special areas that represent a variety of plant and animal communities. In these areas the vegetation, animal life, soils and other physical characteristics form a balanced ecosystem (groups of interdependent species and their non-living environment). Many of these sites contain features such as relict or endangered populations, unique plant associations, breeding areas and critical range for animals, pristine lakes, mineral springs and marine areas. Such sites offer the opportunity to study natural ecosystems or to observe the recovery of the systems from natural and human disturbance.

The boundaries of the ecological sites were created with considerations for the protection of the hunting and fishing resources and as a guarantee of the traditional rights of Inuit. Boundary identification included necessary considerations for gas, mineral and oil development.

Management and protection of these areas through to 2008 in most cases remains uncertain. Some areas, such as Sites 4 – 8 (Perry River Sanctuary), are accorded some protection through designation as the Queen Maud Gulf Migratory Bird Sanctuary (MBS) managed by the CWS. *Eng et al*. (1989) reviewed the IBP sites and updated the protection status of the areas and their ecological relevance. There has been no known follow-up to IBP sites since that time. Little has changed in the protection status of the identified IBP sites—in fact, some that had interim protection by way of being at least partially within proposed Migratory Bird Sanctuaries no longer realize that status (i.e., the MBSs are no longer proposed). The majority of the sites are still not legally protected by any legislation or protection measures (Table 6.1-3) (Appendix B, Figure 6.1-3).

Table 6.1-3: IBP Sites in Nunavut and their Current Status of Protection

Site	Area Name	Ecological Value	Protection Status	Area (ha)	Percent Protected
1-1	Northern Ellef Ringnes Island	Desert, representative flora, representative fauna	No protection		0
1-2	Bracebridge-Goodsir Inlets	Diverse wildlife, baseline, archaeology	Polar Bear Pass National Wildlife Area		100
1-3	Stanwell-Fletcher Lake	Range limits, unique flora, archaeology	No protection		0
1-5	Prince Leopold Island and adjacent Cape Clareance	Seabird colonies	Prince Leopold Island MBS		Partial
1-6	Bellot Strait	Inuit site and feeding site for seabirds	No protection		0
1-7	Seymour Island	Ivory Gull breeding colony	Seymour Island MBS		100
1-8	Cunningham Inlet	Calving area for “white whales”, polar bear feeding	No protection		0
1-10	Washington Point	Black-legged kittiwake colony	No protection		0
2-1	Tanquary Fiord	Unique flora, archaeology	Quttinirpaaq Island National Park Reserve		100
2-2	Sherwood Head-Surprise Fiord	Polar bear denning	No protection		0
2-3	Lake Hazen	High numbers of muskox, wolves, arctic baseline	Quttinirpaaq Island National Park		100
2-4	Fosheim Peninsula	Rich biological site	No protection		0
2-5	Cape Sparbo	Unique flora, muskox range	No protection		0
2-6	Ayles Fiord	Representative flora	Quttinirpaaq Island National Park Reserve		100
2-7	Phillips Inlet	Representative flora	No protection		0
2-8	Expedition Fiord	Unique flora, geomorphology, 130 diverse species	No protection		0
2-9	Van Hauen Pass	Representative and unique flora	No protection		0
2-10	North Kent Island and Calf Island	Black guillemot colonies	No protection		0
2-11	Cape Vera, Devon Island, and St. Helena Island	Seabirds, marine mammals, archaeology	No protection		0
2-12	Coburg Island	Seabirds, marine mammals, archaeology	No protection		0

Site	Area Name	Ecological Value	Protection Status	Area (ha)	Percent Protected
2-13	Chain of Three Lakes	Diverse wildlife, representative flora, archaeology	No protection		0
2-14	Lancaster Sound Marine Area	Northern fulmar colony, marine mammals	No protection		0
2-15	Cape Liddon	Northern fulmar colony, marine mammals	No protection		0
2-16	Hobhouse Inlet	Northern fulmar colony	No protection		0
2-17	Skruis Point	Colony of black guillemots	No protection		0
3-4	Prince Albert Sound, Victoria Island	Representative flora, Peary caribou, muskox and polar bear	No protection		0
3-6	Island of Dolphin and Union Strait	Large colonies of common eider, geomorphology	No protection		0
4-5	Bathurst Inlet	Caribou calving ground	No protection		0
4-6	Thelon River	Unique flora, muskox grazing area	Thelon Wildlife Sanctuary		Partial
4-8	Perry River Sanctuary	Major waterfowl nesting area	Queen Maud Gulf MBS		100
5-1	Tibielik River	Beverly caribou calving ground	Thelon Wildlife Sanctuary		Partial
5-2	Kaminuriak Lake	Caribou calving ground	Caribou Protection Measures		Partial
5-3	McConnell River	Waterfowl nesting, representative flora	McConnell MBS		Partial
5-4	Ennadai Lake	Unique flora, Qamanirjuaq caribou migration	No protection		0
5-5	Baralzon Lake	Representative flora, Qamanirjuaq caribou migration corridor	No protection		0
5-6	Meliadine Esker	Geomorphology, representative flora, archaeology	No protection		0
6-1	Belcher Islands	Common eider, polar bear habitat, archaeology	No protection		0
6-2	Twin Islands	High concentration of polar bear dens, waterfowl.	Twin Islands Wildlife Sanctuary		100
6-3	Coats Island	Seabirds, wildlife, archaeology	No protection		0
6-4	Duke of York Bay	Marine mammals, archaeological remains	No protection		0
6-5	Boas River	Major waterfowl nesting area	Henry Gibbons MBS		Partial
6-6	Akpatok Island	Large colonies of thick-billed murres, marine mammals	No protection		0

Site	Area Name	Ecological Value	Protection Status	Area (ha)	Percent Protected
6-7	Digges Sound	Large colonies of thick-billed murres	No protection		0
6-8	Button Islands	Large breeding colonies of glaucous gulls, marine mammals	No protection		0
6-9	Manitounuk Islands	Representative flora, geomorphology	No protection		0
6-10	Long Island	Representative flora (range limit), wildlife	No protection		0
7-1	Ogac Lake	Unique population of Atlantic cod	No protection		0
7-2	Clyde Foreland	Unique flora and fauna, biologically rich area	No protection		0
7-3	Padle-Kingnait Fiord	Unique continuous vegetation, passerines	Auyuittuq National Park		Partial
7-4	Great Plains of The Koukdjuak	Goose Colony	Dewey Soper MBS		Partial
7-5	Bylot Island	Seabirds, polar bear denning	Bylot Island MBS, Sirmilik National Park		100
7-6	Cape Searle	Northern fulmar colonies	No protection		0
7-7	Baillarge Bay	Seabirds, marine mammals	No protection		0
7-8	Scott Inlet	Northern fulmar colony	No protection		0
7-9	Reid Bay	Five major seabird colonies	No protection		0
7-10	Hantzsch Island	Multi-species community of seabirds	No protection		0
7-11	Buchan Gulf	Northern fulmar colony	No protection		0

Natural Areas of Canadian Significance

Natural Areas of Canadian Significance (Davidson 1977) were identified as part of National Parks System planning as sites that are representative of the 48 natural regions of Canada. The objective was to foster protection of those places that are significant examples of Canada's natural heritage and to encourage public understanding and enjoyment of that heritage. The 48 natural regions were categorized based on physiographic, biological, geological, oceanographic and geographic features that make each region different from others. Within each natural region, natural areas were identified that were either unique, or which encompassed the greatest diversity of natural themes and were therefore considered "representative" of the natural region in which they were situated.

Natural areas of Canadian significance were vaguely described and no specific spatial bounds were identified. Two of the areas (northwest Ellesmere Island and Wager Bay) are now National Park Reserves. One of the areas is the Thelon Wildlife Sanctuary, and the remaining five areas (Fosheim Peninsula, Axel Heiberg Island, Bathurst Inlet, northern Southampton Island, and the Belcher Islands) do not have any type of habitat protection status (Table 6.1-4). No boundaries were identified for the areas because there was intent to not have the areas mistaken for park proposals. Moreover, no account had been made of resource conflicts, usability, accessibility, regional planning or political considerations.

Table 6.1-4: Natural Areas of Canadian Significance Identified in Nunavut

Area	Features	Protection Status
Fosheim Peninsula	Example of high arctic ecosystem. Arctic hare, muskox, Peary caribou, gyrfalcon	No protection
Northwest Ellesmere Island	Five proposed IBP sites listed in the area. Highest concentration of animals along north shore of Lake Hazen	National Park
Axel Heiberg Island	Three proposed IBP sites on the island. Peary caribou, arctic hare, muskox, wolf, fox are plentiful	No protection
Bathurst Inlet	Muskox, caribou, wolf, grizzly bear, peregrine falcons distributed around the inlet. Southern part listed as an IBP site	No protection
Thelon Wildlife Sanctuary	Muskox, caribou migration, peregrine falcons, wolves, arctic and red foxes	Thelon Wildlife Sanctuary
Wager Bay	Marine mammals, polar bears, raptors	National Park
Northern Southampton Island	Rich terrestrial and marine wildlife	No protection
Belcher Islands	Most southerly occurrences of arctic biota in Canada. Marine mammals and birds, polar bear habitat	No protection

Wildlife Areas of Special Interest (WASI)

Wildlife Areas of Special Interest (WASI) are sites of interest to the DoE, GN (Ferguson 1995). As part of its mandate, the Department has a responsibility for ensuring that the land's capacity to support terrestrial wildlife (including polar bears) is not impaired by land use activities. Maintenance of wildlife habitat is a fundamental goal of wildlife management. Accordingly, the primary objective of WASI is to identify areas that may be important wildlife habitats where particular protection measures may need to be applied to ensure their continued use by wildlife. There are identified WASI areas in Nunavut for Caribou, Gyrfalcon and Peregrine Falcon, Muskox and Polar Bear (Table 6.1-5) (Appendix B, Figure 6.1-3).

