NUNAVUT WILDLIFE MANAGEMENT BOARD
Agenda: Regular Meeting No. RM 002-2019
Wednesday, June 19, 2019 (9:00 AM to 7:45 PM)
Ottawa, ON

Time of Day	No:	Item:	Tab:	Presenter:	Maximum Time
9:00 AM to 9:05 AM	1	Call to Order		Chairperson	5 minutes
9:05 AM to 9:10 AM	2	Opening Remarks and Introductions		Chairperson	5 minutes
9:10 AM to 9:15 AM	3	Agenda: Review and Approval	1	Chairperson	5 minutes
		Department of Environment- GN (GN-DOE): Issues/Decisions			
9:15 AM - 10:00 AM	4	Modifying the Total Allowable Harvest for Southampton Island Caribou	2	GN-DOE	45 minutes
		BREAK			15 minutes
10:15 AM - 10:45 AM	5	Modifying the Total Allowable Harvest for Muskox in Management Unit MX-08	3	GN-DOE	30 minutes
10:45 AM - 11:15 AM	6	Modifying the Total Allowable Harvest for Muskox in Management Unit MX-09	4	GN-DOE	30 minutes
		Kugluktuk Angoniatit Association (HTO): Issues/Decisions			
11:15 PM - 11:45 PM	7	Bluenose East Community Caribou management Plan	5	HTO	30 minutes
		LUNCH			1hr &15 minutes
		Qikiqtaaluk Wildlife Board (QWB): Issues/Decisions			
1:00 PM - 1:30 PM	8	Amendment of the Total Allowable Harvest for Baffin Island Caribou	6	QWB	45 minutes
		Kitikmeot Regional Wildlife (KRWB): Issues/Decisions			
1:300 PM - 2:15 PM	9	Request for Five Grizzly Bear Sport Hunts Tags	7	KRWB	30 minutes
		Fisheries and Oceans Canada (DFO): Issues/Decisions			
2:15 PM - 3:00 PM	10	Integrated Fishery Management Plan for Greenland Halibut (Turbot)-2019	8	DFO	45 minutes
		BREAK			15 minutes
		Fisheries and Oceans Canada (DFO) - continued			

3:15 PM - 4:00 PM	11	Nunavut and Nunavik Fishing Allocations in Davis Strait West (DSW) and Nunavut/ Nunavik East--**item withdrawn by proponent**.	9	DFO	45 minutes
4:00 PM - 4:30 PM	12	Review of Nunavut and Nunavik fisheries by the USA under import provisions of the Marine Mammal Protection Act (MMPA)	10	DFO	30 minutes
4:30 PM - 5:00 PM	13	Development of Nunavut Fishery Regulations	11	DFO	30 minutes
5:00 PM - 5:45 PM	14	Tuvaijuittaq Marine Protected Area Proposal	12	DFO	45 minutes
		BREAK			15 minutes
		Environment and Climate Change Canada (EC): Issues/Decisions			
6:00 PM - 6:30 PM	15	Action Plan for the Porsild's Bryum in Canada, pursuant to the *Species at Risk Act (SARA)*	13	ECCC	30 minutes
6:30 PM - 7:10 PM	16	National Polar Bear Management Plan information	14	ECCC	45 minutes
7:10 PM - 7:40 PM	17	Verbal updates on the modernization of the Migratory Birds Regulations and the Wildlife Area Regulations	15	ECCC	30 minutes
7:40 PM - 7:45 PM	18	Adjournment		Chairperson	5 minutes

SUBMISSION TO THE

NUNAVUT WILDLIFE MANAGEMENT BOARD

FOR

Information: **Decision: X**

Issue: Status of the Southampton Island barren-ground caribou population

Background

- Barren-ground caribou (*Rangifer tarandus*) were introduced onto Southampton Island (SHI) from Coats Island in 1968, following their extirpation from SHI in the early 1950s.
- The herd grew for 30 years and supported a subsistence and commercial harvest through the 1990's.
- Beginning in 2003, the SHI caribou started to decline and by June 2011, had declined to levels unable to sustain the existing subsistence harvest.
- The main cause of the decline was likely a combination of a reproductive disease termed *Brucella suis* (Brucellosis), and a new harvest pressure to meet the demand for caribou meat sales on social media, starting in 2011.
- Brucellosis is known to cause reproductive declines within caribou populations, negatively impacting birth rates in females, and male fertility.
- Intra-territorial sales of caribou meat on social media, from SHI to primarily Baffin Communities, accelerated the decline in 2010 and 2011.
- Management actions have proven effective thus far but all co-management partners are concerned about finding a way to control the intra-territorial sale of caribou meat.
- Since 2011, the SHI caribou herd has declined at an estimated rate of 9% per year, apart from an observed increase between 2013 and 2015. A TAH of 1000 animals was introduced in 2012 to reduce the rate of decline.
- During consultations in 2015, the Coral Harbour Hunters and Trappers Organization (HTO) supported a motion to increase the Total Allowable Harvest (TAH) from 1,000 to 1,600 caribou: 1,500 to be dispersed amongst the community (6 per household) and an additional 100 to be put aside for special management purposes, as required by the HTO.

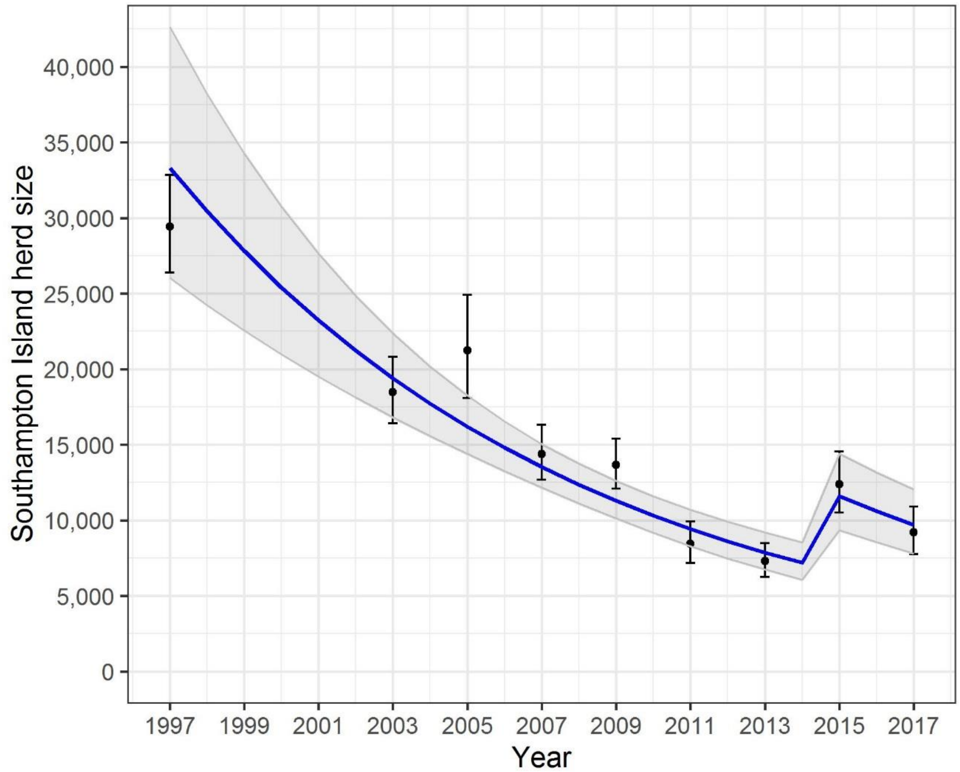

Figure 1. – Trends of the Southampton Island caribou population.

Current Status

- The SHI caribou population increased from an estimated 7,284 caribou in May 2013, to 12,319 caribou in May 2015, and then significantly decreased to an estimated 8,436 adults and yearlings by May 2017.
- Both the Department of Environment (DOE) and the Coral Harbour HTO, believe the 2015 increase is at least in part related to an immigration event detected by Coral Harbour hunters in the winter of 2013-14 from mainland Nunavut.
- Declines between the May 2015 and 2017 abundance surveys are thought, by the Coral Harbour HTO, to be due to hard winters and times of significant icing since the 2015 abundance survey.
- DOE is continuing to assess genetic profiles of recent caribou samples with pre-immigration samples, in an attempt to confirm this immigration event and the herd(s) involved.
- The DOE will conduct an abundance survey of the Southampton Island barren-ground caribou population in early May, 2019.

Consultations:

- The 2017 caribou population re-assessment estimated a significant decline though no management action was sought until the fall of 2018 due to delays in the analysis of abundance survey results.
- Once informed of the continued decline, the Coral Harbour HTO moved to have their membership voluntarily reduce their TAH from 1,600 back to 1,000 caribou. This voluntary reduction in TAH had mixed success.
- Consultations in January 2019 revealed community and HTO concerns for the status of the herd and a need to reduce the TAH.
- In February 2019, the Coral Harbour HTO requested the DOE work with the Nunavut Wildlife management Board to have the current TAH reduced to 1,000 and to conduct another abundance estimate in May 2019.

Recommendation

- Based on a continued declining trend, and consultation with the Coral Harbour HTO, the Department of Environment recommends a decrease in the TAH of Southampton Island caribou from 1,600 to 1,000 for the 2019-20 harvest season.

Executive Summary:

Long-term trends in abundance and distribution of the Southampton Island caribou herd: 1978-2017

Barren-ground caribou (*Rangifer tarandus*) were introduced onto Southampton Island (SHI) from Coats Island, in the Kivalliq Region of Nunavut, in 1968, following their extirpation from SHI in the early 1950s. This demographic study illustrates large fluctuations in abundance and distribution of caribou on SHI since its re-occupation. The SHI caribou herd grew from the 48 animals introduced in 1968 to an estimated population of 30,381 animals (+/- 3,982, 95% CI) by June 1997, with an annual rate of increase of approximately 23%. The SHI herd supported a subsistence harvest beginning in 1978, and a largescale commercial harvest beginning in 1993. After nearly 30 years of growth, herd abundance declined from the estimated 30,381 in June 1997 to 20,582 (95% CI=3,065; CV=0.075) in June 2005, to 15,452 (95% CI=1,858; CV=0.061) in June 2007, to 13,953 (95% CI=1,790; CV=0.065) in June 2009, to 7,903 (95% CI=1,261; CV=0.081) in June 2011, and then to 7,287 (95% CI=1,045; CV=0.073) in May 2013. By May 2015, the population had increased again to 12,297 (95% CI = 1,844; CV = 0.076). However, by 2017, the population had declined again to 9,887 (95% CI = 1,438; CV = 0.080). During the decline caribou distribution gradually concentrated into a core area within the south-central portion of the Island in the vicinity of the Kirchoffer River. Harvest estimates over the same periods varied widely. Following the 2011 survey, an annual Total Allowable Harvest (TAH) of 1,000 caribou was applied over the 2012, 2013, and 2014 harvesting seasons. Following the population increase detected in 2015, the TAH was increased to 1,600 caribou annually then dropped by the community of Coral Harbour to 1,000 caribou following the 2017 estimated declines. Susceptibility to disease and parasites due to low genetic heterogeneity has been a concern since the introduction of caribou to SHI, and was a likely catalyst to the wide spread infection of caribou with *Brucellosis suis* first detected in the population February 2000. Prevalence of Brucellosis climbed from 1.7% in February 2000 to 58.8% in March 2011 and this increase is thought to have contributed to decreased pregnancy rates over the same period. Pregnancy rates dropped from a high of 93.1% in February 2001 to a low of 37% in March 2011. Trend analysis suggests that the SHI caribou population has been decreasing at a rate of 9% per year since the 1997 survey. A genetic analysis and local knowledge confirmed the occurrence of a movement event between the mainland and SHI between the winters of 2014 and 2015 which likely increased the population. However, comparison of the 2015 and 2017 survey estimates suggests the 9% decline continued over the two to three years following this event. Given the continual and steep nature of the decline, combined with the reliance of users on this population for subsistence and commercial harvesting purposes, a reduction in TAH is recommended to reduce the rate of decline and maintain the population over the long term.

Long-term trends in abundance and distribution of the Southampton Island caribou herd: 1978 – 2017

Government of Nunavut
Department of Environment
Final report to the Nunavut Wildlife Management Board
June 2019

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Version: 30 April 2019

Abstract:

Barren-ground caribou (*Rangifer tarandus*) were introduced onto Southampton Island (SHI) from Coats Island, in the Kivalliq Region of Nunavut, in 1968, following their extirpation from SHI in the early 1950s. This demographic study illustrates large fluctuations in abundance and distribution of caribou on SHI since its re-occupation. The SHI caribou herd grew from the 48 animals introduced in 1968 to an estimated population of 30,381 animals (+/- 3,982, 95% CI) by June 1997, with an annual rate of increase of approximately 23%. The SHI herd supported a subsistence harvest beginning in 1978, and a largescale commercial harvest beginning in 1993. After nearly 30 years of growth, herd abundance declined from the estimated 30,381 in June 1997 to 20,582 (95% CI=3,065; CV=0.075) in June 2005, to 15,452 (95% CI=1,858; CV=0.061) in June 2007, to 13,953 (95% CI=1,790; CV=0.065) in June 2009, to 7,903 (95% CI=1,261; CV=0.081) in June 2011, and then to 7,287 (95% CI=1,045; CV=0.073) in May 2013. By May 2015, the population had increased again to 12,297 (95% CI = 1,844; CV = 0.076). However, by 2017, the population had declined again to 9,887 (95% CI = 1,438; CV = 0.080). During the decline caribou distribution gradually concentrated into a core area within the south-central portion of the Island in the vicinity of the Kirchoffer River. Harvest estimates over the same periods varied widely. Following the 2011 survey, an annual Total Allowable Harvest (TAH) of 1,000 caribou was applied over the 2012, 2013, and 2014 harvesting seasons. Following the population increase detected in 2015, the TAH was increased to 1,600 caribou annually then dropped by the community of Coral Harbour to 1,000 caribou following the 2017 estimated declines. Susceptibility to disease and parasites due to low genetic heterogeneity has been a concern since the introduction of caribou to SHI, and was a likely catalyst to the wide spread infection of caribou with *Brucellosis suis* first detected in the population February 2000. Prevalence of Brucellosis climbed from 1.7% in February 2000 to 58.8% in March 2011 and this increase is thought

to have contributed to decreased pregnancy rates over the same period. Pregnancy rates dropped from a high of 93.1% in February 2001 to a low of 37% in March 2011. Trend analysis suggests that the SHI caribou population has been decreasing at a rate of 9% per year since the 1997 survey. A genetic analysis and local knowledge confirmed the occurrence of a movement event between the mainland and SHI between the winters of 2014 and 2015 which likely increased the population. However, comparison of the 2015 and 2017 survey estimates suggests the 9% decline continued over the two to three years following this event. Given the continual and steep nature of the decline, combined with the reliance of users on this population for subsistence and commercial harvesting purposes, a reduction in TAH is recommended to reduce the rate of decline and maintain the population over the long term.