Table 6.1-5: Wildlife Areas of Special Interest in Nunavut

ID	Area name	Species	Area (km^2)	Protection Status
1	Bathurst caribou calving grounds	Caribou	9,470	No protection
2	Beverly caribou calving grounds	Caribou	19,753	Caribou Protection Measures
3	Bluenose caribou calving ground	Caribou		Tuktut Nogait National Park (partial)
4	Qamanirjuaq caribou calving grounds	Caribou	31,548	Caribou Protection Measures
6	Dewar Lakes	Caribou	23,542	Longstaff and Dewar Lakes Critical Wildlife Areas
7	Northeastern Kivalliq caribou calving ground	Caribou	28,617	Ukkusiksalik National Park
9	Wrottesley Inlet	Caribou	4,018	No protection
12	Coppermine River	Gyrfalcon and Peregrine Falcon	4,223	No protection
13	Melville Sound	Gyrfalcon and Peregrine Falcon	13,468	Queen Maud Gulf MBS (partial) and Bathurst Critical Wildlife Area (partial)
14	Rankin Inlet	Gyrfalcon and Peregrine Falcon	1,250	Qamanirjuaq Critical Wildlife Area (partial) and Iqalugaarjuup Nunanga Territorial Park (partial)
15	Ford Lakes	Gyrfalcon and Peregrine Falcon	14,093	Ukkusiksalik National Park
16	Foxe Peninsula	Gyrfalcon and Peregrine Falcon	19,745	Malikjuaq Territorial Park
17	Meta Incognita Peninsula	Gyrfalcon and Peregrine Falcon	32,914	Katannilik Territorial Park, Sylvia Grinnell Territorial Park
20	Back Lowland	Muskox	25,927	Queen Maud Gulf MBS
23	Fosheim Peninsula	Muskox	4,823	No protection
24	Horton Plain	Muskox		No protection
25	Mokka Foird	Muskox	3,761	No protection
26	Truelove Lowands	Muskox	748	No protection
27	Bellot Strait	Polar Bear	12,265	No protection
28	Gasteshead Island	Polar Bear	2,079	No protection

ID	Area name	Species	Area (km^2)	Protection Status
29	Hadley Bay	Polar Bear	39,090	No protection
30	Hoare Bay	Polar Bear	12,526	No protection
31	Home Bay	Polar Bear	29,988	Proposed Isabella Bay National Wildlife Area
32	Maxwell Bay	Polar Bear	9,016	No protection
33	Southampton Island	Polar Bear	13,591	Harry Gibbons and East Bay Migratory Bird Sanctuaries
34	Wager Bay	Polar Bear	6,260	Ukkusiksalik National Park
35	Bylot Island	Polar Bear	9,415	Sirmilik National Park, Bylot Island MBS

Wetlands of International Importance (Ramsar)

Wetlands of International Importance (Table 6.1-6) in Nunavut are identified in the Ramsar Convention on Wetlands which provides the framework for international cooperation for the conservation of wetland habitats.

The purpose of Ramsar sites is to promote conservation of wetlands of global significance. The CWS, through the Federal Policy on Wetland Conservation (1991), the Federal Water Policy (1987) and CWS Procedures Manual on Nomination and Listing (1994), is the responsible government agency for identification and management of Ramsar sites in Canada. The objective of the Federal Government with respect to wetland conservation is to "promote the conservation of Canada's wetlands to sustain their ecological and socio-economic functions, now and in the future".

A Ramsar site is a wetland designated under the Convention on Wetlands (Ramsar List 2009) as internationally significant based on a variety of criteria including ecological, biological and hydrological functions and values.

Table 6.1-6: Wetlands of International Importance (Ramsar Sites[6]) in Nunavut and Associated Protection Status

Ramsar Site	Protection Status
Dewey Soper MBS	MBS
McConnell River	MBS
Polar Bear Pass	National Wildlife Area
Queen Maud Gulf	MBS
Rasmussen Lowlands	No protection

[6] Extracted from the "List of Wetlands of International Importance," updated 11 April 2008. The Ramsar List was established in response to Article 2.1 of the Convention on Wetlands (Ramsar, Iran, 1971). www.ramsar.org/sitelist.pdf

National and Territorial Parks

There are four national parks in Nunavut: Auyuittuq National Park, Sirmilik National Park, Ukkusiksalik National Park and Quttinirpaaq Island National Park (Appendix B, Figure 6.1-4). All parks contain small marine components and freshwater systems. Lands within a national park become, if they are not already so, federal crown lands. National Parks offer some of the most stringent protection of all forms of parks in Canada. Management plans are developed in collaboration and agreement with Nunavut communities and organizations. National Parks require a relatively lengthy process to reach designation.

The GN has established a number of territorial parks which provide a range of benefits, including cultural and natural resource protection, recreation and tourism opportunities. Territorial parks range from small campgrounds to large wilderness areas affording protection of the natural environment. The larger territorial parks in Nunavut (providing greater opportunity for wildlife protection) include Igulugaarjuup Nunanga near Rankin Inlet, Katannilik on southern Baffin Island and Sylvia Grinnell near Iqaluit.

National and Territorial Parks can be an effective mechanism in protecting freshwater habitat and have the added advantage of protecting some or all of the land mass surrounding the water body or water course. A good example of this is Lake Hazen on Ellesmere Island which has the most northerly population of Arctic Char. This lake is situated within the Quttinirpaaq National Park. Lake Hazen is thus provided protection through the regulatory effect of the National Park. Another example is the Territorial Park Sylvia Grinnell River Park which includes the lower stretch of the Sylvia Grinnel River. An important spawning area for Arctic char in the Sylvia Grinnell River is provided protection through this Territorial Park.

There are currently two proposed National Parks: the Northern Bathurst Island and expansion of the Tuktut Nogait National Park (Appendix B, Figure 6.1-4). Bathurst Island is the largest island in the Bathurst Island Group and is 16,042 km^2 (Internet Site 2011). The island is uninhabited, relatively flat, with average elevations ranging between 100 – 200 m above sea level and features an irregular coastline marked by wide inlets, bays, and peninsulas (Internet Site 2003). Bathurst is a typical high Arctic island, characterized by landscapes of bare rock and vegetation consisting primarily of grasses, sedges, mosses and lichens (Sheard and Geale 1982). The proposed national park would include the entire island and incorporate the existing Polar Bear Pass, a national wildlife area along the southern end of the island.

Tuktut Nogait National Park is an area in the Northwest Territories along Nunavut's western border that encompasses 16,340 km^2. It is home to a wide variety of animals including caribou, muskoxen, grizzly bears, wolves, red foxes, wolverines, arctic ground squirrels and collared lemmings. The area is also an important calving ground for the Bluenose West Caribou herd as well as a major breeding and nesting site for a wide variety of birds. The area proposed in Nunavut would border this existing park.

Federal Marine Protected Areas

There are three federal marine protected area programs; National Marine Conservation Area (NMCA) (Parks Canada (PC) is federal lead), Marine Protected Areas (DFO is federal lead) and National Marine Wildlife Areas (CWS is federal lead). A federal marine protected area strategy (DFO *et al.* 2005) has been developed whereby the three federal agencies responsible for marine protection work together to ensure the best protection mechanism is used for the area and objectives in question. The DFO plays a coordinating role for this Strategy. The three marine protected area programs provide flexibility in the level of protection which can be put in place for a given area.

Recently (August 2008) Isabella Bay was the first marine area in Nunavut to be designated as a National Wildlife Area under the *Canadian Wildlife Act*. This protects the bowhead whale summering grounds in addition to habitat for various marine species. PC and the DFO along with the GN have had preliminary discussions on Lancaster Sound as another potential candidate for protection (Appendix B, Figure 6.1-4).

The proposed Lancaster Sound National Marine Conservation Area would encompass more than 40,000 km^2 (Parks Canada 2011b). Lancaster Sound is the eastern entrance to the Northwest Passage and is an area of critical ecological importance. The designation of Lancaster Sound as an NMCA would allow for the protection of narwhals which use Lancaster Sound as a feeding ground during the summer and as a migration route. It would provide direct protection for the winter habitat of polar bears, in addition to conserving areas of high ringed seal concentrations. Beluga whale summer habitat and migration routes would also fall under the protection of a Lancaster Sound NMCA should it be designated in the future. The area is extremely important for seabirds with approximately one-third of eastern Canada’s colonial seabirds breeding and feeding in Lancaster Sound (Parks Canada 2011a).

Four representative marine areas have also been identified by the Government of Canada and proposed as marine protected areas in James Bay, two of which are located in Nunavut and would overlap with beluga range in this area: Belcher Islands and the Twin Islands/Rivière du Castor.

Migratory Bird Sanctuaries

There are eleven Migratory Bird Sanctuaries in Nunavut. The *Migratory Birds Convention Act* prohibits activities in Migratory Bird Sanctuaries. These sanctuaries are for the purpose of protecting migratory birds and their habitat. Migratory Bird Sanctuaries can have a marine component, which often are nearshore areas used by migratory birds for feeding or other activities. Prohibitive measures can be placed on what and how activities can take place in these sanctuaries and are set out in the *Bird Sanctuary Regulations*. Although important fish habitat could be protected through a MBS, it is not an effective measure unless there is valuable bird habitat associated with the area that coincides with important or critical fish habitat.

6.1.3 Voluntary Mechanisms of Conservation

Voluntary mechanisms do not have the regulatory backing as with the mechanisms described above however, they often utilize management plans designed to protect the integrity of an area through guidelines. Guidelines established for voluntary mechanisms sometimes can gain a level of regulatory effect by being added into license or permit conditions by regulatory bodies.

Coastal and Marine Integrated Resource Management

Integrated management planning of coastal and marine areas under the *Oceans Act* is a valuable process to determine; areas of importance, areas or species which may be most at risk from industrial activities or natural events, and provides a process to determine the most effective management options to provide protection to marine areas or guidance on how activities should operate. Although integrated management plans may not have any regulatory backing on their own, they can be used to guide the type of activity which can occur in an area and when. These guidelines can be enforced through existing application processes such as through the Nunavut Impact Review Board. The *Oceans Act* provides the DFO with the federal lead for coordinating integrated management planning for marine and coastal areas. There is no immediate plan for DFO to initiate an integrated management planning process in Nunavut. The current focus for integrated management planning at this time is in the five Large Ocean Management Areas (LOMAs) which were established under Canada's Ocean Strategy. There is only one arctic LOMA and that is the Beaufort Sea. An integrated management process led by the Inuvialuit and coordinated through DFO is currently underway and is referred to as the Beaufort Sea Partnership. Any integrated management initiative in Nunavut is required to be consistent with or become part of a broader Nunavut Land Use Plan as referred to in Article 11 of the NLCA.

United Nations Educational Scientific and Cultural Organization (UNESCO) Biosphere Reserves

UNESCO Biosphere Reserves are areas recognized under UNESCO's Man and the Biosphere Programme. Their function is to provide conservation measures to special areas. Only development which is socio-culturally sustainable would be allowed. The Biosphere Reserve should be used to provide research, education and information sharing opportunities (UNESCO 2008). Although a Biosphere reserve is recognized internationally, it is still operated and owned through natural sovereign jurisdictions. There are three interrelated zones to a Biosphere Reserve. These are the core area, buffer zone and transition zone. The core area provides protection of this area through existing laws or regulations of that country. UNESCO Biospheres can be established for marine, freshwater and territorial environments or a combination of any three. At present, there are no established or proposed UNESCO Biosphere Reserves in Nunavut.

Canadian Heritage River System (CHRS)

The CHRS has no legislative authority but can use existing laws and regulations. A Heritage River must have natural and/or cultural values worthy of designation. Local, as well as government support, is required before a nominated river can become established as a Heritage River. Each

Heritage River must have a management plan which provides conservation objectives and mechanisms to achieve these objectives.

There are four Heritage Rivers in Nunavut:

1. **Kazan Heritage River**

   The Kazan River Management Plan does not identify specific conservation objectives. Conservation objectives are broadly incorporated into the management plan objectives. The management plan objectives are:

   - To manage the heritage resources within a river corridor extending 1 km from each bank, in accordance with CHRS objectives.
   - To conserve and interpret the heritage resources identified in the nomination, through existing legislation and regulations and, where appropriate and necessary, through the future establishment of Territorial Parks; heritage resources will be interpreted through a program of printed materials and a visitor centre in Baker Lake. These will foster understanding and appreciation of the heritage values of both the Kazan River and the Thelon River, which was also nominated to the system in 1989.
   - To encourage and monitor recreational use of the river, and to ensure its compatibility with the conservation of the heritage resources.
   - To give a national perspective to visitors regarding the role of the Kazan and Thelon Rivers in northern native history, and the cultural development and evolution of the Keewatin region.
   - To foster an appreciation of the culture of the Caribou Inuit, and to foster pride for Inuit culture (Municipality of Baker Lake *et al*. 1990a).

2. **Thelon Heritage River**

   The CHRS management plan for the Thelon River (Municipality of Baker Lake *et al.* 1990b) does not contain specific conservation objectives but are broadly captured within their management plan objectives. The management plan objectives are identical to those of the Kazan Heritage River.

3. **Coppermine Heritage River**

   The vision and management goal for the Coppermine Heritage River as stated by Nunavut Parks (2008) is:

   "As a Canadian Heritage River the Coppermine is valued for its pristine water, aesthetic, wilderness, heritage and recreational characteristics, and its watershed is being maintained in the most natural condition possible for traditional Inuit activities and for its enjoyment by Kugluktuk residents and visitors".

   The main management objectives for the Coppermine Heritage River are:

   - Maintain water quality and water flow

- Conserve natural heritage features and values
- Conserve cultural heritage features and values
- Enhance heritage appreciation and recreation
- Promote tourism and development (Nunavut Parks 2008).

4. **Soper Heritage River**

The Soper River Management Plan (GN 1992) conservation objectives are identified in two categories; land and water, and vegetation and wildlife.

Land and Water Objectives:

- To ensure the long term protection of the biophysical values and visual qualities of the management area
- To minimize the impacts of non-traditional uses such as the extraction and transportation of lapis lazuli
- To minimize the impact of community controlled land use and development on lands adjacent to the management area
- To maintain the quantity and quality of waters within the management area for their ecological, aesthetic and recreational benefits.

Vegetation and Wildlife Objectives:

- To protect the indigenous plant communities of the management area for their benefits to the continuation of natural processes, the provision of natural wildlife habitats and the attractiveness of the area for interpretation and recreational use
- To maintain the natural diversity of species representative of the southern Baffin Island region
- To maintain viable fish populations, with particular emphasis on species susceptible to pressure from sport fishing
- To protect critical habitats from inappropriate development and use
- To reconcile the traditional harvesting requirements of residents with the interests of recreational users.

Voluntary Fishery Closures

Voluntary fishery closures have been more common with freshwater fisheries but they can be applied to marine fisheries as well. Voluntary fishery closures are only effective if users of the resource participated in the decision to put into effect a closure and abide by that closure.

Voluntary fishery closures generally are identified within fishing plans; these may be community fishing plans or stock based plans. Voluntary fishery closures may include prohibition from fishing a particular stock regardless of the area or may only limit fishing in particular areas such as spawning or overwintering areas. There is no regulatory effect to a voluntary closure. The success of voluntary fishery closures depends on the involvement of the fishers in the decision to close the fishery and their willingness to obey the closure. If supported by users of the resource, voluntary fishery closures can be an effective tool to protect a specie or species.

6.2 Identification of Habitat Features Critical to Wildlife

6.2.1 Marine Mammals

Important habitat for marine mammals in Nunavut may include concentration, feeding, nursing, breeding areas, migration routes and denning locations. Where information exists, sensitive times of year are summarized by species. The following presents only an overview of presently available information and should not be considered exhaustive. Research and studies of marine mammals, particularly in the Arctic, are limited. To portray the current understanding of important marine mammal habitat it is important to recognize limiting factors associated with obtaining knowledge:

- Marine mammals have very large distribution ranges and often travel great distances in short periods of time
- The marine environment is very dynamic; the combination or interaction of factors influencing marine mammal distribution (e.g., prey availability, water temperature) are not well known
- During open water periods marine mammals are underwater for more than 90percent of the time (and hence not visible)
- Marine mammal surveys of large areas are costly and hence are rare
- Relatively few marine mammals have been successfully instrumented with satellite tags.

An important consideration for the identification of important habitat in Nunavut is the changing climate in the Arctic. In recent years the effects of climate change have been apparent in the Arctic; reduced ice cover, melting of glaciers, longer open-ice periods and over all warmer temperatures have changed how animals live in this region (Laidre and Heide-Jorgensen 2005; Stirling and Parkinson 2006; Stirling and Derocher 2007). Those areas previously identified (by research or IQ) as important may have changed. Alternatively, for a few species, climate change may increase available habitat or have a negligible or positive impact on habitat availability.

The following species specific information integrates data from a variety of resources. Where graphic information exists (i.e., maps) important habitat has been included on species-specific figures (Appendix B, Figures 4.1-1 to 4.1-9). Data or information specific only to the territorial waters of Nunavut (e.g., 12 nm from coast) were portrayed and identified in this report. The terms “likely to occur” or “likely range” are used to represent those areas where supporting literature documents were not identified, but general species biology knowledge and experience would suggest otherwise.

The reader is directed to the numbering scheme in the legend of the marine mammal figures (Appendix B) should they want to locate specific references used to identify all important habitat areas.

Ringed Seals

A key feature of important habitat for ringed seals is sea ice. Ringed seals depend upon sea ice for shelter and areas for pupping (Finley *et al.* 1983; Ferguson *et al.* 2005). Several localized coastlines and islands of Nunavut have been identified as important areas during the pupping/whelping period (Stirling and Smith 2004); these include, but are not limited to: the northwest Coast of Hudson Bay, Brevoort Island, Hozier Islands, Popham Bay, Cumberland Peninsula, Qikiqtani and the Southeast Coast of Hall Peninsula. Data collected on known important, or higher density, ringed seal habitat is outlined in Figure 4.1-1 (Appendix B). Generally, higher density or important ringed seal habitat is believed to occur along the eastern coast of Baffin Island, Lancaster Sound and extending northward along the east coast of Ellesmere Island. Similarly, southeastern Prince of Whales Island and a portion of Prince Regent Inlet have been identified as important to ringed seals. Several areas near Southampton Island have been identified as areas of likely ringed seal abundance. Known overwintering habitat has been identified in the North Baffin Land Use Plan and is also summarized in Figure 4.1-1 (Appendix B).

Overall, it is difficult to isolate specific important or critical habitat for a species that is so wide ranging and abundant (Finley et al 1983; COSEWIC 1989). The use of different sea ice types (pack ice vs. fast ice) may indicate different populations of ringed seals, each placing a different level of importance on each ice type (Finley *et al.* 1983). Winter habitat with pack or fast ice (depending on the population, and even the age and sex of the seal (Born *et al.* 2004), and summer habitat with opportunities for feeding, provide the most suitable habitats for ringed seals. The climatic change occurring in the Arctic may, for the short term, provide improved seal habitat as thick multi-year ice is replaced with annual ice with more leads, a key important habitat feature for ringed seals (Derocher *et al.* 2004).