Key words: Commercial harvest, barren-ground caribou, caribou, *Rangifer tarandus*, Southampton Island, Coral Harbour, Kivalliq, disease, *Brucellosis suis*, Nunavut, population survey, demographic studies.

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1.0 Introduction

Following the extirpation of caribou from Southampton Island (SHI) in the early 1950s, there was much discussion regarding their re-introduction as well as recognition of the careful husbandry that must go hand in hand with any such program (MacPherson, 1967). Discussions continued up until 1967 at which time Northwest Territories Commissioner Stuart Hodgson along with D.S. Munro, Director of the Canadian Wildlife Service (CWS), made the decision to move forward with the reintroduction of caribou to SHI. The target group for the source population was the Coats Island Herd, due to its close proximity and ecological and environmental similarities to Southampton Island. Regional Superintendent A. G. Loughery and Research Supervisor A.H. MacPherson began implementation of the program on June 7th, 1967. The very first animals on Southampton Island following their extirpation, were these 48 animals captured and transported from Coats Island.

From their start on Southampton Island, caribou were watched closely by wildlife officials. The first evidence of the success of the introduction was communicated by the game Management Officer Ed Bowden who estimated between 100 and 125 caribou ranging over the southern half of the island in the winter of 1971 (Game Management Files, 1971, 1972, 1973). The success of the re-introduction was soon realized and an aerial survey to estimate the population planned for June 1978. From 1978 to 1999 the Government of the Northwest Territories managed the progress of the 1948 reintroduction of caribou. With its formation in 1999, the Government of Nunavut (GN) took over this responsibility. The current GN management strategy follows a management plan developed in partnership with the Coral Harbour HTO and consists of a program relying upon regular aerial surveys and an extensive health monitoring program. Due to confirmed declines following the 2011 population estimate, the health monitoring component of population monitoring of the SHI herd, which included a one hundred animal harvest for the assessment of health and condition, has been suspended to allow all available tags to go to the hunters of Coral Harbour.

The introduced caribou had steadily increased to an estimated population of 30,381 animals (95% CI=3,982; CV=0.066) in 1997, which represented the highest number of caribou ever recorded on the island. The 1997 estimate suggested a rate of increase of 23% between survey periods. However, the potential for a founder effect for this introduced population, leading to low genetic variability and increased susceptibility to disease and parasites was a concern. In February 2000, the reproductive disease *Brucellosis suis* was detected and grew to a prevalence of 58.8% by February 2011. High rates of *Brucellosis* in the population are thought to have been the main catalyst behind later declines observed following the June 1997 survey (Campbell, 2015). An aerial population survey conducted in 2003 detected the first decline of caribou since their introduction, showing a population estimate of 17,981 +/- 2,127 (95% CI=2,127; CV = 0.06) animals. The population remained relatively stable, or increased slightly, between June 2003 and a follow-up survey flown in June 2005. The June 2005 abundance survey estimated 20,582 +/- 3,056 (95% CI=3,056; CV=0.075), but the observed increase from 2003 results was not found to be statistically significant. The first evidence of a significant drop in abundance was recorded between June 2005 and June 2007 when survey results estimated 15,452 (95% CI=1,858; CV=0.06) caribou. This suggested a 14% decline from the June 1997 estimate (Campbell, 2015). The SHI caribou population continued its decline to 13,953 (95% CI=1,790; CV=0.07) in 2009, and to 7,902 (95% CI=1,261; CV=0.08) in June 2011. Following the introduction of a Total Allowable Harvest (TAH) by the 2012 harvesting season, the decline slowed and by May 2013, abundance was statistically stable at an estimated 7,287 (95% CI=1,045; CV=0.07) caribou (Campbell, 2015).

Over this same period, body condition did not appear to change, with the exception of a condition study in February and March of 2011 which showed that the Southampton Island Herd was in the poorest condition reported since the initiation of the health monitoring program in March 1993 (Campbell, 2015). During the winters of 2010 and 2011, hunters reported numerous freezing rain events and extensive icing across the island. These icing events likely made winter forage less accessible to caribou (Tyler, 2010). Icing events that reduced accessibility to food could also have been associated with observed declines in condition, which further reduced reproductive success (Cameron et al. 1993, Gerhart et al. 1997). Support for this hypothesis stemmed from numerous local reports of starving and dead caribou during mid to late winter 2011 (Campbell, 2015).

Along with severe weather events, reproductive disease is thought to be a major contributor to overall population declines. Pregnancy rates declined from approximately 80% in 1997, to 60% in 2003, reaching a low of 36.3% in 2008, then climbing to 55.6% in 2010 only to decline again to 37.0% in 2011 (Campbell, 2015). The reproductive disease *Brucellosis suis* (Brucella) was first detected in February 2000 at a rate of 1.7% and by March 2011, rates of infection had risen to 58.8% by March 2011 (Campbell, 2015). High Brucella infection rates raised concerns regarding human health, as well as the ability of the SHI caribou herd to sustain and recover from substantial commercial harvesting and subsistence harvesting pressures.

Brucellosis and icing events are not the only issues threatening the SHI caribou population. Over-harvest has become a dominant threat to the long term sustainability of this population. In particular, a growing export market within Nunavut territory, driven in large part through caribou meat sales via social media, has been driving harvest levels beyond sustainable limits since 2011. Elements of the unrestricted sale of caribou meat are also driving increased harvest pressure on breeding females: customers on social media offer higher payment for fat caribou, which during the winter and spring seasons are predominantly pregnant females.

In this report we summarize the findings of over 20 years of monitoring on the SHI caribou herd and discuss trends in abundance, disease, harvest, and other long-term threats to the herd and their implications for management of this population.

2.0 Study Area

At 43,000 km^2, Southampton Island is the largest island in Hudson Bay. The island is divided into the Northern and Southern Arctic ecozones. The Northern Arctic ecozone covers White Island, and the northeastern third of Southampton Island including northern Bell Peninsula and can be further divided into the Boothia-Foxe Shield eco-province and then the Wager Bay Plateau ecoregion (**Figure 1**).

The Wager Bay Plateau ecoregion covers the northeastern Kivalliq Region, extending westward from the northern portion of Southampton Island on Hudson Strait to Chesterfield Inlet in the south, and as far west as the Back River (Wiken, 1986; Natural Resources Canada, 2001). The mean annual temperature is approximately -11°C with a summer mean of 4.5°C and a winter mean of -26.5°C. The mean annual precipitation ranges from 200 to 300 mm. This ecoregion is classified as having a low Arctic ecoclimate and is characterized by a discontinuous cover of tundra vegetation, consisting mainly of dwarf birch (*Betulaglandulosa*), willow (*Salix spp*.), northern Labrador tea (*Ledumdecumbens*), mountain avens (*Dryas integrafolia)*, and *Vaccinium* spp. Taller dwarf birch, willow, and alder (*Alnusspp.*) occur on warm sites, while wet sites are dominated by willow and sedge (*Carex spp*.). Lichen-covered rock outcroppings are prominent throughout the ecoregion. This ecoregion is composed of massive Archean rocks of the Canadian Shield that form broad, sloping uplands, plains, and valleys. It rises gradually westward from Chesterfield Inlet to 600 m ASL (above sea level) elevation, where it is deeply dissected. Turbic and static cryosols developed on discontinuous, thin, sandy moraine and alluvial deposits are the dominant soils in the ecoregion, while large areas of regosolic static cryosols are associated with marine deposits along the coast. Permafrost is continuous with low ice content. Naujaat and Baker Lake are the main settlements within the ecoregion (Wiken, 1986; Natural Resources Canada, 2001).

The Southampton Island Plain ecoregion includes the remainder of Southampton Island and all of Coats and Mansel Islands (**Figure 1**). The mean annual temperature is approximately -11°C with a summer mean of 3°C and a winter mean of -24.5°C. The mean annual precipitation ranges from 200 to 300 mm (Wiken, 1986; Natural Resources Canada, 2001). This ecoregion is classified as having a low Arctic ecoclimate and is characterized by a nearly continuous cover of low Arctic shrub tundra vegetation, consisting of dwarf birch, willow, northern Labrador tea, mountain avens, and *Vaccinium* spp. Wet sites are dominated by willow, sedge, and moss. The region is composed of the partly submerged blanket of flat-lying Paleozoic carbonate rocks and is generally less than 90 m ASL in elevation. Bedrock outcrops are common. Static and turbic cryosols developed on level to undulating morainal and marine deposits are the dominant soils. The maritime influence is limited to the late summer and early fall. Coastal ice and fog persist for long periods in the summer when the sea ice is absent. The ecoregion is underlain by continuous permafrost with medium ice content composed of ice wedges. Coral Harbour is the largest settlement within this ecoregion (Wiken, 1986; Natural Resources Canada, 2001).

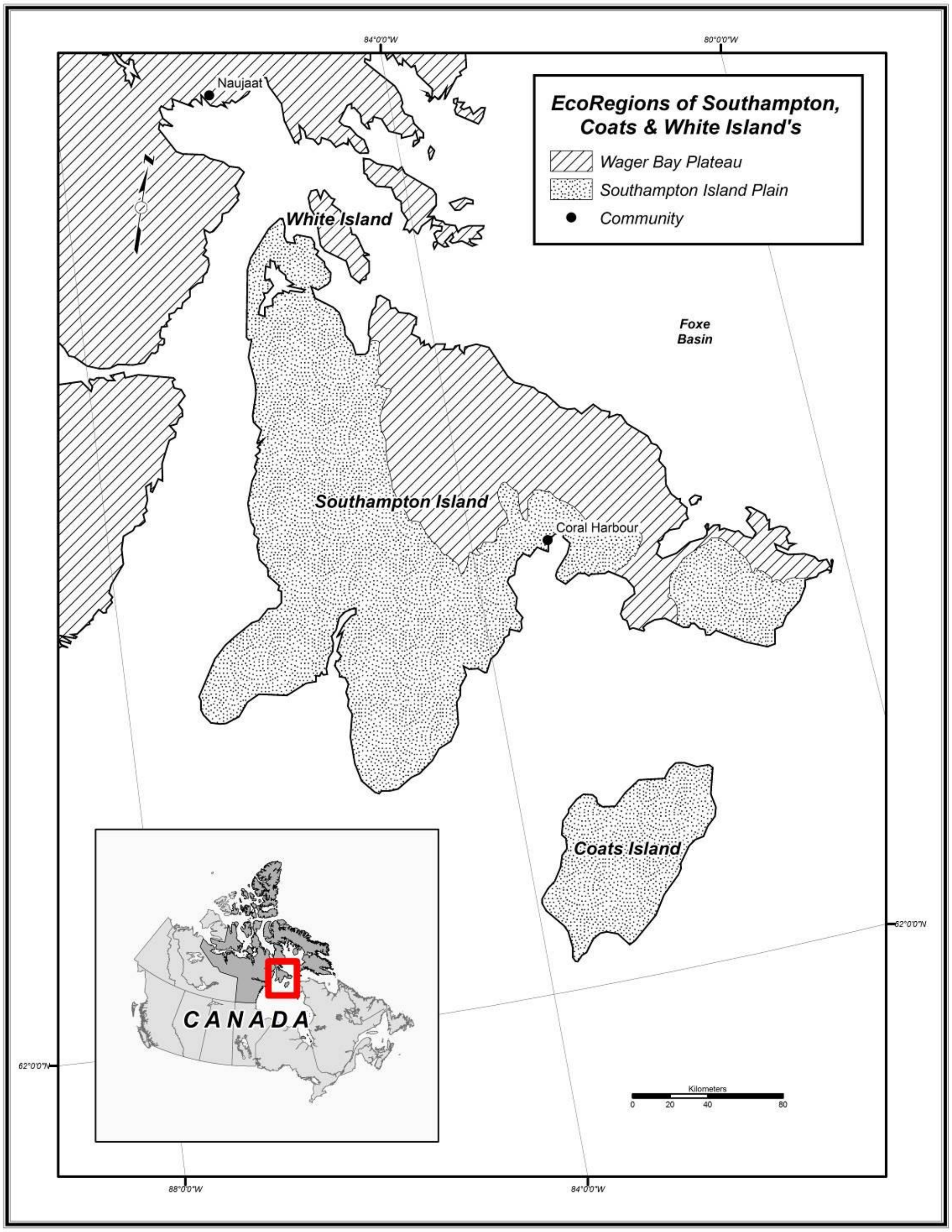

Figure 1 Ecoregions of the Southampton Island, Coats Island and White Island study areas (Wiken, 1986; Natural Resources Canada, 2001).