Bearded Seals

Much like the ringed seals, and many of the Arctic marine mammals of Nunavut, bearded seals require sea ice for survival (DFO 2002e). Pupping, breeding and denning all occur during periods of ice cover (DFO 2002e). Bearded seals, more so than ringed or harp seals, avoid shallow open water areas, preferring floe and rotten ice (Kingsley *et al.* 1985). Populations of bearded seals in the Arctic are currently data deficient (COSEWIC 2007f) and occur throughout Nunavut. Coburg Island and the southern coast of Devon Island are areas where high densities of bearded seals occur (DFO 2002). Important Bearded seal habitat tends to be areas of natural ice cracks and re-freezing, along with polynyas, but not where walruses are abundant (Cleator and Stirling 1990 in COSEWIC 2006a). The GN has also identified northern Foxe Basin and the northeast coast of Hudson Bay as areas of high (or likely to be high) density bearded seal habitat (Appendix B, Figure 4.1-2).

Harp Seals

Harp seals are medium sized and abundant in the Eastern Arctic (Appendix B, Figure 4.1-3). They depend upon ice for pupping and breading in the winter. Their summer range, along the eastern and southern coasts of Baffin Island, extends as far north as Smith Sound, with numerous inlets and bays along the eastern coast of Baffin Island being part of their summer feeding grounds (DFO

2005). Harp seals have large populations with a wide range and limited available data on critical habitat in Nunavut. It is likely that most harp seals do not winter in Nunavut, instead migrating southward to the coast of Labrador, Newfoundland and the Gulf of St. Lawrence (DFO 2005). Defining critical habitat for harp seals requires further information and review of population numbers and structure. Availability of suitable habitat in Nunavut requires further investigation to determine the qualities of the habitat and whether or not any is present.

Walrus

Important winter walrus habitats are polynyas (Cleator and Stirling 1990 in COSEWIC 2006a). These areas have open-water and ice edge habitat, important for both hauling out and feeding (Henshaw 2003). Areas that may be important summering areas for walruses are islands in northwestern Hudson Bay, including Southampton Island and Coats Island; eastern and southeastern portions of Baffin Island (DFO 2002b; Figure 4.1-4 (Appendix B). It is difficult to define important walrus habitat because of the lack of complete or modern estimates for the populations in Nunavut. This is compounded by the geographically and temporally incomplete harvest statistics, unknown natural mortality rates or reproduction rates, and limited life span data (DFO 2002a).

Areas, based on traditional hunting data, limited population studies and research, which may have important summer or winter habitat include: Penny Strait, Ottawa Islands, Sleeper Islands, Belcher Islands, Cape Henrietta Maria, the south coast of Devon Island, Dundas Island, Rowley Island, Kane Basin, Buchanan Bay, Cornwallis Island, Grise Fiord, northern Foxe Basin, Jones Sound, Grinnel Peninsula and the south coast of Coburg Island (DFO 2002a; COSEWIC 2006b). Researchers participating in the Arctic Marine workshop (Stephenson and Hartwig 2010b) identified northern Cornwallis and Devon Island, and northern Foxe Basin as year-round concentrations of walrus.

Walruses may be the least impacted directly by the effects of climate change in the Arctic, as sea ice cover does not appear to be a critical determinant of walrus population survival, due to various areas of their habitat being essentially ice free (COSEWIC 2006b). Walruses will use land to haul out on when ice is not available, which has also been shown in the fossil record for the historical eastern Atlantic walrus populations (COSEWIC 2006b).

Narwhal

There are two separate populations of narwhal in Nunavut; the Hudson Bay and Baffin Bay populations. Each population uses a different area of Nunavut for summering and wintering (DFO 1998a, b). The two populations have similar habitat requirements throughout the year (Culik and CMS 2004). Narwhals are vulnerable to climatic change, especially in traditional wintering areas such as Baffin Bay, changes in water currents and ice formation (Laidre and Heide-Jorgensen 2005).

Important summer narwhal habitat typically includes deep fiord areas, often in Inlets, sounds or inshore bays in which the whales concentrate in waters of 350 m or more in depth (Richard *et al.* 1994; DFO 1998b). Prince Regent Inlet, Admiralty Inlet, Northern Foxe Basin and other fiords and inlets of Parry Channel, including Peel Sound, Barrow Strait and the Eclipse Sound area, are thought to be important Narwhal areas (Appendix B, Figure 4.1-5). These areas were found to have a population of approximately 18,000 Narwhals during summer months (Richard *et al.* 1994); suggesting these areas are important for Narwhal summering and feeding.

Important wintering areas, near the offshore ice pack, were identified by Dietz *et al.* (2001) and included the Southern reaches of Baffin Bay and Davis Strait, including areas such as Disko Bay (DFO 1998b). Lancaster Sound, Jones Sound and Smith Sound may be important areas for narwhal during their spring movements (DFO 1998b).

Beluga Whales

Belugas generally prefer warm, shallow bays and large river estuaries where they can congregate in large numbers during the summer months. Overwintering typically occurs amongst the pack ice, in leads and polynyas and where open water exists providing breathing holes (Doidge and Finley 1993; DFO 2002b; Goetz 2005; NAMMCO 2005).

Areas that have been identified (Appendix B, Figure 4.1-7) as important summering areas for belugas in Nunavut include (but may not be limited to): Southampton Island (most of the coastal areas), Summerset Island, Northern Foxe Basin, Prince Regent Inlet, Admiralty Inlet, Eastern Amundsen Gulf, Frobisher Bay, South Coast of Baffin Island, Clearwater Fiord, Cumberland Sound and the Arviat Area (Western Hudson Bay) (Kilabuk 1998; DFO 2002b; COSEWIC 2004a).

Off-shore, ice-filled waters are important habitat for beluga mating, although little to no information exists on the adult breeding behaviour and the habitat requirements for mating (COSEWIC 2004a). It has been found that winter areas in the Lancaster Sound and North Water Polynya area (within and on the edge of ice flows) are important habitat (Heide-Jorgensen et al 2003 in COSEWIC 2004b). Belugas found in the Cumberland Sound area may remain there all year, as they have been found though the winter (COSEWIC 2004a). Other areas of winter beluga habitat are: Hudson Strait (Western Hudson Bay Population), Northern Baffin Bay/West Coast of Greenland (Eastern High Arctic-Baffin Bay Population) and the outer reaches of Cumberland Sound (Cumberland Sound Population) (COSEWIC 2004a).

Bowhead Whale

Generally speaking, bowhead whales are often associated with ice (1 to $10/10^{ths}$) and hence inhabit these regions. Satellite tagging and modeling studies have identified several important (or predominantly used) open water regions within Nunavut (Appendix B, Figure 4.1-8). These include Prince Regent Inlet/Gulf of Boothia, Lancaster Sound, and the east coast of Baffin Island, Cumberland Sound, and northern Foxe Basin. Hudson Strait is believed to be important overwintering habitat.

Polar Bears

Polar bear distribution and important denning habitat has been identified throughout Nunavut (Appendix B, Figure 4.1-9). The Simpson Peninsula and nearby islands to the northwest have been identified as a key denning region, as 191 dens were identified by Inuit hunters from 1937 to 1969 (Van de Velde *et al.* 2003). Other more recently described areas of importance for denning are: Devon Island, Bylot Island, Twin Islands and Surprise Fiord (Nettleship and Smith 1975; EC 2008).

Summer feeding areas of importance include Cunningham Inlet and Coburg Island (Nettleship and Smith 1975; Environment Canada 2008a). The GN has identified several areas of interest for polar bears. These areas may be important summer or winter habitat and include: Hadley Bay, Gateshed Island, Bellot Strait, Wager Bay, most of the coast of Southampton Island, Hoare Bay (and nearby coastal areas) and Clyde River (and nearby coastal areas).

Polar bears require ice cover for survival, using it to raise young and travel long distances to find mates, food and/or prey (COSEWIC 2002b; Derocher *et al.* 2004; Parks *et al.* 2006; Stirling and Parkinson 2006). With the current warming trend in the Arctic, (Derocher *et al.* 2004; Stirling and Parkinson 2006; Stirling and Derocher 2007) it is important to note that habitat identified as important may change and be relocated, or may already be unsuitable (Derocher *et al.* 2004).

Killer Whales

As indicated earlier in this report, information specific to killer whales in the Canadian Arctic is lacking. Consequently no areas of importance, or higher reported density, were identified (Appendix B, Figure 4.1-6). Presumably, killer whales are more likely to occur in or near Hudson Strait during the winter, in open-water, overwintering beluga and bowhead habitat, although this has not been confirmed.

6.2.2 Fish and Invertebrates

Important or critical habitat for fish and invertebrates can include a variety of different habitats and timing considerations. In determining important habitat, understanding the life history stages and requirements of that species is required. Knowledge of a specific species relationship to the environment and biological community is also required.

Marine Habitat

Kulka *et al.* (2007) identified three factors which impeded defining critical habitat for wolffish in the north Atlantic, but these three factors can also be applied to most marine fish and invertebrates in Arctic marine waters and in particular Nunavut. The three factors that Kulka *et al.* (2007) identified for wolffish were:

1. Deficient knowledge on a species life history.
2. Limited information on the influence of multi-scale processes upon a species dynamics.
3. Lack of information on acceptable targets for an individual species' population abundance.

All three factors apply for marine fish and invertebrate species in Nunavut. There are only one or two isolated spawning locations that have been identified for arctic cod and Greenland cod however these locations only represent a very small fraction of spawning locations used by these species. There are also isolated beds of mollusks, such as blue mussels, clams and Iceland scallops which have been identified however it is unknown how common and how widely distributed these beds may be.

Important or critical habitat for marine fish will most often include spawning and rearing areas. It is important to identify and understand their physical, chemical and biological attributes to adequately describe these areas. Commercial fishing or industrial activities which impact a spawning or rearing area can have negative consequences on populations utilizing those areas. Species which exhibit nearshore migrations could also be impacted by development activities and special consideration should be given to how development occurs in nearshore areas as it can affect both marine and anadromous fish species.

Critical habitat for marine invertebrates would include spawning areas as well as areas where large aggregations of a particular invertebrate such as Iceland scallop, blue mussels or clams may be established.

Parks Canada (1995) sponsored a workshop to identify potentially important ecologically or biologically sensitive areas. They were generally areas of high productivity with high numbers of seals, whales, seabirds, or polar bears (Appendix B, Figure 6.2-1). These areas were also believed to have high abundances of marine fish species such as Arctic cod. Although most areas have not been fully described, using a precautionary approach, these areas should be considered as important habitat for marine fish and invertebrate species.

Freshwater Habitat

Areas where life history stages for freshwater fish populations are most vulnerable to impacts are areas required for spawning, rearing, feeding, migrating and overwintering. Of these spawning, rearing and overwintering are often the most important to Arctic freshwater species in terms of requiring protection. Spawning areas are often considered critical as large numbers of fish are congregated in a small area and the eggs produced are more sensitive to impact than later stages in life. Young, rearing fish are also more sensitive to perturbation than larger fish thus often making rearing areas good candidates for some level of protection. Overwintering habitat can be a limiting factor for Arctic freshwater fish species especially in smaller lakes and rivers. Species which overwinter in small rivers or lakes may be limited by the number and size of overwintering holes available to them. Impacts to these overwintering holes or activities which may move fish from these spots could have severe repercussions on a population.

Individual species exhibit different levels of tolerance to stress. Similarly different habitats exhibit varying degrees of tolerance or resilience to impacts (stress). Therefore different activities may have a greater effect if it occurs in a more sensitive habitat than it would in a less sensitive habitat (MOT 2006). It is important that a basic understanding of the resilience of important/critical habitat be known. It is also important to know the availability of similar habitat available to a species. With the exception of some Arctic char and lake trout populations in Nunavut, information on resilience and availability of habitat is largely unknown.

Knowledge of critical habitat of Arctic char in Nunavut is probably the best known and understood of all Nunavut freshwater and marine fish. Spawning, overwintering, rearing, feeding and migration locations are well known, although not necessarily reported, for rivers and lakes which are located near communities and support some form of (domestic, commercial) fishery.

Spawning, rearing and overwintering habitats for Arctic char can vary within Nunavut. Arctic char populations are known to spawn in both lakes and rivers (Hunter 1976). In the Cambridge Bay area and many areas within the central Arctic char spawn mostly in lakes as rivers in this area mostly freeze to the bottom in winter. In eastern Nunavut it is dependent on the system whether char spawn in lakes or rivers. Arctic char make 2 – 3 m diameter redds (nests) in 3 – 6 m of water depth. Overwintering areas has been described as critical habitat where overwintering holes may be small (Read 2004).

Unlike some terrestrial species such as caribou which have large ranges, critical habitat for freshwater fish species must be identified, delineated and described system by system for each species of interest.

6.2.3 Birds

In Nunavut, five Migratory Bird Sanctuaries have been created to protect important habitats for bird species. CWS defines a key habitat site as an area that supports at least 1% of the national population of any migratory bird species, or subspecies, at any given time. These five Migratory Bird Sanctuaries protect the breeding grounds of more than 75% of the eastern and central Arctic populations of the Lesser Snow Goose. These sites also protect more than 1% of the national population of other migratory bird species, including the Atlantic Brant, Ross's Goose, Sabine's Gull and Common Eider.

Habitat classification and assessment has been completed in the Queen Maud Gulf Migratory Bird Sanctuaries and is currently in progress for the Dewey Soper and McConnell River Migratory Bird Sanctuaries. These two sanctuaries are important nesting areas for geese and other migratory birds, including shorebirds and waterbirds, as well as other wildlife. A variety of digital image tools, combined with ground-truthing data, were used to prepare a land cover map of Southampton Island. This project generated a baseline geo-referenced map of the current habitat conditions of the island, which will assist in the future management of the bird populations and in the design and implementation of effective wildlife surveys. Land cover classification of East Bay and Harry Gibbons MBS on Southampton Island was recently completed.

The GN can also protect habitat under the Nunavut Parks and NWAs and some areas are protected because they fall within National Parks or National Park reserves. Land use activities are regulated under the *Territorial Lands Act* and the Territorial Land use regulations. Wildlife habitat may be withdrawn from disposition under the Act and effectively protected because development activities are not allowed. In 1995 several Wildlife Areas of Special Interest were identified and recommended as Candidate areas for designation as Wildlife Conservation Areas by the Department of Renewable Resources. Areas were identified based on their specific geographic areas which comprise important wildlife habitats (Ferguson 1995). Below are listed the six areas identified as special interest for Gyrfalcon and Peregrine Falcon.

1. Coppermine River
2. Melville Sound
3. Rankin Inlet
4. Ford Lake
5. Foxe Peninsula
6. Meta Incognita Peninsula.

6.2.4 Terrestrial Wildlife

Areas known to be important to terrestrial wildlife have been identified over time through the IBP (Section 6.1.2, Table 6.1-1), the Wildlife Areas of Special Interest (Section 6.1.2, Table 6.1-3), and those areas identified in the NWA and the NLCA as Conservation Areas (including Wildlife Sanctuaries and Special Management Areas). Caribou Protection Areas have been identified for the Beverly and Qamanirjuaq caribou, and protection measures continue to be applied within those areas as well as within the range of other caribou through tools such as caribou protection measures being applied through land use permits issued by Regional Inuit Organizations.

No comprehensive baseline descriptions have been conducted systematically on caribou habitat throughout the north, therefore any assessments of landscape change will already reflect changes that have taken place. As well there has not been a comprehensive ground assessment of the state of the landscape to assess the quality of the vegetation on these ranges. There is currently an incomplete landscape level assessment of vegetation across Nunavut using Landsat technologies however no comprehensive assessment of habitat use by caribou has been conducted.

The Caribou Protection Measures impose seasonal controls on land use operations inside Caribou Protection Areas, regions that used to be drawn yearly based on areas used by caribou during calving and post-calving periods in the previous five years. Although a telemetry collaring program has been re-established as of 2006 the current information has not been applied. Therefore no current protection of habitat can be designated at this time.

Caribou in general, live in a “non-equilibrium grazing system” where sporadic, unpredictable abiotic variables (such as snow and ice, climate variables), usually govern the distribution of the caribou over time (Caughley and Gunn 1993; Behinke 2000; Miller and Gunn 2003a). Under such environmental conditions, the broad distribution of caribou across the various climate regions has enhanced their probability of persistence. A previous assessment of three caribou ranges determined that none of the environmental characteristics examined (topography, vegetation) clearly isolates the calving grounds from the surrounding area; the general location of traditional calving grounds is likely the influence of several interacting factors including plant phenology and predator avoidance. Traditional behaviour is likely important in explaining the choice of a specific location of a calving ground (Fleck and Gunn 1982). As a result, only recently have requests been made to protect caribou habitat. As such comprehensive assessments of caribou habitat have only just begun to be investigated (Hillis and Gunn 2008; Jan Adamchewski pers. comm.).

Miller (1991) describes Peary caribou habitat as; ice fields, bare ground and rock limit the area of suitable forage for Peary caribou to a small percentage of the total area. Peary caribou use poorly to moderately vegetated dry to moist habitats. Forage of high digestibility is selected when available but when not, they eat high percentages of low digestibility forages. Summer foraging areas are on mesic habitats with sedges (*Carex* spp.), willow (*Salix arctica*), grasses and forbs, especially purple saxifrage *Saxifraga oppositifolia*). In winter, caribou use more exposed sites with shallower snow cover. On Somerset Island, winter range is mainly broken rock outcrops where snow depth is variable but usually soft and less often crusted. Winter foraging sites are xeric and vegetated with dryas (*Dryas integrifolia*), purple saxifrage, arctic willow, sedges and lichens (Miller 1991).

Caribou can travel 3 – 4 km per hour while actively foraging (Miller *et al.* 1982a). Under ideal conditions when the snow is soft and relatively shallow, the caribou forage by simply pushing the snow off the vegetation with their noses. When the snow cover is denser but still above a 'threshold hardness, they dig small individually scattered craters, unlike the large cratered areas often used by muskoxen and mainland barren-ground caribou. Once the snow cover passes a threshold hardness and greater density, the caribou seek forage at snow-free sites or at sites with only shallow fresh snow cover. Caribou will also forage by breaking blocks of hard-packed snow off edges of windblown areas to get to the vegetation.

On Banks Island, caribou often feed in winter by cratering in the snow of upland habitats (upland barrens, hummock tundra, and stony barrens) where it is softer and shallower than in wet meadows, and snow depth and hardness can be used to determine winter severity (Larter and Nagy 2000).

Schaefer and Messier (1994) described the spatial structure of plant communities in southeast Victoria Island:

1. Graminoid-dominated wet meadows (*Carex aquatilis, C. atrofusca, Eriophorum angustifolium*)
2. Wetter willow-sedge meadows (*Salix lanata, Kobresia* spp., *Arctagrostis latifolia*)
3. Mesic-hydric meltwater slopes (*Eroiphorum angustifolium* and *Cassiope tetragona*)
4. Sparsely vegetated uplands (*Poa* spp., *Carex rupestris, Saxifraga tricuspidata, Oxytropis maydelliana*)
5. Raised beaches with little vegetation
6. Mesic-xeric areas (*Carex rupestris, C. misandra, Kobresia* spp., *Dryas* spp.)
7. Xeric, highly exposed communities (*Carex ruprestris, Cetraria* spp., *Saxifraga oppositifolia*)
8. Mesic between-polygon communities (*Arctagrostis latifolia, Dryas* spp., *Oxytropis maydelliana*).