3.0 Methods

3.1 Caribou Introduction (1967) – An Historical Account:

Caribou reintroduced to Southampton Island from the Coats Island Herd were initially immobilized from a G2 helicopter using a CO_2 gas-operated Palmer 'Cap-chur' gun and both 2 cc and 5 cc darts. The darts used during the initial capture contained a pre-measured dose of crystalline succinylcholine ('Anectine') dissolved in isotonic water at a concentration of 5mg/cc and administered at a rate of 5 mg per 100 pounds (Eskimo 1968). The tranquillizer 'Largactil' at a concentration of 25 mg/cc and a dosage of 125mg per 100 pounds was used to maintain immobility. Up to seven animals were captured in this way, per day. Captured animals were taken to a base camp with an enclosure on Coats Island, where they were weighed, medicated with Vitamin E and Selenium, as well as an antihistaminic and anti-biotic, injected into the shoulder. Animals were held for up to one week. From the enclosure, animals were re-captured for transport by roping or tackling, tied up in slings, tranquillized and placed in single and twin Otter fixed wing aircraft for their final transport and release onto Southampton Island, in the vicinity of the airport. In total, 66 caribou, comprising 12 bulls, 26 cows (one pregnant), and 10 calves (8 male and 2 female), were captured and released onto Southampton Island. Of the original 66, 18 animals died, two from dart wounds, two from broken legs, and six from what appeared to be capture myopathy (CWS correspondence, 1969; Eskimo 1968). Reasons for the remaining eight deaths do not appear in the records examined. In total, 48 animals survived the reintroduction and make up the founding group of Southampton Island's reintroduced caribou herd.

3.2 Aerial Surveys (1978-2012):

Following their reintroduction onto Southampton Island, caribou were monitored periodically by both local and Government wildlife officials, primarily using ground-based methods. Kraft's aerial survey flown in November 1978 was the first scientific population estimate made since their re-introduction (Kraft, 1981). Kraft used a stratified transect survey method to cover 3 strata that were believed to represent the full extent of the Southampton Island Herd's distribution. The survey was flown between November 22nd and 25th, 1978 and utilized one observer on each of the left and right side of the single engine high wing DE Havilland Otter aircraft. Transects were placed 6.44 km apart for a total of 12.5 % coverage of the entire survey area. Effective strip width was a total of 800 meters, 400 meters out each side of the aircraft, while survey elevation was 122 meters AGL (above ground level) with a mean survey speed of 140 Kph (Kraft 1981). Population estimates were derived by calculating the density of caribou observed for all transect strips, and multiplying density by the total stratum area.

3.3.2 Random Block Survey Method:

A second survey method was employed in June 1986 and consisted of a stratified random block survey design (Heard and Grey, 1987). The census zone was divided into 5 strata which received differential coverage ranging from 11% to 54%. The stratification into census zones was based on a pre-survey reconnaissance, habitat and range preference (Parker, 1975), and recent observational data from both local hunters, wildlife service personnel, and previous survey observations of caribou. A Bell 206B helicopter was used as the survey vehicle at variable speeds and altitudes. The survey personnel consisted of two rear seat observers, a front left seat navigator, and a pilot. Sightings from all personnel were recorded. Each animal observed was approached and circled so that its sex and age could be determined. Heard and Grey also attempted to determine sightability through the re-surveying of portions of three blocks at three times the initial survey intensity and determining the differences recorded between these surveys. This method of determining sightability was, however, unsuccessful do to the movement of animals between surveys. A third survey flown June 1991 aimed at improving the 1987 survey effort. The June 1991 survey followed, for the most part, the same methodology employed in 1987 by Heard and Grey (Ouellet, 1992). The main modifications made to the 1987 methods were made to ensure complete coverage of the island and involved the delineation of two strata defined as low density which were surveyed using an aerial strip transect survey flown with a Cessna 337 fixed-wing aircraft. Sampling intensity varied from 11% to 51% over 48 transects and/or blocks flown.

3.3.3 Single Observer Pair Method:

The November 1978, March 1990, June 1995, 1997, 2003, 2005, 2007, and 2009, surveys were flown using a single observer pair stratified systematic aerial strip transect method while the June 2011, May 2015, and May 2017 surveys were flown using a dependent double observer pair stratified aerial strip transect method. Little of the method has been documented for the March 1990 survey that was undertaken to estimate the SHI caribou population and distribution (Ouellet, 1992). The March 1990 survey was flown using a Cessna 337 fixed wing aircraft at 120 meters above ground level (AGL) at various speeds between 100 and 120 knots. The survey crew included two rear seat observers, a front right seat navigator, and the pilot. The strip width on each side of the aircraft was 400 meters. The survey covered the entire Island using 18 transects, which yielded 4% coverage, leading to low survey intensity and precision, resulting in an estimate of 9,319 (95% CI=6,341) caribou (Ouellet, 1992). Because of the low precision of the 1990 estimate, the survey was repeated in 1991 utilizing a different quadrat method. The 1991 survey estimated 13,676 (95% CI=3,105; CV=0.12), and being of greater precision, should be the relied upon estimate. A single observer pair stratified systematic aerial strip transect survey was flown in late June and early July of 1995, but there were serious problems of sightability as caribou were extremely hard to see due to their darker summer coats. Surveyors consider their population estimate result from the 1995 survey of

18,275 +/- 1,390 (95% CI) to be a major underestimate, and these results are therefore excluded from this report. Due to the sightability issues with the 1995 survey, a specific recommendation was made to conduct surveys earlier in June or before, prior to moulting (Mulders, pers. comm.). The survey to re-estimate the population was later flown in June 1997 and resulted in a population estimate of 30,381 (95% CI=3,982; CV=0.066).

Survey efforts in June 1997, 2003, 2005, 2007, 2009, 2011, 2012, May 2013, 2015 and 2017 utilized a stratified systematic aerial strip transect method flown with a high wing single engine turbine or gas, fixed wing aircraft. In 2013 surveys were moved from early June to mid-May as weather modelling indicated more "flyable" days during May. Additionally, the month of May provided more continuous snow cover for improved sightability, while maintaining distributions within June based strata. These findings lead to a permanent change in survey scheduling to May. Reconnaissance surveys used to delineate strata extents were flown in June of 1997, 2003, 2005, and 2007 (**Figure 2**). Although densities of caribou declined between 1997 and 2013, strata remained consistent with an even drop in relative densities across all survey strata, with the exception of White Island (**Figure 3**), where caribou abundance declined disproportionately more than on Southampton Island. Though strata remained similar between surveys, transect spacing did increase with decreasing relative densities within the Bell Peninsula and White Island strata. The largest single modification to strata occurred within the Low South strata in 2005 as a result of extensive flooding along the Boas River, which travels through the strata. In this case transects over the Boas River area were shortened to avoid flooded areas where caribou would not be found. Strip width (w) for all surveys were established using streamers or dowels attached to the wing struts, based on calculations described in Norton-Griffiths (1978) (**Figure 4**), and as follows:

$w = W * h/H$

where:

W = the required strip width**;**

h = the height of the observer's eye from the tarmac; and

H = the required flying height

Strip width calculations were confirmed by flying perpendicularly over runway distance markers or other fixed distance markers periodically throughout the survey. The strip width area for all abundance surveys was 400 meters per side.

Standardized reconnaissance transects with a total observation strip of 800 meters (400 meters per side) were flown during the June 1997, 2003, and 2005 surveys and used to stratify caribou into areas of similar relative densities, used later to allocate effort for the abundance phase (Heard 1987). A stratified random transect method was then used during the abundance phase of all surveys (**Figure 5 to 8**). Attempts were made to maintain a constant altitude of 400 ft. during the 1978, 1990, 1995 and 1997 surveys. A radar altimeter was employed during the 2003, 2005, 2007, 2009, 2011, 2012, 2013, 2015 and 2017 surveys to increase altitude precision between transects and survey years. The first transect within each of three strata (Low, Medium and High) was randomly placed along a line of latitude or otherwise randomly selected, with each sequential line being evenly spaced.

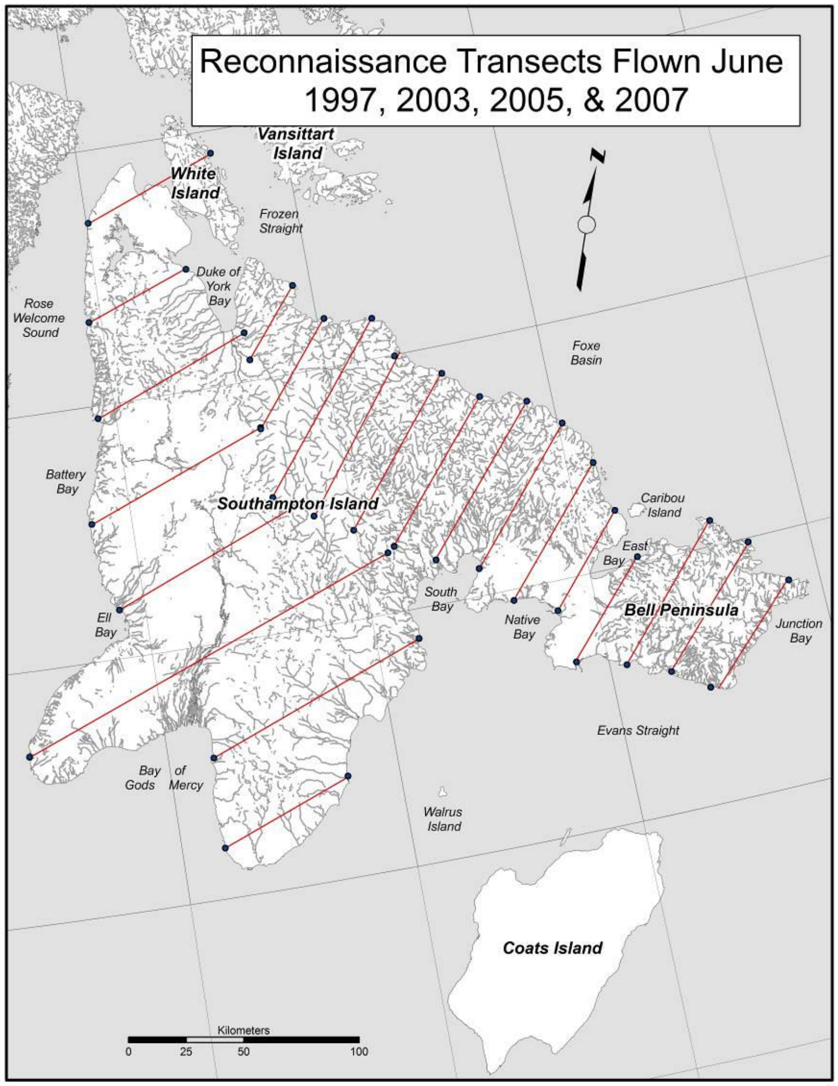

Figure 2. Reconnaissance transects flown in June of 1997, 2003, 2005, and 2007, to delineate abundance strata used to estimate Southampton Islands (including White Island) caribou population.

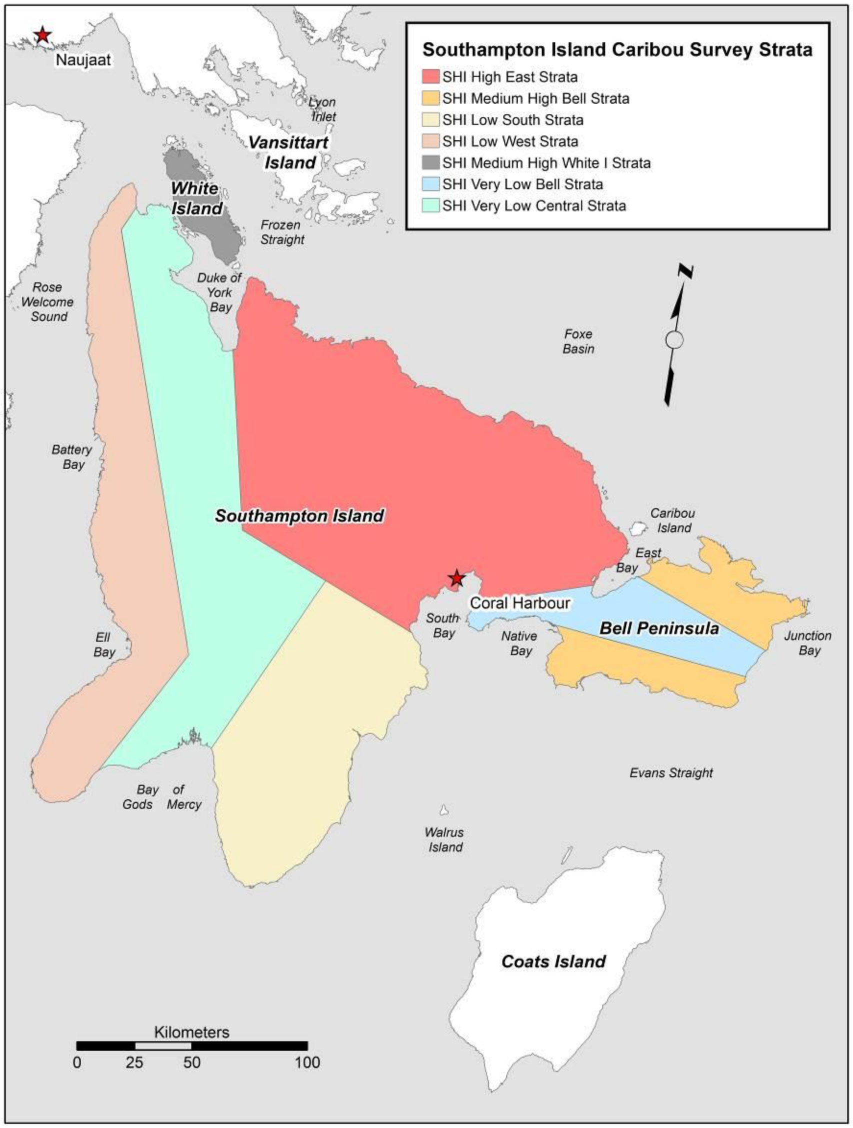

Figure 3. Abundance strata initially delineated using reconnaissance flights to map relative densities of caribou. As caribou distribution changed little across all survey years, these strata were utilized for all surveys post-2007.