Banks Island is the only Peary caribou habitat with extensive, well-vegetated rolling hills that fall mostly within the "wet tundra class" of the satellite image-generated North American Land Cover database (Gunn and Dragon 1998). The four principal Banks Island caribou habitats are (Kevan 1974; Wilkinson *et al.* 1976; Larter and Nagy 2000):

1. Wet sedge meadows are generally level hydric and hydric lowlands characterized by water sedge (*Carex aquatilis*), cotton sedge (*Eriophorum scheuchzeri*), and tundra grass (*Dupontia fisheri*).
2. Upland barrens are well drained sites found on the upper and middle parts of slopes. Vegetation is dominated by mountain avens (*Dryas integrifolia*) and arctic willow (*Salix arctica*).
3. Hummock tundra is found on moderately steep slopes and is characterized by individual hummocks which are vegetated primarily by dwarf shrubs including mountain avens, arctic willow and arctic heather (*Cassiope tetragona*).
4. Stony barrens have a coarse gravelly substrate and are sparsely vegetated. This habitat is found on wind-blown areas, ridges and gravel and sand bars.

Calving, post-calving, and rutting areas are likely critical habitats because caribou are vulnerable as they congregate in those areas. This is a particularly important concern as the use of those areas is at times when uninterrupted foraging is important to the annual cycle of physical condition and calf growth. Cows are faithful to calving areas (Gunn and Miller 1986; Heard and Stenhouse 1992) although calving is at a lower density and more dispersed than the high densities usually described for barren-ground caribou (Gunn and Fournier 2000; Nishi and Buckland 2000). Calving site fidelity is balanced, however, by occasional range shifts within a population's traditional territories, which allows forage to recover in one area while caribou use the available forage in another part of their territory. Also, caribou may shift calving locations because of snow and ice conditions in one calving area while in search for better conditions in another. Banks Island caribou calve on the northwest and northeast tips of the island and in the mid-east coastal area across Prince of Wales Strait from Victoria Island (Larter and Nagy 2000). The Dolphin and Union population calves south of Prince Albert Sound (Gunn 1993). Aboriginal traditional knowledge suggests that the Dolphin and Union herd also calves, or used to calve, north of Prince Albert Sound (Gunn 1993).

Calving areas of the Prince of Wales-Somerset and Boothia populations have included the Wrottesley Inlet area on northwestern Boothia Peninsula, the Aston Bay area on the northwest coast of Somerset Island, the southwestern Arrow Smith Plains, the northeastern coastal area from Young Bay to Inner Browne Bay, the northwest coast and the Mount Clarendon "peninsula-like" area of northwestern Prince of Wales Island and western Russell Island (Fischer and Duncan 1976; Miller and Gunn 1978, 1980b; Miller and Kiliaan 1981; Miller *et al.* 1982b). Many caribou from Somerset Island used to cross to Prince of Wales Island for calving (Gunn and Dragon 1998).

Miller (1991) noted that in temperate region ungulate management, winter range is regarded as controlling the upper limits of population, but in the Arctic, summer range may be considered critical because of the short growing season available for caribou to build up their fat reserves. He found no evidence that either winter or summer habitats were limiting factors in terms of absolute forage availability. Peary caribou researchers are careful to distinguish between absolute forage availability and relative or seasonal availability when limited by winter snow and ice (Gunn and Dragon 1998; Milette 1998; Larter and Nagy 2000; Ferguson *et al.* 2001b; Gunn and Dragon 2002b; Miller and Gunn 2003c).

The main Barren Ground Caribou species (particularly the Beverly and Qamanirjuaq Caribou Herd) typically have seasonal migrations between the northern-forested landscapes and the lower arctic landscapes. As with many of the other mainland barren ground caribou herds, these species are sustained by habitats that exist on the northern edge of the forest landscapes, as well as the southern edges of the arctic landscapes. The two landscape settings are integral parts of the overall range of these caribou herds in which the forested landscapes tend to be more important as wintering grounds and the arctic landscapes are more important summering grounds. In the winter season, the herds (especially the Beverly herd), generally abandon the arctic areas. They migrate south and graze within the warmer and more sheltered areas of the northern forests. However, in the summer season, the arctic meadows and wetlands become productive and valued grazing areas for these herds. The arctic areas are also the main calving sites.

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7 IDENTIFICATION OF KNOWLEDGE GAPS

7.1 Identification of Monitoring Initiatives

7.1.1 Marine Mammals

Monitoring of marine mammal populations in Nunavut is conducted through harvest studies and species specific research programs. Those species recognized as a management concern (e.g., threatened bowhead whale) by COSEWIC or by SARA are monitored on a quasi-regular (e.g., every five years) basis over some parts of their range in Nunavut.

Current, long-term, population level, monitoring and research programs were not identified for ringed, bearded seals and walrus. Smaller scale, ecological research programs are undertaken by the DFO and university researchers (e.g., R. Stewart, DFO; S. Ferguson, University of Manitoba).

The Atlantic region of DFO has scheduled a harp seal population survey in 2008, largely to assess the impact of ice conditions, reproductive rates and other factors on population growth; however this is not in Nunavut waters.

Monitoring of narwhal and beluga populations in Nunavut is undertaken by the DFO (P. Richard) when funds are available and according to the order of conservation and hunt management priorities, as determined by SARA sector, Fisheries and Aquaculture Management and the NWMB. Smaller scale research on narwhal acoustics and population ecology is being conducted by researchers at McGill and Dalhousie University.

Killer whales are presently not monitored in Nunavut though efforts to collect Traditional Knowledge and community information are underway (J. Higdon, DFO). Killer whale presence in Nunavut is reportedly increasing and consequently killer whale research and monitoring is expected to increase.

Monitoring and research of bowhead whales is conducted primarily by the DFO (L. Dueck). According to SARA, monitoring frequency and extent is dictated by policy and available funding.

Monitoring and research of polar bears in Nunavut is under the purview of the CWS and GN. University researchers also study polar bears in Nunavut (A. Desrocher, University of Alberta). Polar bear management (and therefore monitoring) in Nunavut relies heavily on the harvest quota system. The GN regularly maintains a database on polar bear distribution and important habitat.

7.1.2 Fish and Invertebrates

There are only a limited number of monitoring activities occurring for freshwater and marine fish and invertebrates in Nunavut. Some of these monitoring programs may cover different water bodies annually on a rotational basis. Monitoring programs are most often related to subsistence, sport or commercial fisheries. Monitoring programs generally occur for a limited period of time and is dependent on issues or concerns raised by a particular community about a stock. Harvest monitoring of subsistence fisheries ended in 2002 with the end of the Nunavut Harvest Study.

Sport fisheries at lodges are monitored, generally through either licensing or voluntary processes in which lodge owners report catches back to the DFO and/or NWMB.

There has been an ongoing monitoring program on the Cumberland Sound winter fishery since its inception. All commercial fishing operations must report catches and effort levels back to the Department of Fisheries and Oceans.

With an increase in industrial activity, especially in the mining sector, some monitoring programs will be established to validate the effectiveness of mitigation and the accuracy of predictions regarding impacts.

7.1.3 Birds

There are currently numerous research/monitoring initiatives currently being undertaken in Nunavut on birds. The primary agency involved in these activities is the CWS. A website listing current activities by CWS (along with other agencies and organizations) in the Northwest Territories and Nunavut is available at http://www.mb.ec.gc.ca/nature/ecb/index.en.html. The following is a list of several of the projects currently being undertaken:

- Research and surveys of Ivory Gulls
- Population dynamics of Thick-billed Murres
- High-Arctic seabird studies in Lancaster Sound
- Eastern arctic seabird population monitoring
- Population size, distribution and survival of eastern Arctic geese
- NWT/Nunavut Bird Checklist Survey
- Arctic Shorebird Monitoring Program for North America.

7.1.4 Terrestrial Wildlife

Currently monitoring programs for caribou and muskox are limited. Surveys for caribou in Nunavut are conducted by both the Government of the Northwest Territories and Nunavut. From 1993 – 2009 in the Northwest Territiries, Nunavut and northern Alberta, 510 barren-ground and 39 island caribou were tracked with satellite collars (Nagy 2011). One of the most important findings from this study was that caribou did not consistently return to “traditional” calving grounds. Over time, the location of the calving grounds can shift. The management and land use implications of this finding are that shifts in caribou breeding ground may be common and areas that are suitable for calving but are currently not being used should be managed with consideration for potential future use (Nagey *et al*. 2011).

Caribou calving and post calving ground surveys have been conducted 2007 and 2008 for both the Beverly and Qamanirjuaq herds. Surveys are conducted on a five year basis or on a need to know basis (e.g., caribou population has declined). Some information is gathered from Nunavut Harvest reports. Although updated spatial data on caribou populations has been compiled by the Government of Nunavut, it was not available for inclusion in this report.

Caribou information is also collected through, Incidental observations of wildlife, recorded by PC staff and park visitors. Information collected includes: date and time of observation, name of observer, species observed, number of individuals seen, location of observation, elevation, aspect, age, sex of animal, evidence of reproduction, habitat, weather and remarks. Information from the wildlife cards is entered into a database. Summaries and maps of incidental observations for each park are produced. This information only pertains to national park areas.