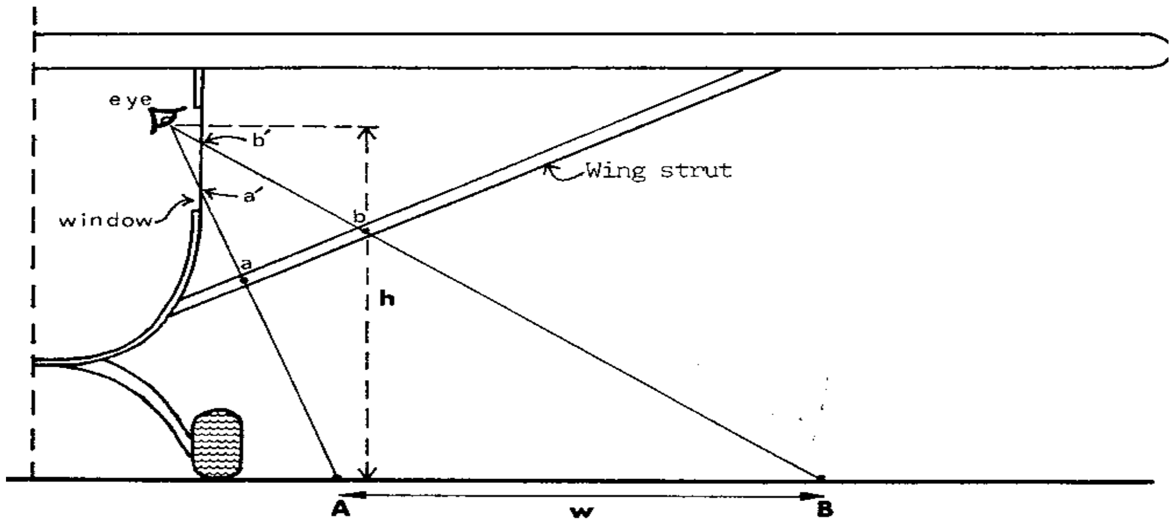

Figure 4. Schematic diagram of aircraft configuration for strip width sampling (Norton-Griffiths, 1978). W is marked out on the tarmac, and the two lines of sight a' – a – A and b' – b – B established. The dowels/streamers are attached to the struts at *a* and *b*. a' and b' are the window marks.

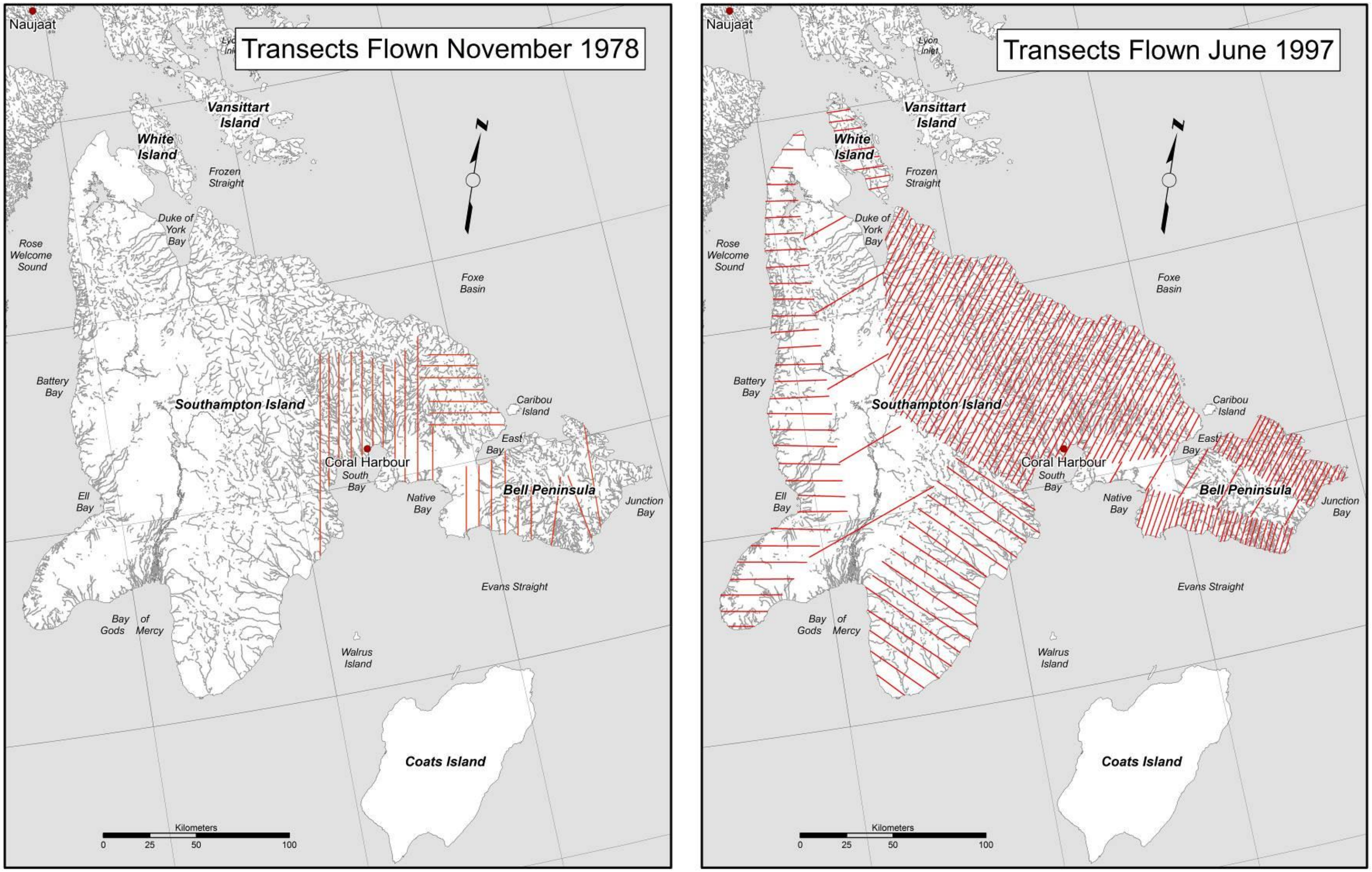

Figure 5. Stratified random transect surveys flown in November 1978 and June 1997.

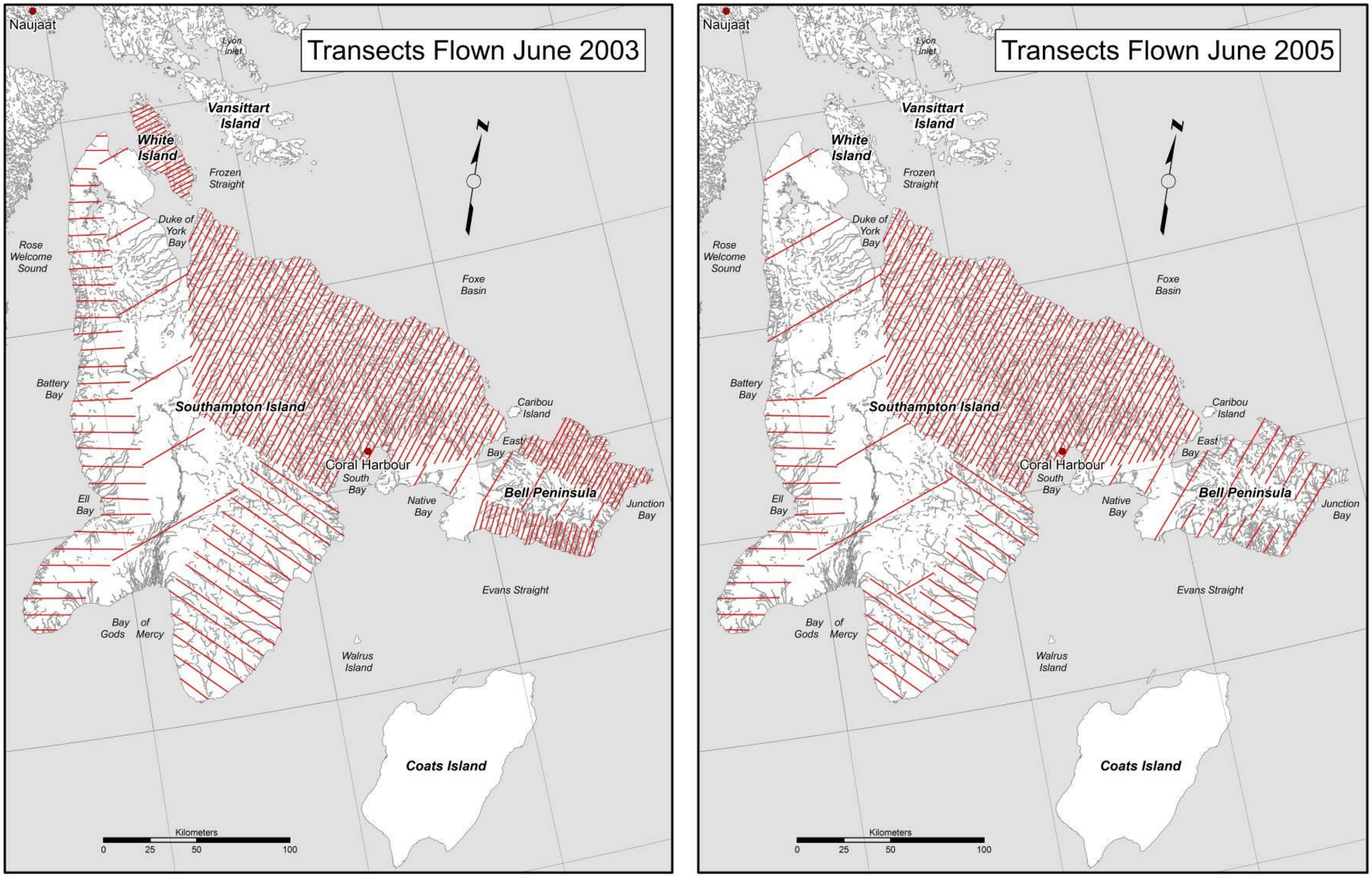

Figure 6. Stratified random transect surveys flown in June 2003 and 2005.

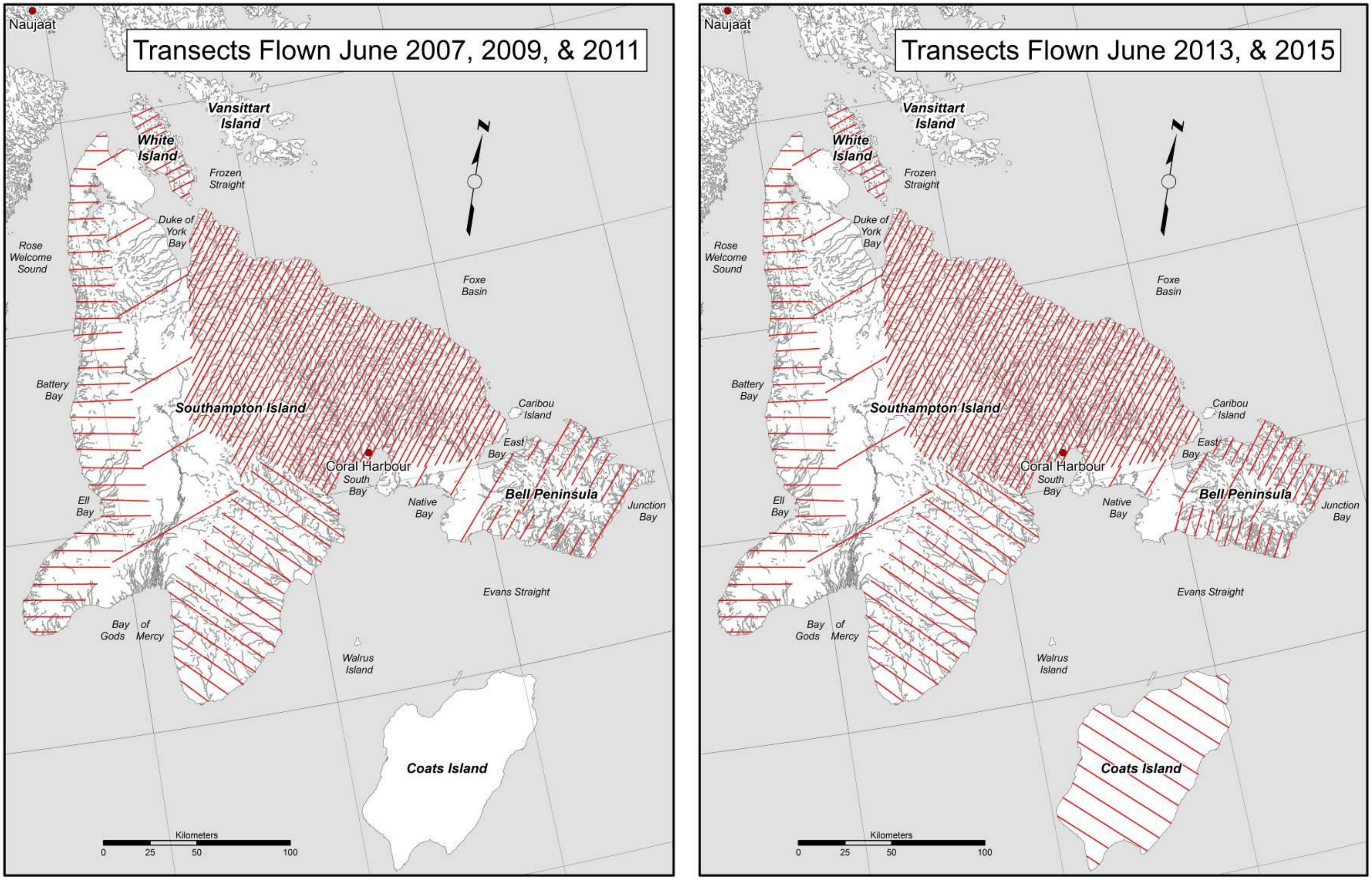

Figure 7. Stratified random transect surveys flown in June 2007, 2009, 2011 and June 2013 and 2015.