There are no inventory programs to determine or estimate carnivore populations in Nunavut. There is an experimental program being conducted in the Kitikmeot region using DNA mark-recapture techniques to study wolverine and grizzly bear distribution in a local study area. Unfortunately that study has not been completed and the utility of that method for use at the population management level is unknown. Harvest records, including locations and carcass samples are collected in the Kitikmeot region. However, the use of harvest records to manage populations or determine overall distribution is not possible. Foxes and wolves are not managed or studied in Nunavut.

7.2 Identification of Key Knowledge Gaps

7.2.1 Marine Mammals

Key knowledge gaps that exist for the majority of the marine mammal species in Nunavut are the identification of critical habitat; habitat that once lost will irrevocably impact the survival of the species in question, and how the species are adapting to this habitat loss to meet their biological needs in the changing Arctic environment.

Research on Arctic marine mammals has been focused on polar bears, belugas and bowhead whales. To a lesser extent the ringed seal has also been studied, as it has a key relationship to the survival of the polar bear throughout Nunavut.

Climate change is an important and pressing topic for the Arctic environment. Understanding the effects of ice composition and water temperature changes on all arctic marine mammal species is becoming increasing important, and lacking for many species.

Key gaps that exist for Arctic marine mammal species are:

- Identification, delineation and description of important/critical habitats such as breeding and pupping areas
- Population statistics, including numbers and locations of different populations and sub-populations
- Extent of impact of climate change on habitat availability for species
- Degree of philopatry exhibited by each species, and how this has changed or is changing because of population changes, climate changes and hunting or human encroachment pressure.

7.2.2 Fish and Invertebrates

Marine

There is a paucity of information on marine species and marine habitat. Research that has been conducted has mainly focused on a few important domestically or commercially harvested species close to communities. There has also been a limited amount of research conducted in areas such as Sverdrup Basin and Lancaster Sound where industry (e.g., oil and gas exploration) were active in the past. Unfortunately, much of this data is difficult to access and is becoming dated and therefore may require validating for today's conditions.

Marine species of research focus have been arctic cod due to its ecological importance in arctic food chains, and Greenland halibut due to its economic importance. Available data on marine invertebrates such as Icelandic scallops and blue mussels are mainly due to exploratory fisheries which have occurred for these species.

There have been studies conducted on Arctic cod in all regions, but with most of this research in isolated locations within each region. No known spawning areas for arctic cod have been identified as of yet, although some areas are suspected to support spawning. Inferences from studies outside of Nunavut are often used to gain insight on how and where species are behaving or could be impacted.

Key knowledge gaps exist in basic baseline data for all marine species of fish and invertebrates.

- Distribution and composition of marine fish and invertebrates
- Identification, delineation and description of important/critical habitats such as spawning and rearing areas
- Identification, delineation and description of mollusc beds.

When data is lacking research should focus on identifying habitats most likely to be limiting based on the fishes life history (Rosenfeld and Hatfield 2006). When doing so consideration has to be given to the different life history stages of that fish and its habitats it may utilize at those different life history stages. This approach would also apply to invertebrates.

Freshwater

There is a paucity of information regarding important and critical habitat for freshwater fish species. A limited amount of data does exist for some of the more important subsistence or sport fishery species such as Arctic char and lake trout. Quality of habitat data is best for Arctic char and lake trout populations which are fished close to communities or through sport fishing operations such as lodges.

Much of the research related to freshwater fish in Nunavut has been related to stock assessment studies in support of various fisheries (Carder 1991, 1995; Read 2000; Read 2004). These assessment type reports focus on age, growth and abundance parameters and generally provide little information on habit requirements and restrictions. A fair amount of research has also been done examining contaminants in freshwater fish through the Northern Contaminants Program.

Samples for this program are often collected through subsistent or commercial fisheries but again little habitat information is provided.

The Nunavut Atlas (Riewe 1992b) provides good general information on water bodies that are fished but it is not detailed enough to reflect important or critical habitat. This information may have been captured during consultations for the Atlas and if so could be valuable to the NPC.

Much of the information on important and critical habitat of freshwater fish species is with the users of the resource. These users can often provide specific site information for different systems and species. Some of this information has been collected and reported but most has either been collected but not reported or not collected at all. There is a need to capture this data from users, record, report and map it.

Key data gaps include:

- Identification, delineation, and description of important fishing locations, spawning habitat, rearing habitat and overwintering habitat of key subsistent harvested species
- Identification, delineation, and description of spawning habitat, rearing habitat and overwintering habitat for freshwater species which are of lesser economic or social importance such as whitefish, Arctic grayling, etc.

7.2.3 Birds

For most of the birds reviewed, limited documentation exists regarding their distribution and abundance within Nunavut, thereby precluding any meaningful assessment of population trends. As a result, such trends are commonly inferred from alternate sources of data from further south in Canada and the United States. However, these may have limited applicability to Nunavut. For species with a breeding range that is partly covered by the North American Breeding Bird Survey, negative Survey trends may reflect extensive habitat alteration, but given that habitat has remained largely unchanged in most of Nunavut, it may not be reasonable to expect a similar change in the territorial population. Christmas Bird Count data is also often used to assess population trends on a regional or continental basis, but their interpretation is complicated by the limited knowledge regarding links between wintering and breeding areas, therefore it is rarely possible to draw any specific conclusions about Nunavut populations from such data. The only way to reliably assess population trends of birds in Nunavut over time would be to develop a standardized program to monitor numbers of breeding birds.

In a few cases, primarily those species with a particularly limited distribution in Nunavut, relatively accurate population estimates are known. However, other data gaps exist. For example, Ivory Gull colonies have been fairly well monitored, and the decline in their extent and size documented in detail. However, their breeding biology remains poorly understood, including the primary factors influencing nesting success and lifetime productivity (Stenhouse *et al.* 2004). Key habitat characteristics have yet to be defined for Ivory Gull at either breeding or wintering sites, limiting the potential to evaluate the suitability of habitat (Stenhouse *et al.* 2004).

For some other species at risk, detailed monitoring has been undertaken in some areas, but not for Nunavut as a whole. For example, it is suspected that additional undiscovered breeding sites may exist for Ross's Gull in Nunavut, with the population possibly as high as 100 or more pairs (COSEWIC 2007d). The Peregrine Falcon population around Rankin Inlet has been monitored closely for the past few decades, but the distribution of nesting individuals elsewhere in Nunavut is poorly known. For Eskimo Curlew, some intensive searches have been carried out at historic breeding grounds, but if the species still survives anywhere, it could well be in areas of Nunavut that have not been surveyed for wildlife.

7.2.4 Terrestrial Wildlife

7.2.4.1 Caribou

No comprehensive baseline descriptions have been conducted systematically on caribou habitat throughout the north, therefore any assessments of landscape change will already reflect changes that have taken place. As well there has not been a comprehensive ground assessment of the state of the landscape to assess the quality of the vegetation on these ranges. There is currently an incomplete landscape level assessment of vegetation across Nunavut using Landsat technologies however no comprehensive assessment of habitat use by caribou has been conducted. Scale is an issue when describing key and important caribou habitat therefore, a standardization of methodologies to describe which areas is required.

Peary Caribou Data Gaps

There is an overall need for a strategic research plan. Historical information on Peary caribou populations are lacking. Population studies have been conducted during the past 30 – 40 years but they have been limited to certain parts of the range and there have often been long periods of time between surveys. No range assessments have been conducted to determine quantity or quality of vegetation. Effects of climate change and development need to be further understood. As well conditions for initiating movement on ice and the effects of ice breaking on Peary caribou, as well as inter island use during summer needs to be further understood.

High Arctic Island Data Gaps

Collaring of Dolphin-Union caribou was conducted between 1999 and 2004; however, collaring was discontinued and has not occurred since. There is a need to establish current population status and baseline information on their habitat is unavailable. Patterns and timing of movements and conditions for ice crossings and non-ice crossing are also unavailable. Therefore, expanding the monitoring of trends in Dolphin Union caribou populations would be useful. The implications of global warming, is unknown. Cumulative effects for the Dolphin Union caribou herd are unknown relative to mining activity, oil and gas exploration and development. There is an absence of information to discriminate between effects of environmental variation and human activities.

Island Caribou Data Gaps

There is a need to establish current population status and baseline information on their habitat which is currently unavailable. Patterns and timing of movements are also unavailable. Therefore, expanding the monitoring of trends for Island caribou populations would be useful. The implications of global warming, is unknown. There is an absence of information to discriminate between effects of environmental variation and human activities. More information could be gathered on contaminants, parasites and diseases in caribou. Historical information on Island caribou populations is lacking. Population studies have been conducted sporadically, but they have been limited to certain parts of the range and there have often been long periods of time between surveys. No current range assessments have been conducted to determine quantity or quality of vegetation; as well no habitat characteristics have been defined for this group.

Mainland (Beverly/Qamanirjuak/Lorillard/Wager Bay) Data Gaps

Population estimates and status are outdated and lacking, and although several caribou have been collared as of 2006 data are unavailable to calculate a population estimate and update range information. Calving ground surveys have only recently been initiated and survey information is as of unavailable. A cumulative effects assessment is needed for major herds, as well as the potential effects of fire, development, habitat quantity and quality on all ranges. Outdated Caribou Protection Measures are being included in terms and conditions of land use permits, which means that any protection they provide to caribou occurs by chance, rather than by design. Even if they are effective, the Measures were meant to minimize disturbance to caribou, not to provide habitat protection, and to minimize disturbance resulting only from exploration—not development. The Nunavut government has identified six gaps that need to be addressed and these include; population monitoring using scientific and ground surveys; surveys of parasitic loads and the effects of parasitism and disease on caribou populations; comprehensive mapping of habitat to monitor the effects of habitat change; improve the understanding of predator-prey relationships; further documentation of traditional knowledge; cease the development of large scale commercial harvesting.

7.2.4.2 Muskox

In general, there is quite a discrepancy in the rate of harvest (variation from 0.7 to 9.2%) among the different management zones. To justify such a discrepancy in the quota setting, there should be clear management objectives linked with each rate of harvest for muskox. Detailed demographic information is not available for eastern arctic mainland muskoxen populations therefore it is difficult to set quotas without recruitment data. A Nunavut musk ox management plan should be a priority to orient research and provide the necessary background and rational to management decisions and actions. The management plan should recognize the regional specificity in term of environmental conditions, muskoxen behaviour and ecology, and harvest practices. Hunting seasons should be adapted for local conditions in order to accommodate for both musk ox life-cycle and hunter’s access to hunting grounds. It’s during the summer and rut that females are increasing their fat reserves (White *et al.* 1989; Adamczewski 1995). Reproduction success is positively related with fatness of the female (Adamczewski *et al.* 1998). Quota and non-quota limitations are linked with each other and if harvest is allowed during the sensitive periods of a species biological cycle, then quotas should be more conservative.

Also, for communities organizing muskox sport hunts, there should be a clear understanding that removing the dominant bulls from the population has some consequences and that in order to sustain this activity, they should avoid the critical period of grouping and rutting. Moreover, muskox bulls' movements seem to be the main factor for colonizing new area and for re-colonizing historic range (Smith 1989). It seems that migratory or exploratory movements by bulls could be driven by the competition for harems (where bulls that cannot find a harem would colonize new area). This means that bulls' survival may play a critical role in the rate of re-colonization. Currently, seasons vary among management zones and type of users. There is no clear background for this discrepancy and they are difficult to defend in a global musk ox management strategy.

There is more and more pressure to develop commercial muskox harvest (meat, leather, qiviuq, sport hunts). This development will bring a new dimension to the management of muskox populations. As the pressure on muskox population increases, the risk of decline may increase. The loss of habitat may also become an issue as development increases in the territory and nothing is known about the impacts of developments and associated structures on muskox populations. However the reduction of muskox population densities may also limit the impact of epizootics and overgrazing.

7.2.4.3 Carnivores (e.g., Grizzly Bear, Wolf, Wolverine, Fox)

There are no inventory programs to determine or estimate carnivore populations in Nunavut. There is an experimental program being conducted in the Kitikmeot region using DNA mark-recapture techniques to study wolverine and grizzly bear distribution in a local study area. Unfortunately that study has not been completed and the utility of that method for use at the population management level is unknown. Harvest records, including locations and carcass samples are collected in the Kitikmeot region. However, the use of harvest records to manage populations or determine overall distribution is not possible. Foxes and wolves are not managed or studied in Nunavut.

8 CONCLUSIONS AND RECOMMENDATIONS

The current state of information on important and critical wildlife habitat in Nunavut presents challenges to the NPC in developing land use plans. In many cases detailed site specific information is lacking, which prevents a comprehensive analysis of potential land uses, conflicts and solutions. This situation will also hamper planning partners during plan approval where they need to satisfy themselves that all necessary information has been considered. Due to the large amount of gaps in information on wildlife and their habitat, a practical and systematic approach will be required to begin addressing these gaps. No one agency or government has the funding or capacity to begin addressing all the data gaps which now exist. Priorities for research need to be established, for example priority might be given to address gaps on species utilized by communities first and, secondly, habitat which may be affected through pending industry activity. Utilizing knowledge of the users of wildlife resources will aid in filling a number of existing gaps in a timely and cost effective manner. While the data gaps will hamper the preparation of land use plans, the lack of baseline wildlife habitat information will prevent accurate monitoring of the health of the ecosystemic environment as envisioned under Article 12.7.6 of the NLCA. The NPC and its planning partners need to determine how the data gaps will be addressed to meet planning and monitoring requirements in Nunavut.

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APPENDIX A

Wildlife Species Present in Nunavut

Appendix A: Wildlife Species Present in Nunavut

Species Group	Common Name	Focal Species
Birds- seabirds	Ivory Gull	yes
Birds- seabirds	Ross' Gull	yes
Birds- gamebirds	Ptarmigan	yes
Birds- raptors	Gyrfalcon	yes
Birds- raptors	Golden Eagle	yes
Birds- raptors	Snowy Owl	yes
Birds- raptors	Peregrine Falcon	yes
Birds- raptors	Short eared owl	yes
Birds- raptors	Roughlegged Hawk	yes
Birds- raptors	Northern Goshawk	yes
Birds- seabirds	Black guillemot	yes
Birds- seabirds	Dovekie	yes
Birds- seabirds	Atlantic Puffin	yes
Birds- shorebirds	Black-bellied Plover	yes
Birds- shorebirds	American Golden Plover	yes
Birds- shorebirds	Ruddy Turnstone	yes
Birds- shorebirds	Red Knot	yes
Birds- shorebirds	Sanderling	yes
Birds- shorebirds	Semipalmated Sandpiper	yes
Birds- shorebirds	Buff-breasted Sandpiper	yes
Birds- shorebirds	Wilson's Snipe	yes
Birds- shorebirds	Red Phalarope	yes
Birds- shorebirds	Eskimo Curlew	yes
Birds- songbirds	American Tree Sparrow	yes
Birds- songbirds	Harris's Sparrow	yes
Birds- songbirds	White-crowned Sparrow	yes
Birds- songbirds	Snow Bunting	yes
Birds- songbirds	Rusty Blackbird	yes
Birds- waterfowl	Common Eider	yes
Birds- waterfowl	King Eider	yes
Birds- waterfowl	Harlequin Duck	yes
Birds- waterfowl	Ross Goose	yes
Birds- waterfowl	Snow Goose	yes
Birds- waterfowl	canada goose	yes
Freshwater Fish	Northern pike	yes
Freshwater Fish	Lake chub	
Freshwater Fish	Longnose sucker	
Freshwater Fish	White sucker (?)	
Freshwater Fish	Burbot	yes
Freshwater Fish	Threespine stickleback	
Freshwater Fish	Ninespine stickleback	
Freshwater Fish	Trout-perch (?)	
Freshwater Fish	Arctic grayling	yes
Freshwater Fish	Arctic char	yes
Freshwater Fish	Lake trout	yes
Freshwater Fish	Slimy sculpin	yes
Freshwater Fish	Spoonhead sculpin	

Appendix A: Wildlife Species Present in Nunavut

Species Group	Common Name	Focal Species
Freshwater Fish	Lake herring	yes
Freshwater Fish	Arctic cisco	
Freshwater Fish	Least cisco	
Freshwater Fish	Lake whitefish	yes
Freshwater Fish	Broad whitefish	yes
Freshwater Fish	Round whitefish	
Freshwater Fish	fourhorn sculpin	yes
Freshwater Fish	Northern Pike	yes
Marine Invertebrate	Green sea urchin	yes
Marine Invertebrate	Sea cucumbers	
Marine Invertebrate	Euphasids	
Marine Invertebrate	Squid	yes
Marine Invertebrate	Octopus	
Marine Invertebrate	Blue mussel	yes
Marine Invertebrate	Clams	yes
Marine Invertebrate	Icelandic scallops	yes
Marine Invertebrate	Whelks	yes
Marine Invertebrate	Northern shrimp	yes
Marine Invertebrate	Striped Pink shrimp	yes
Marine Invertebrate	Snow crab	yes
Marine Invertebrate	Brachyuran crab	
Marine Fish	Capelin	yes
Marine Fish	American sand lance	
Marine Fish	Northern sand lance	
Marine Fish	Rainbow smelt	
Marine Fish	Fourhorn sculpin	yes
Marine Fish	Greenland halibut	yes
Marine Fish	Atlantic herring	
Marine Fish	Pacific herring	
Marine Fish	Starry flounder	yes
Marine Fish	Eelpout	
Marine Fish	Snailfish	
Marine Fish	Roughhead grenadier	yes
Marine Fish	Arctic cod	yes
Marine Fish	Polar cod	
Marine Fish	Greenland cod	yes
Marine Fish	Atlantic cod	yes
Marine Fish	Fourhorn sculpin	yes
Marine Fish	Arctic sculpin	
Marine Fish	Shorthorn sculpin	
Marine Fish	Arctic staghorn sculpin	
Marine Fish	Twohorn sculpin	
Marine Fish	Spatulate sculpin	
Marine Fish	Bigeye sculpin	
Marine Fish	Ribbed sculpin	
Marine Fish	Greenland shark	yes
Marine Fish	Thorny skate	yes

Appendix A: Wildlife Species Present in Nunavut

Species Group	Common Name	Focal Species
Marine Fish	Arctic skate	yes
Marine Fish	Northern wolffish	yes
Marine Fish	Atlantic wolffish	yes
Marine Fish	Spotted wolffish	yes
Marine Mammal	polar bear	yes
Marine Mammal	walrus	yes
Marine Mammal	ringed seal	yes
Marine Mammal	bearded seal	yes
Marine Mammal	harp seal	yes
Marine Mammal	Beluga Whale	yes
Marine Mammal	Bowhead Whale	yes
Marine Mammal	Narwhal	yes
Marine Mammal	killer whale	yes
Terrestrial mammals	Peary Caribou	yes
Terrestrial mammals	Barrenground caribou	yes
Terrestrial mammals	Muskox	yes
Terrestrial mammals	Grizzly Bear	yes
Terrestrial mammals	Black bear	
Terrestrial mammals	Arctic Fox	yes
Terrestrial mammals	Wolf	yes
Terrestrial mammals	Wolverine	yes
Terrestrial mammals	Ermine	
Terrestrial mammals	Lemming	
Terrestrial mammals	Arctic hare	