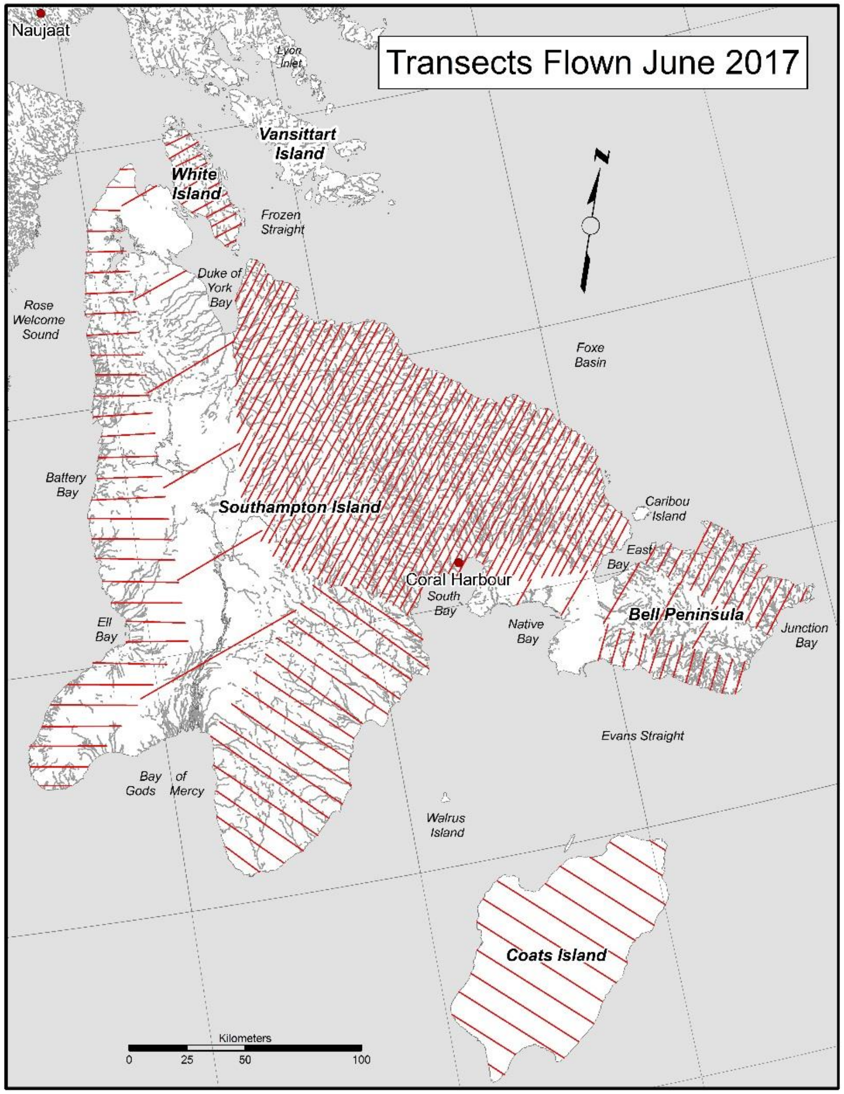

Figure 8. Stratified random transect survey flown in June 2017.

During the 1978, 1997, 2003, 2005, 2007, and 2009 population estimates the survey crew included a pilot (front left seat), a data recorder/navigator (front right seat), a left rear seat observer and a right rear seat observer. The pilot monitored air speed and altitude while following transects pre-drawn on 1:250,000 topographic maps (November 1978) or shooting waypoints on a Trimble GPS (June 1995, 1997). During the 2003, 2005, 2007, 2009, 2011, 2012, 2013, 2015 and 2017 surveys, transects were navigated using cloned pre-programmed routes on two Garmin C-176 (203 through 2013) and Montana 650T (2015 and 2017) geographic positioning system (GPS) units set to WGS 1984 datum and true north. The data recorder/navigator was responsible for assisting in the navigation of transects (1978 and 1997), and monitoring a second identically programmed GPS unit for the purposes of double-checking the position, altitude, distance from transect, and ground speed (2003, 2005, 2007, 2009, 2011, 2012, 2013, 2015, and 2017). Geographic coordinates (waypoints) and numbers of adult and calf caribou were either recorded on compact tape recorders with associated positions marked on a map (1997), or recorded on both maps and data sheets (1978), or recorded on data sheets (2003, 2005, 2007, 2009, 2011, 2012, 2013, 2015, and 2017). The responsibilities of the left side and right side observers was to monitor their 400 meter strips and call out numbers of caribou separated by adults and calves, both on and off transect as indicated by wing strut markers. The 2003, 2007, 2009 and 2017 air crews remained the same throughout the survey, while during the 2005, 2011 and 2015 surveys, one observer was changed part way through the survey. Information on the 1978, and 1997 surveys concerning consistency in air crews is lacking. All observational data including position were archived in a digital database and are included in Appendix 1.

Survey data from all surveys were initially analyzed using Jolly's Method 2 for unequal sample sizes (Jolly 1969 *In* Norton-Griffiths 1978). Only counts of adults and yearlings were used for the final population estimates as calves are not considered fully recruited into the population until they have survived their first winter. Lake areas were not subtracted from the total area calculations used in density calculations.

3.3.4 Dependent Double Observer Pair Method:

The June 2011, May 2013, 2015, and 2017 surveys were marked by a change in visual survey method. An additional 2 observers and one data recorder were added to the survey crew increasing the crew to 7 individuals including the pilot. The method has been adopted to all Kivalliq regional ungulate surveys. Pilot studies conducted on Muskox abundance in 2010 and barren-ground caribou abundance in 2011, confirmed fewer animals were being missed while using this new configuration. Additionally more HTO representatives could be involved in the survey while maintaining two experienced observers covering each side of the survey aircraft. The new method is termed a dependent double observer pair visual method, and is set up with two left side observers and two right side observers with a data recorder for each.

The dependent double-observer pair method involves one “primary” (front) observer who sits in the front seat of the plane and a “secondary observer” (rear) observer who sits behind the primary observer on the same side of the plane (**Figure 9**). One data recorder sitting to the right of the pilot was assigned the right primary and secondary observers while the second data recorder, sitting on the rear left side was assigned the left primary and secondary observers. The method adhered to five basic steps; ***1 -*** The primary observer called out all groups of caribou (number of caribou and location) he/she saw within the 400 meter wide strip transect before they passed halfway between the primary and secondary observer (approximately at the wing strut). This counting included caribou groups that were between approximately 12 and 3 o’clock for right side observers and 9 and 12 o’clock for left side observers. The main requirement was that the primary observer be given time to call out all caribou seen before the secondary observer called them out; ***2 -*** The secondary observer called out whether he/she saw the caribou that the first observer saw and observations of any additional caribou groups. Both the primary and secondary observers waited to call out caribou until the group observed passed half way between observers (between 3 and 6 o'clock for right side observers and 6 and 9 o'clock for left side observer); ***3 -*** The observers discussed any differences in group counts to ensure that they are calling out the same groups or different groups and to ensure accurate counts of larger groups; ***4 -*** The data recorder categorized and recorded counts of caribou groups into "primary only", "secondary only", and "both", entered as separate records; ***5 -*** The observers switched places approximately half way through each survey day (i.e. during re-fueling) to monitor observer ability. The recorder noted the names of the primary and secondary observers.

The sample unit for the survey was "*groups of caribou*" not individual caribou. This created problems for the data recorder trying to determine when a group of caribou differed from individual caribou that were separated by short distances. To resolve this issue, recorders and observers were instructed to consider individuals to be those caribou that were observed independent of other individual caribou and/or groups of caribou through an estimated separation of 100 meters.

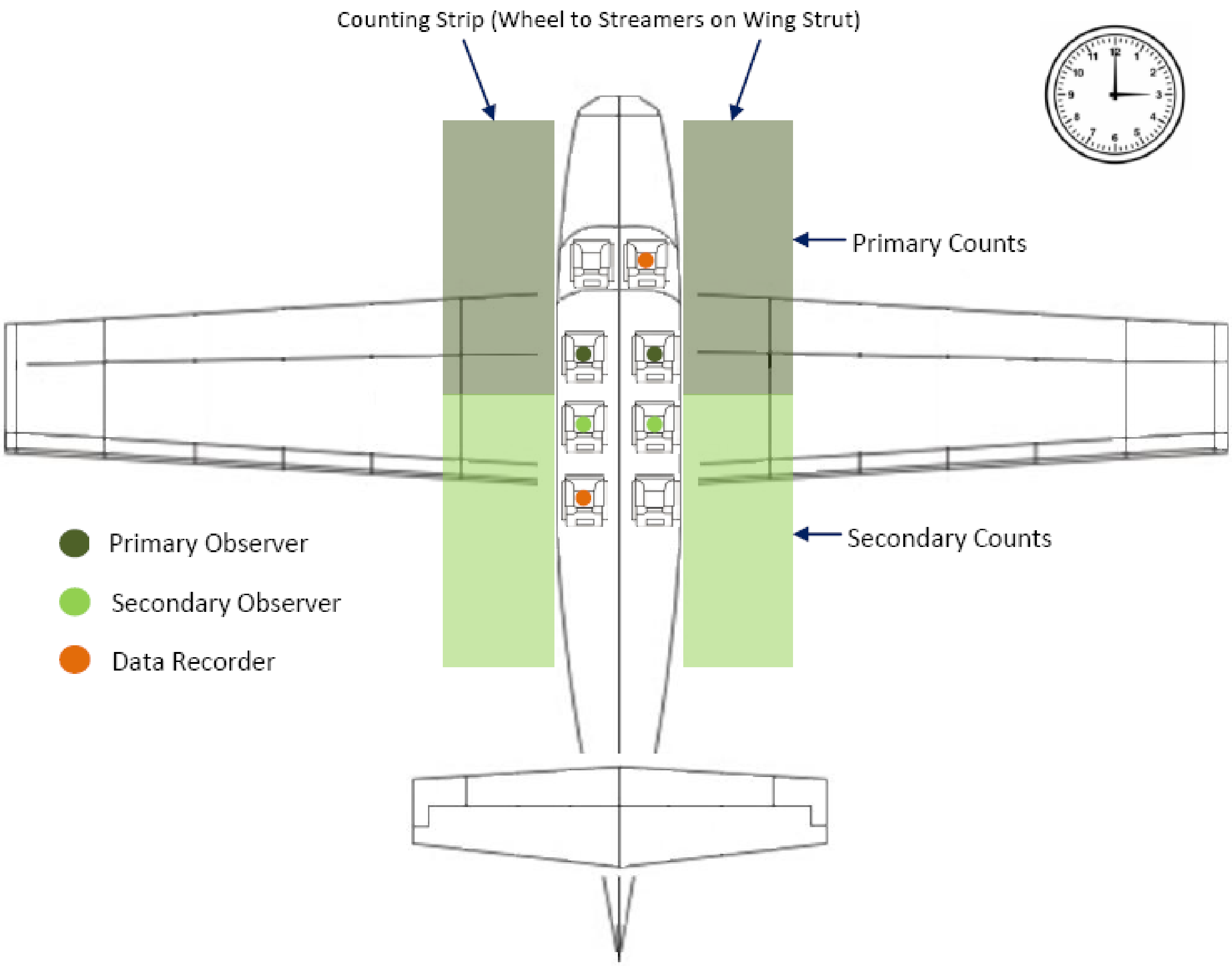

Figure 9. Observer position for the dependent double observer pair method employed on the 2011, 2013, 2015, and 2017 Southampton Island caribou abundance surveys. The secondary observer calls caribou not seen by the primary observer after the caribou have passed through the main field of vision of the primary observer. The small hand on a clock is used to reference relative locations of caribou groups (e.g. “Caribou group at 3 o’clock” would suggest a caribou group 90º to the right of the aircrafts longitudinal axis.).

3.3 Distribution:

Distribution maps were developed to graphically summarize survey data for survey observations up to and including June 2007. The distribution maps were generated through an interpolation which provided an estimate of the number of animals present at un-sampled locations based on the known values gathered at surrounding locations. This type of analysis generates a surface consisting of cells, each with an attribute (in this case, population density), used to interpret the spatial distribution of geographic points and then convert them into a continuous distribution reflecting estimates of point densities. In this study an Inverse Distance Weighted (IDW) interpolation technique was used within ArcMap's Spatial Analyst extension. IDW is an effective means of interpolating scattered data points. It assumes that the resulting interpolated surface should be influenced most by the nearby points and less by more distant points. It estimates values by calculating a weighted average. The farther a sampled point is from the cell being evaluated, the less weight it has in the calculation of the cell's value (Watson and Phillip, 1985).

To account for null data, all survey observations were first buffered to ten kilometers. To account for nil records those portions of the transect not covered by the observation buffers were then divided into 5 kilometer segments with the first starting 5 km from the edge of the nearest buffered observation or transect starting point. At each division between 5-km segments, a point with an observed value of zero was inserted. The analysis was then run using the survey observation values as well as the newly populated zero values. The analysis requires that a series of parameters be defined. The parameters, along with a description and the settings used are summarized in **Table 1**.

The resulting surfaces were themed by the population density attribute and overlaid on a base map of Southampton and White Islands to develop the figures. Density class or “bins” are developed to reveal the most visual information and highlight and estimate distributional changes between surveys. As area estimates of relative densities on Southampton Island are mostly aggregated in the 0 to 5 caribou/km^2 class, the bins were developed to accentuate these lower relative densities.

Table 1. Inverse distance weighting (IDW) analysis parameters employed in the analysis of Southampton Island caribou densities from 1978 through 2007.

Parameter	Description	Settings
Z Value Field	The Z value is the attribute being used to derive the interpolated surface.	The population attribute stored in the field Number.
Power	The higher the Power value, the greater the influence of values closest to the interpolated point. The most common value for the Power parameter is 2.	A value of 2 was selected.
Search radius type	The search radius can be either variable or a fixed distance.	As the sample points were not evenly distributed, a variable search radius was used that assessed the data points nearest to the particular cell of interest.
Search radius setting	The search radius setting specifies either the maximum distance of a fixed radius search or the number of points for a variable type.	The number of points considered in each of the analyses was 12.
Output cell size	The resolution (or cell size) of the grid (the surface) resulting from the analysis.	An out cell size of 100 m2 was specified resulting in a population density of animals per hectare.

3.4 Statistical Analysis of Abundance and Trend:

3.4.1 Strip transect surveys (1997-2017):

The standard Jolly estimator (Jolly 1969, Krebs 1998) was applied to the strip transect data for all years with an assumed strip with of 800 meters for all years except 2015 where the strip width was 918 meters. Strip transect data for 2017 was created using the first 2 bins of the distance sampling data which amounted to an 800 meter strip. Strata were estimated separately and then combined for a total estimate for the Island. Coats Island was also surveyed in 2013, 2015, and 2017 and was excluded from the South Hampton Island estimate. Log-normal confidence limits were generated on the estimates (Thompson 1992).

3.4.2 Double observer/strip transect analyses (2011, 2013, 2015, and 2017):

Given that this method assume equal sightability between observers it is essential that the observers switch seats over the course of the survey (Cook and Jacobsen 1979). Estimates of herd size and associated variance were measured using the mark-recapture distance sampling (MRDS) package (Laake et al. 2012) in the program R (R Development Core Team 2009). In MRDS, a full independence removal estimator which models sightability using only dependent double observer pair information (Laake et al. 2008a, Laake et al. 2008b) was used making it possible to derive dependent double observer pair strip transect estimates. Strata-specific variance estimates were calculated using the formulas of Innes et al. (2002). Data were explored graphically using the ggplot2 (Wickham 2009) package in R.

3.4.3 Modelling of sighting probability variation:

One assumption of the dependent double observer pair method is that each caribou group observed had an equal probability of being sighted. To account for differences in sightability we also considered the following sightability covariates in the MRDS analysis (**Table 2**). Each observer pair was assigned a binary individual covariate and models were introduced that tested whether each pair had a unique sighting probability. Previous analyses (Campbell et al. 2012; Boulanger et al. 2014) suggested that the size of the group of caribou had strong influence on sighting probabilities and therefore we considered linear and log-linear relationships between group size and sightability (**Table 2**). Cloud and snow cover were recorded by data recorders as they changed and were included in the analysis as ordinal rankings. We suspected that sightability was most likely lowest in mixed snow cover conditions and therefore we considered both categorical and linear models to describe variation in sightability caused by snow cover. Cloud cover could also influence sightability by causing glare, flat light, or variable lighting. We used the same basic strategy to model cloud cover variation as we did for snow cover variation.

The fit of models was evaluated using the Akaike Information Criterion corrected for small sample size (AIC_c). The model with the lowest AIC_c score was considered the most parsimonious, thus minimizing estimate bias and optimizing precision (Burnham and Anderson 1998). The difference in AIC_c values between the most supported model and other models (ΔAIC_c) was also used to evaluate the fit of models when their AIC_c scores were close. In general, any models with a ΔAIC_c score of less than 2 between them were considered to have equivalent statistical support.

3.4.4 Distance sampling analyses (2017):

For the 2017 survey, distances of caribou groups from the survey planes were binned into intervals (0-200m, 201-400m, 401-600m, 601-1000m, and 1001m-1500m), based upon markers on wing struts of the survey plane, as was done in the 2014 Baffin Island caribou survey (Campbell et al. 2015). In addition, the dependent double observer pair also assessed sightability of caribou in the 0-200 meter strip closest to the aircraft.

A combined distance sampling and mark-recapture approach was used to estimate abundance for the 2017 data set. The basic approach involved using mark-recapture analytical methods to estimate the probability of detection of caribou at 0 distance from the survey plane and distance sampling methods to estimate the decrease in probability of detection at greater distances from the plane. This approach ensured a more robust estimate than using distance sampling methods alone which assume that the probability of detection of caribou groups at 0 distance from the plane is 1 (Borchers et al. 1998, Buckland et al. 2004, Laake et al. 2008a, Laake et al. 2008b, Buckland et al. 2010, Laake et al. 2012).

As with the dependent double observer pair analysis, the MRDS R package (Laake et al. 2012) was used to build mark-recapture and distance sampling models. The general approach used was to build distance sampling models with the mark-recapture model parameters held constant. Once a parsimonious distance sampling model was identified, the mark-recapture model was built to further assess sightability of caribou in immediate proximity to the aircraft. The same general set of covariates used in the dependent double observer pair analysis (**Table 2**) were used for both the dependent double observer pair and distance sampling models. As with the dependent double observer pair analysis, AIC methods were used to assess model fit. Overall model fit was also assessed using goodness of fit tests as well as graphical comparison of detection functions with histograms of frequencies of observations from the survey.

3.4.5 Trend analyses:

We used log-linear models to analyze trends for the increase and decrease phase of the caribou abundance dataset (McCullough and Nelder 1989, Thompson et al. 1998, Williams et al. 2002). Our models assumed an underlying quasi-Poisson distribution of estimates with population change occurring on the exponential scale. Abundance survey estimates were weighted by the inverse of their variance therefore giving more weight to the more precise estimates. A log-link was used for the analysis allowing direct estimates of yearly rate of change as one of the regression β terms. Additive terms were used to estimate phase-specific trends and the effect of a possible immigration event, likely occurring between May 2013 and May 2017, on SHI herd trend.

Table 2. Covariates used to model variation in sightability of caribou for the dependent double observer pair analysis conducted on the 2017 abundance survey of the Southampton Island caribou herd.

Covariate	Acronym	Description
Observer pair	observers	each unique observer pair
Group size	size	size of caribou group observed
	Log(size)	Natural log of group size
Snow cover	snow	snow cover (0,25,75,100)
	snowc	continuous
Cloud cover	cloud	cloud cover (0,25,75,100)
	cloudc	continuous

3.5 Condition and Disease Sampling:

The health and condition of SHI caribou condition was monitored through the collection of harvest samples, beginning in 1995 (Campbell, 2015). Variables measured included a ratio of bare kidney to kidney fat index, the recording and sampling of any apparent disease and/or diseased tissue, the recording and sampling of parasitic infections, the measurement of back fat, bone marrow condition (in some years), pregnancy rates, fetal sex (in some years), and age through the analysis of cementum-annuli from the sampling of I-1 (the first incisor) from the lower jaw. In the case of the GN health studies, all anatomical components of an individual caribou being sampled and/or measured were recorded along with a common tag number and the associated harvest year. This common tag number allowed for the pooling of analysis results to provide a comprehensive description of the health, age and sex of the individual being sampled. From 1995 through 1999, approximately 400 animals per year were sampled in this way. Sampling across February and March 2000 through 2009 was reduced to approximately 200 to 300 animals (excluding 2001, 2002 and 2003). Prior to 2009, all sampling was carried out in conjunction with the commercial harvest, which ran from mid-February through to early April in most years. Following the cessation of the commercial harvest in 2009, harvest numbers in 2010 and 2011 were reduced to 100 animals. Following the 2011 survey results and subsequent application of a total allowable harvest (TAH) in 2012, the community of Coral Harbour requested that the 100 animals harvested for body condition be suspended so that all TAH allocations could be provided to the community. The suspension of the condition sampling harvest has remained in effect to-date.

The kidneys sampled for the kidney fat index (either left or right) were selected based on the amount of fat surrounding the kidney. In all cases the fatter of the two was chosen. The thickness of back fat was measured along a line 5 to 10 centimeters from the base of the tail, perpendicular to the spine. Measurements were taken from the thickest fat deposits on the rump (one to two inches to the left and right of the base of the tail) on mainly the left side but also on the right side when left-side fat was obviously removed during the skinning process.

As a standard protocol, the Canadian Food Inspection Agency (CFIA) randomly collected between 300 and 400 blood samples from commercially harvested animals from 1993 through 2007. From 2007 to 2011, blood samples were collected by GN biologists from animals collected for health and condition harvests, from remaining ventricular and/or arterial blood. Sampled blood was drained into red topped vacutainers, left to stand approximately two hours at between five and ten degrees Celsius, then spun down in a centrifuge for approximately ten to fifteen minutes to separate the serum from cellular material. Individual serums were poured off into new sterile red-topped vacutainers, carefully packed and allowed to freeze at approximately -20º to -30º degrees Celsius. Frozen blood serums were then transported first to labs in Lethbridge, Alberta for Brucellosis, and Tuberculosis screening then to the CFIA lab in Ontario for further disease testing. Adult female reproductive tracts were also collected in 2005 for the purposes of identifying reproductive stress and/or disease. All sampling pre-2009 was carried out in conjunction with the commercial harvest which ran from mid-February to early April. The GN did not have access to all CFIA test results.

3.6 Genetic Analysis – Movement:

Over the winter of 2014, Coral Harbour hunters reported caribou tracks crossing the ice from the mainland across to the northwestern extents of SHI. Though no estimates of the total number of caribou involved in this crossing were communicated beyond “hundreds”, local hunters had observed more calves in June 2014 and increased densities of caribou in the following harvesting year, compared to preceding hunting seasons. Results from the May 2015 abundance survey estimated a significant increase in SHI caribou abundance of both adults and calves, compared with 2013 results. This population increase was theorized by both the community of Coral Harbour and Wildlife officials’ to be related to the immigration of mainland caribou onto SHI. We set out to further investigate this hypothesis using population genetics.

We engaged Wildlife Genetics International (WGI) to pursue this question using the clustering programs Structure and Genetix, which produce accessible visual summaries of the results (Paetkau, 2015). Caribou tissue collected on SHI in 2004, and 2014, as well as tissue samples collected from hunters in the Naujaat (Repulse Bay) area, were compared for assessments of ancestry. Additionally, WGI used archived samples from the Qamanirjuaq caribou herd for added comparative analysis with the SHI herd. WGI used GeneClass2 to assess ancestry hypotheses, explicitly. Initial explorations included data from South Baffin Island, Melville Peninsula, and Ahiak/Beverly, but these explorations did not identify any associations of relevance to SHI.

Genotyping was performed by Wildlife Genetics International (WGI) using a standard set of 18 highly variable microsatellites that they had consistently employed for other caribou genetic analyses in Nunavut, Northwest Territories, British Columbia, and Alberta. The analysis proceeded in two rounds of 9 markers (including gender markers), as all 18 markers cannot be loaded into a single sequencer lane. After completing a first pass with all 18 markers, WGI did a round of reanalysis ('cleanup') of individual data points that were scored with low confidence (1) during the first pass (Paetkau, 2015). This reanalysis used 5 μL of DNA per reaction, up from the 3 μL used for first pass. In some cases multiple attempts were made to confirm problematic data points. At the end of the cleanup phase, 6 samples from SHI still had low-confidence scores in their genotypes (Paetkau, 2015). In total, WGI was able to successfully genotype complete 18-locus genotypes for 37 samples from Naujaat, and 131 from SHI. With genotyping completed, WGI defined an individual for each unique multilocus genotype, taking identifiers from the first sample to be assigned to each individual, of which 37 samples from Naujaat were assigned to 34 individuals (10M:24F), and the 131 samples from SHI in 2014 were assigned to 127 individuals (76M:51F). None of these animals had previous detections in the greater Nunavut dataset including samples from the 2004 harvesting season.

Paetkau (2015) then used resampling in the software GeneClass2 to generate 10,000 simulated mainland and island genotypes, and plotted the distribution of the island/mainland likelihood ratio to produce critical values for statistical testing (Paetkau *et al.* 2004 *Mol. Ecol.*). By way of example, 99% of simulated island genotypes had a log likelihood ratio in excess of 9.

4.0 Results and Discussion:

4.1 Population Distribution:

In discussing changes in distribution of caribou on Southampton Island, it is important to note that although an island population, some exchange with the mainland likely occurred on a very small scale during winters when an ice bridge had formed across Roes Welcome Sound (Local Knowledge). According to island residents, during most winters, Roes Welcome sound does not freeze over completely creating an effective barrier to caribou movement. If such a change was to occur however, this exchange would most likely have been with the Wager Bay population of caribou occupying the Lyon Inlet area due to its closer proximity to SHI. Though tracks have been observed of caribou on the ice of Roes Welcome Sound in late winter (going both east to the island and west from the island) there has been no documented evidence of a successful crossing.

Between 1968 and 1978, the first ten years of caribou occupancy on SHI following re-introduction, monitoring was mainly conducted using ground observations. During this period observations of caribou taken during patrols whether by ground or by air suggested caribou had spread considerably across the Island (Figure 10). Kraft's aerial survey in November 1978 was the first to estimate the population since its re-introduction. Both transects and points of observation were digitized off report figures and used with IDW to produce an estimate of abundance of the newly introduced Southampton Island Caribou herd (**Figure 11**). At this time, caribou were largely aggregated in the shoulder area east and northeast of Coral Harbour, the south shore of Bell Peninsula, and along the coast just south of the town of Coral Harbour. No animals were observed by either hunters nor during aerial reconnaissance conducted in previous years, anywhere further north nor west of the areas indicated.

After the examination of all available observational data up to 1987, Heard and Gray (1987) concluded that there always appeared to be caribou in the core areas of Bell Peninsula and the Kirchoffer River uplands, northeast of Coral Harbour (Heard and Grey, 1987). These observations made during their 1987 aerial population estimate showed an expansion of the herds distribution further north and west, and throughout the coastal strip encompassing Bell Peninsula. Unfortunately, point data are not available from this survey. Caribou distribution estimated on SHI in June 1991 was similar to that recorded in 1987. Oullett (1992) suggested that caribou range did not appear to expand between 1987 and 1991 even though their numbers increased substantially. Oullett (1992) found that to accommodate growth, densities simply increased within the existing range. Once again, point data is not available for either of Oullett's 1990 or 1991 surveys.

All surveys conducted from 1997 to present have point data, from which to base the analysis. The 1997 results also showed little in the way of distributional change since Oullett's observations in 1992, although densities had continued to increase significantly (**Table 3 & 4**) (**Figure 12**).

An examination of distributional change following introduction was made using IDW with ground and aerial survey point data (**Figures 12, 13, 14, and 15**). These analyses suggests that caribou distribution increased across the Island from the point of introduction, up to the 1987 survey year, at which time the now rapidly increasing population stopped expanding its range, suggesting that the herd had reached full occupancy of usable caribou habitat on the island. Caribou had occupied the southern portions of the island including Bell Peninsula and inland toward the central portions of the island along the Kirchoffer River watershed by as early as 1983. As observed by Oullett (1992) densities increased over the same geographic areas from 1987 up until a period between 1998 and 2002, at which time densities over the same areas decreased significantly. The most dramatic decrease in densities was in Bell Peninsula between the 2005 and 2007 surveys (Figure 14 and 15). Caribou had all but abandoned the area, likely as a result of overgrazing from years of higher relative densities. Today the central portion of the island remains the most highly used habitat by SHI caribou. Ecologically, this area is where the western flats meets the eastern highland, creating an ecotone between the Wager Bay Plateau and Southampton Island Plain Ecoregions.

Observed distributions from the 2003 survey indicated little change from distributions observed during previous surveys though localized densities had decreased. The first distributional change was recorded in June 2005, at which time, there was a noticeable decrease in the numbers of caribou occupying Bell Peninsula (**Figure 14, and 15**). According to survey density estimates, this declining trend in Bell Peninsula continued through June 2007, and was also reported by local hunters.

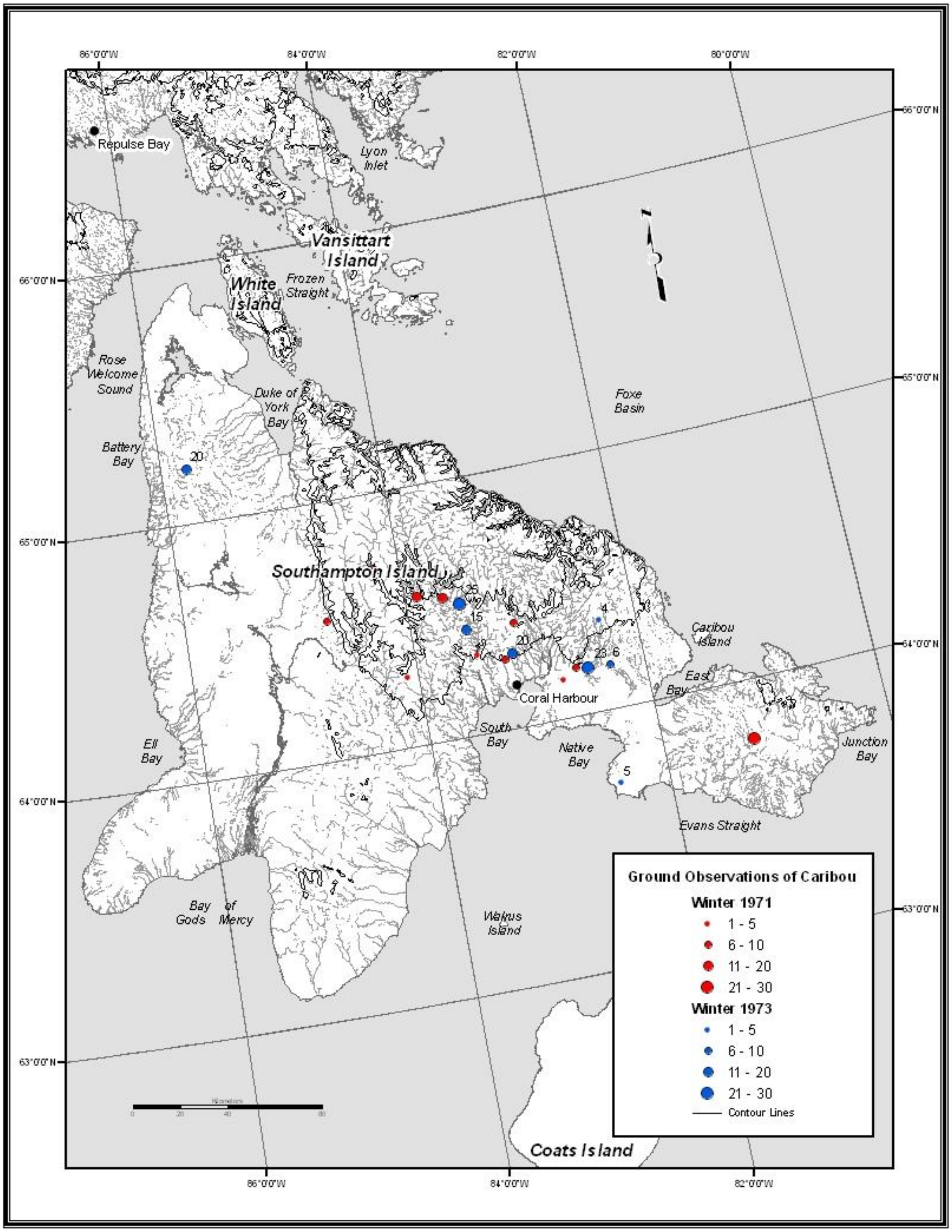

Figure 10. Observations of caribou on Southampton Island (1970 to 1973).

Table 3. Inverse distance weighting (IDW) values for the entire Southampton Island study area including White Island and Bell Peninsula showing changes in adult caribou density through time. Results from June 2005 were removed as White Island was not surveyed in that year.

Caribou/km²	1978		1997		2003		2007		% Change			
	km²	Percent	km²	Percent	km²	Percent	km²	Percent	1978 to 1997	1997 to 2003	2003 to 2007	1997 to 2007
0-1	43,471	98.5%	31,591	71.6%	32,674	74.0%	36,514	82.7%	-26.9%	2.4%	8.7%	15.6%
1-2	345	0.8%	4,535	10.3%	4,741	10.7%	3,862	8.8%	9.5%	0.4%	-1.9%	-1.5%
2-5	230	0.5%	4,836	11.0%	5,190	11.8%	3,248	7.4%	10.5%	0.8%	-4.4%	-3.6%
5-8	58	0.1%	1,680	3.8%	1,202	2.7%	434	1.0%	3.7%	-1.1%	-1.7%	-2.8%
>8	22	0.0%	1,484	3.4%	319	0.7%	68	0.2%	3.4%	-2.7%	-0.5%	-3.2%
Total	**44,126**	**100.0%**	**44,126**	**100.0%**	**44,126**	**100.0%**	**44,126**	**100.0%**				

Table 4. Inverse distance weighting (IDW) values for the entire Southampton Island study area including White Island and Bell Peninsula showing changes in the density of observed calves through time.

Caribou/km²	2003		2005		2007		% Change		
	km²	Percent	km²	Percent	km²	Percent	2003 to 2005	2005 to 2007	2003 to 2007
0-1	43,276	98.1%	44,062	99.9%	44,042	99.8%	1.8%	-0.1%	1.7%
1-3	801	1.8%	60	0.1%	82	0.2%	-1.7%	0.1%	-1.6%
>3	49	0.1%	4	0.0%	2	0.0%	-0.1%	0.0%	-0.1%
Total	**44,126**	**100.0%**	**44,126**	**100.0%**	**44,126**	**100.0%**			

Figure 11. Results of the inverse distance weighted (IDW) interpolation technique applied to November 1978 abundance survey observations showing relative density of barren-ground caribou (*Rangifer tarandus*) on Southampton Island..

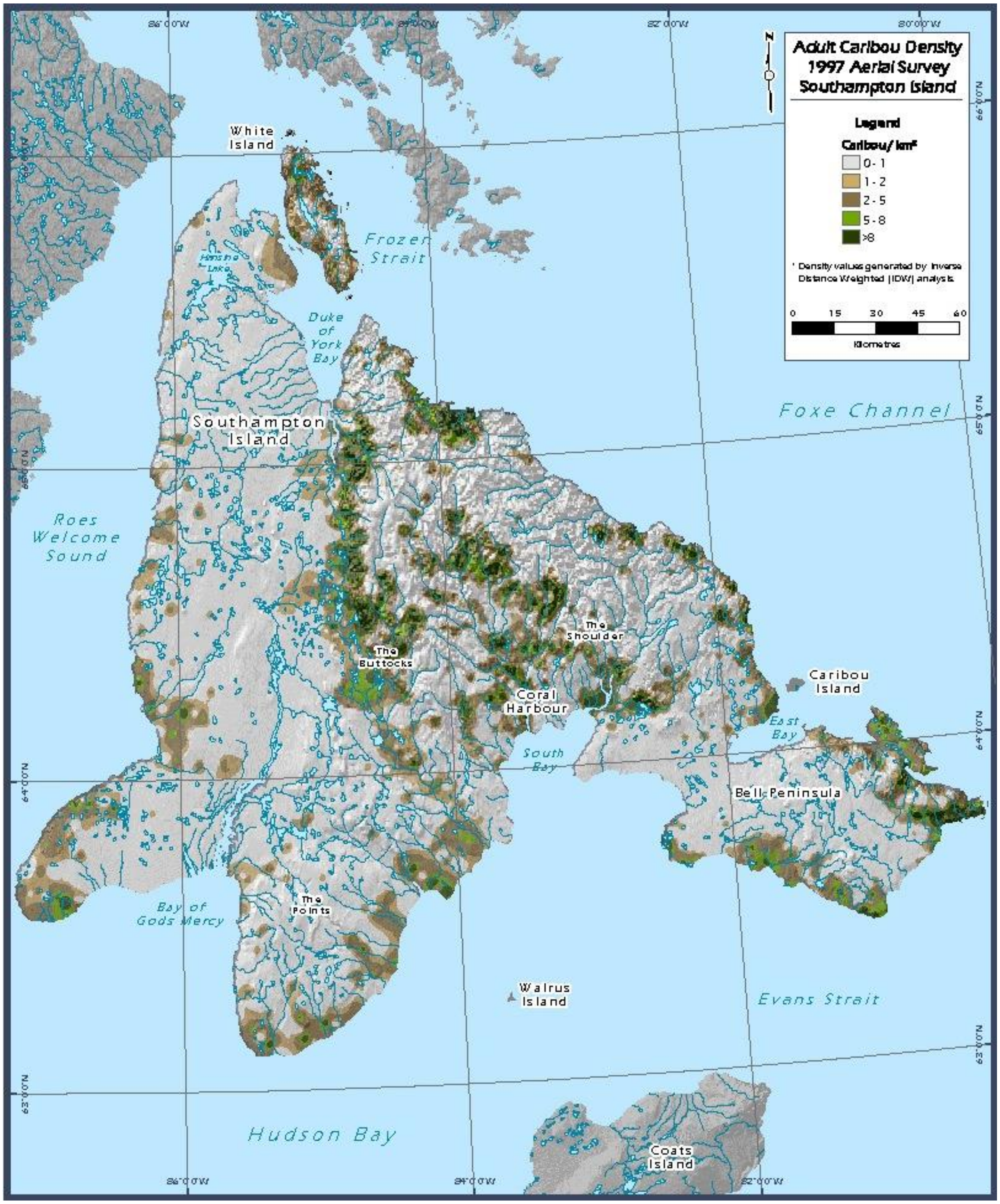

Figure 12. Results of the inverse distance weighted (IDW) interpolation technique applied to June 1997 abundance survey observations showing relative density of barren-ground caribou (*Rangifer tarandus*) on Southampton Island.

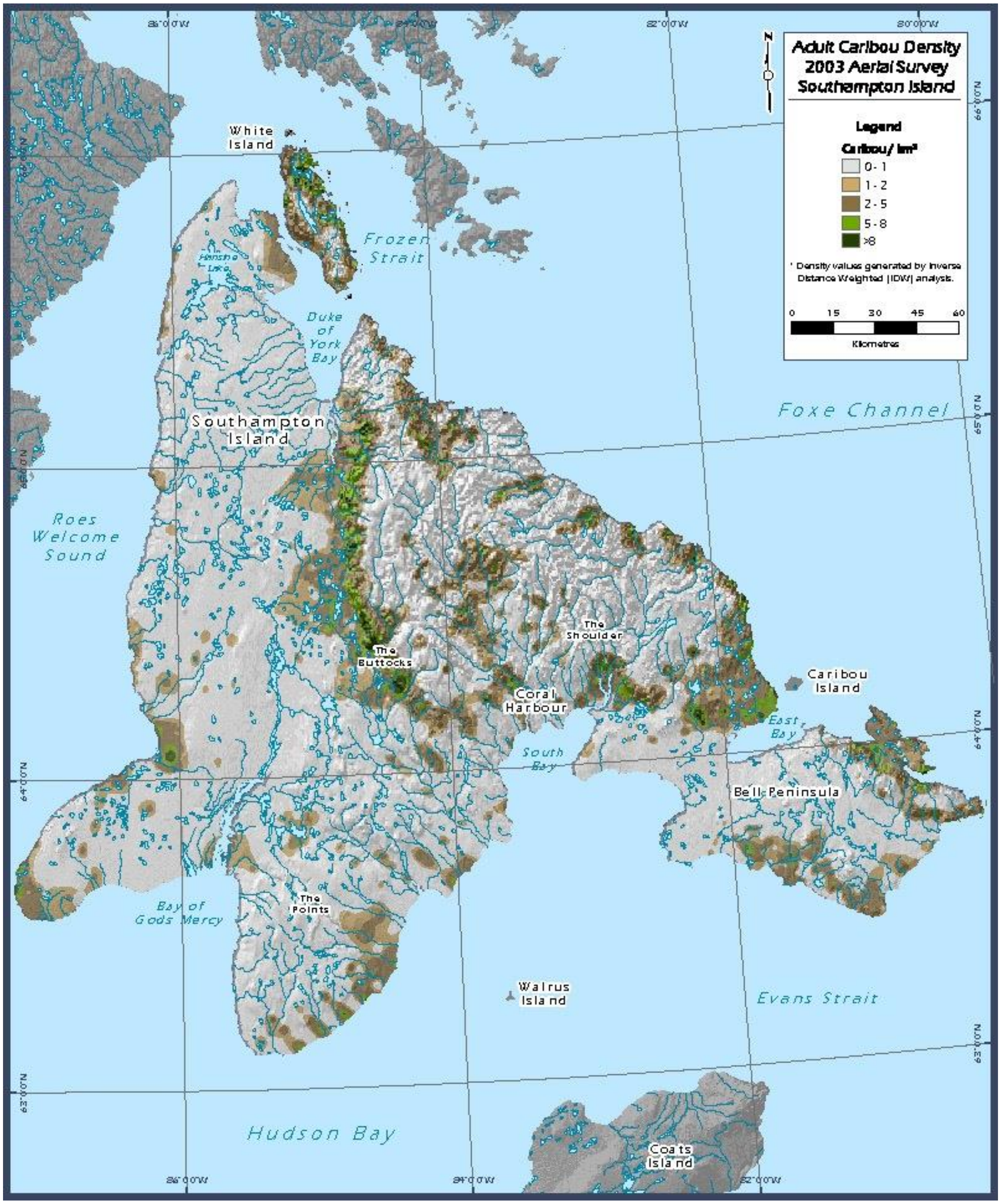

Figure 13. Results of the inverse distance weighted (IDW) interpolation technique applied to June 2003 abundance survey observations showing relative density of barren-ground caribou (*Rangifer tarandus*) on Southampton Island.

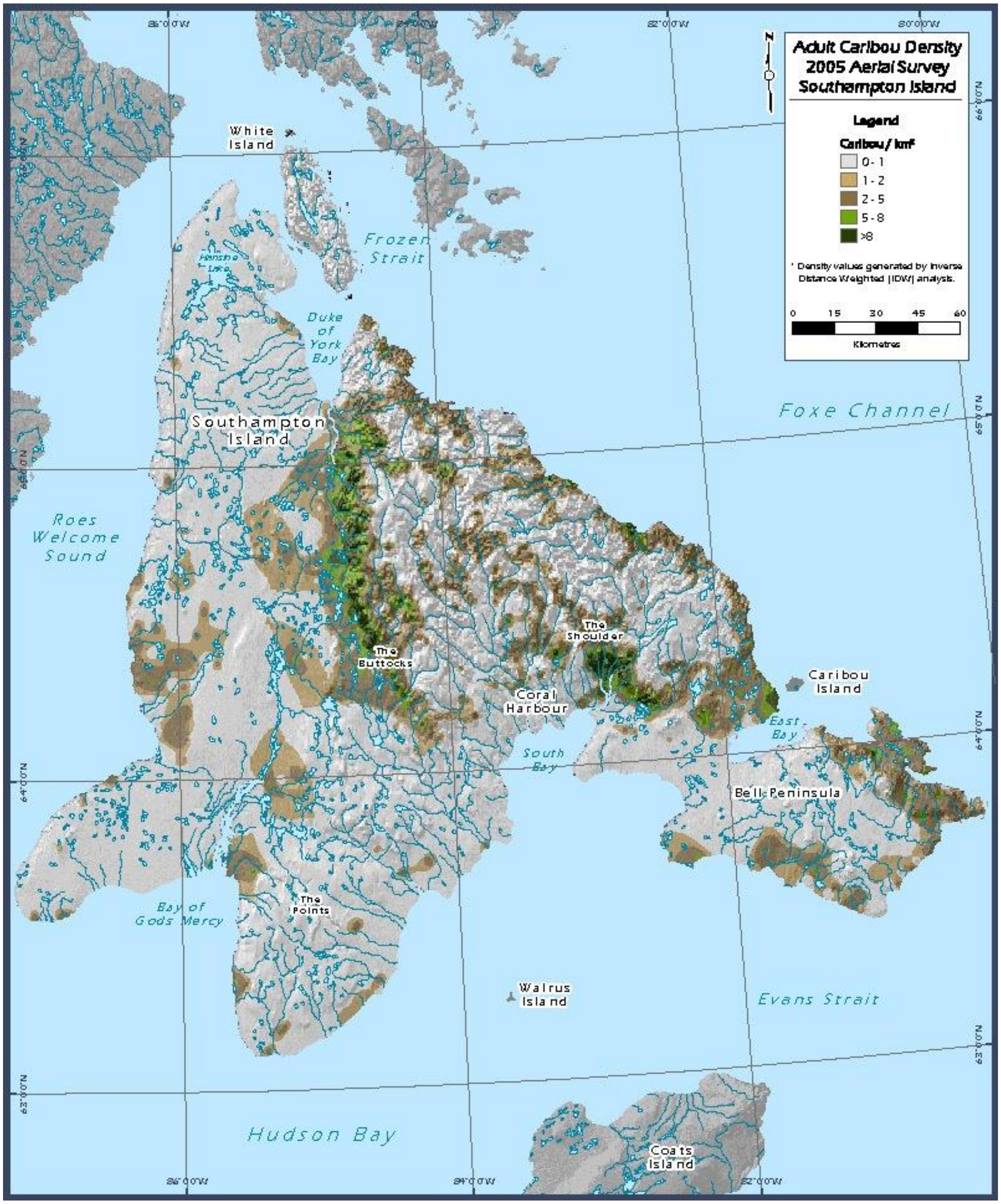

Figure 14. Results of the inverse distance weighted (IDW) interpolation technique applied to June 2005 abundance survey observations showing relative density of barren-ground caribou (*Rangifer tarandus*) on Southampton Island.

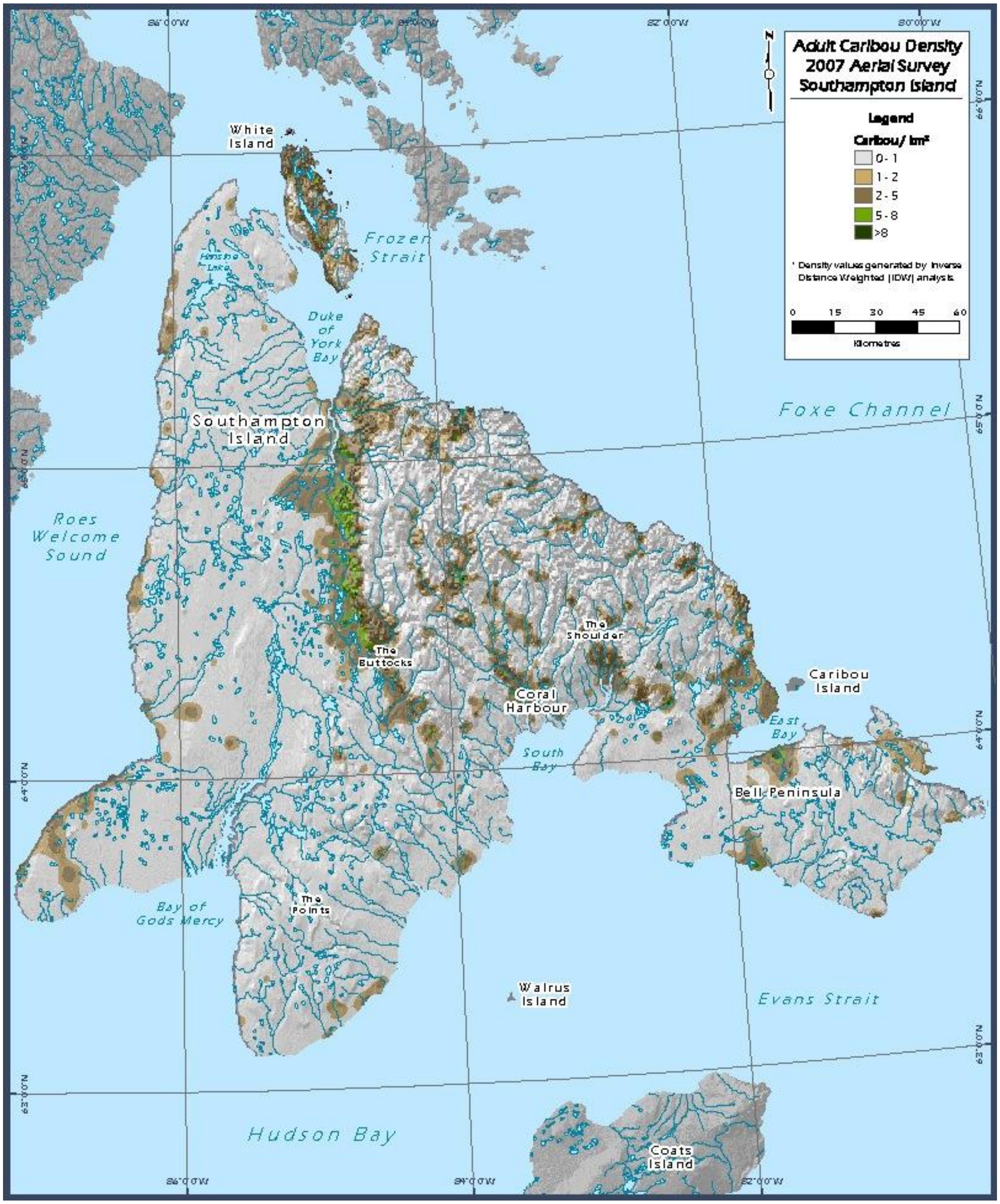

Figure 15. Results of the inverse distance weighted (IDW) interpolation technique applied to June 2007 abundance survey observations showing relative density of barren-ground caribou (*Rangifer tarandus*) on Southampton Island.

4.2 Strip Transect Surveys:

Overall, population abundance estimates from 1997 to 2017 were reasonably precise, with Coefficients of Variation (CVs) of less than 10% in all years (**Table 5, Figure 16**). **Figure 16** displays the estimates from **Table 5** and strata-specific estimates are shown in **Figure 17**. A tabular listing of estimates is provided in excel worksheets with this report. Coats Island is included in **Figure 17**, however, it was not included in overall Southampton Island estimates. Population declines occurred in all strata from 1997 to 2013, and again from 2015 to 2017. The use of different scales on the graph in **Figure 17** aids in interpretation of stratum-specific trends but it is also misleading in terms of the relative abundance of caribou in each strata. For this reason, the same estimates of caribou numbers are plotted on the same scale (**Figure 18**), clearly indicating that the majority of caribou on SHI occurred on the High Eastern SHI strata, in all years.

Table 5. Strip transect estimates of caribou on Southampton Island, showing the number of strata sampled each year, the number of caribou counted on transect, and population estimates with descriptive statistics (SE = standard error, CV = coefficient of variation) are given for each year of surveys from 1997 through 2017.

Year	Strata sampled	Caribou Counted	Strip transect estimates N	SE	Confidence Limits		CV
1997	7	5777	29,425	1622.5	26,375	32,827	5.5%
2003	7	3833	18,479	1099.8	16,420	20,797	6.0%
2005	6	4079	21,227	1701.8	18,098	24,896	8.0%
2007	7	2689	14,389	914.6	12,684	16,325	6.4%
2009	6	2521	13,651	833.1	12,091	15,412	6.1%
2011	7	1667	7,937	580.4	6,861	9,182	7.3%
2013	7	1597	7,284	525.3	6,307	8,413	7.2%
2015	7	3068	12,319	931.6	10,591	14,328	7.6%
2017	7	1685	8,436	680.8	7,184	9,906	8.1%

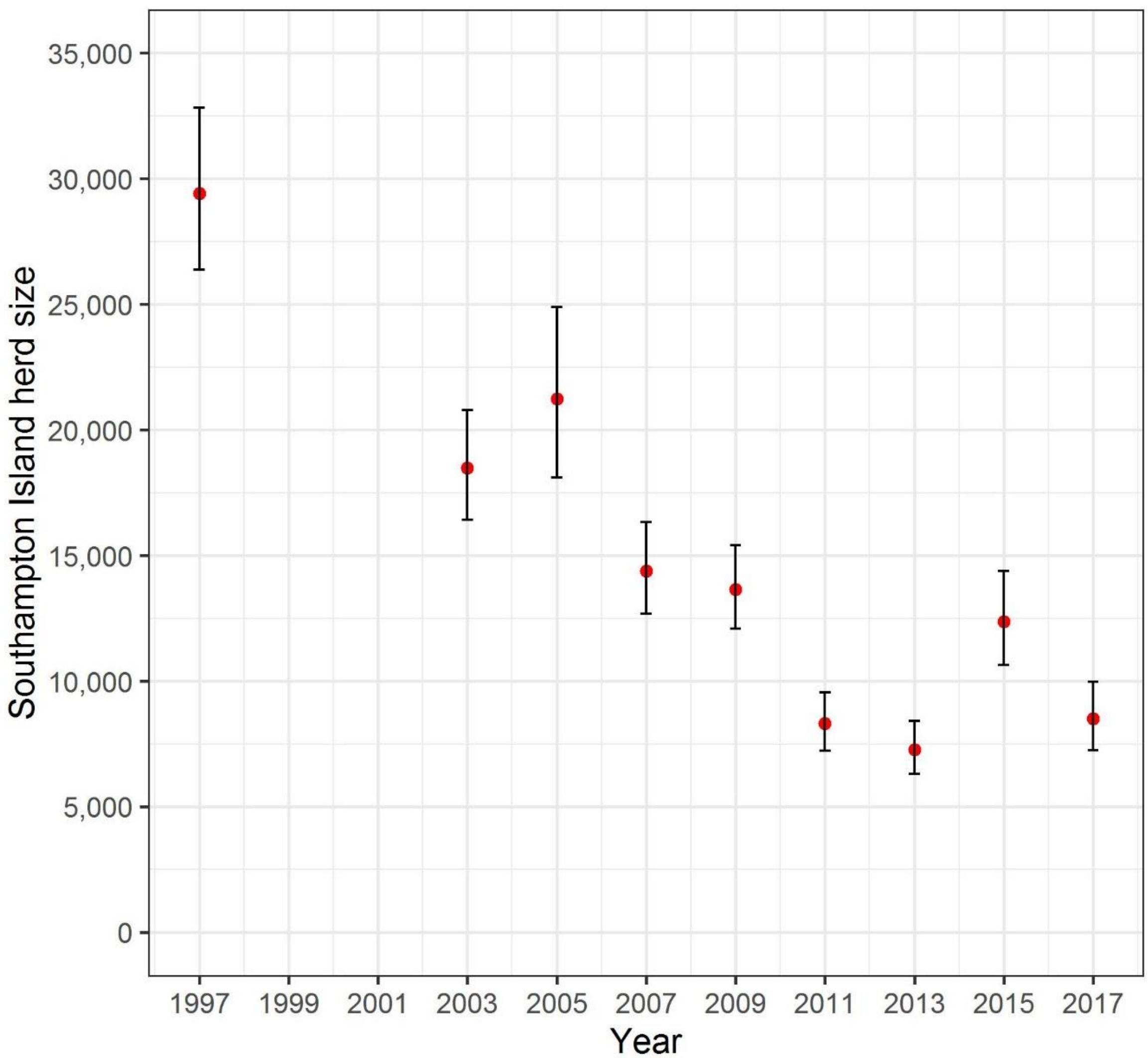

Figure 16. Population abundance estimates of the Southampton Island caribou herd using a strip transect estimator, according to strata listed in Table 5.

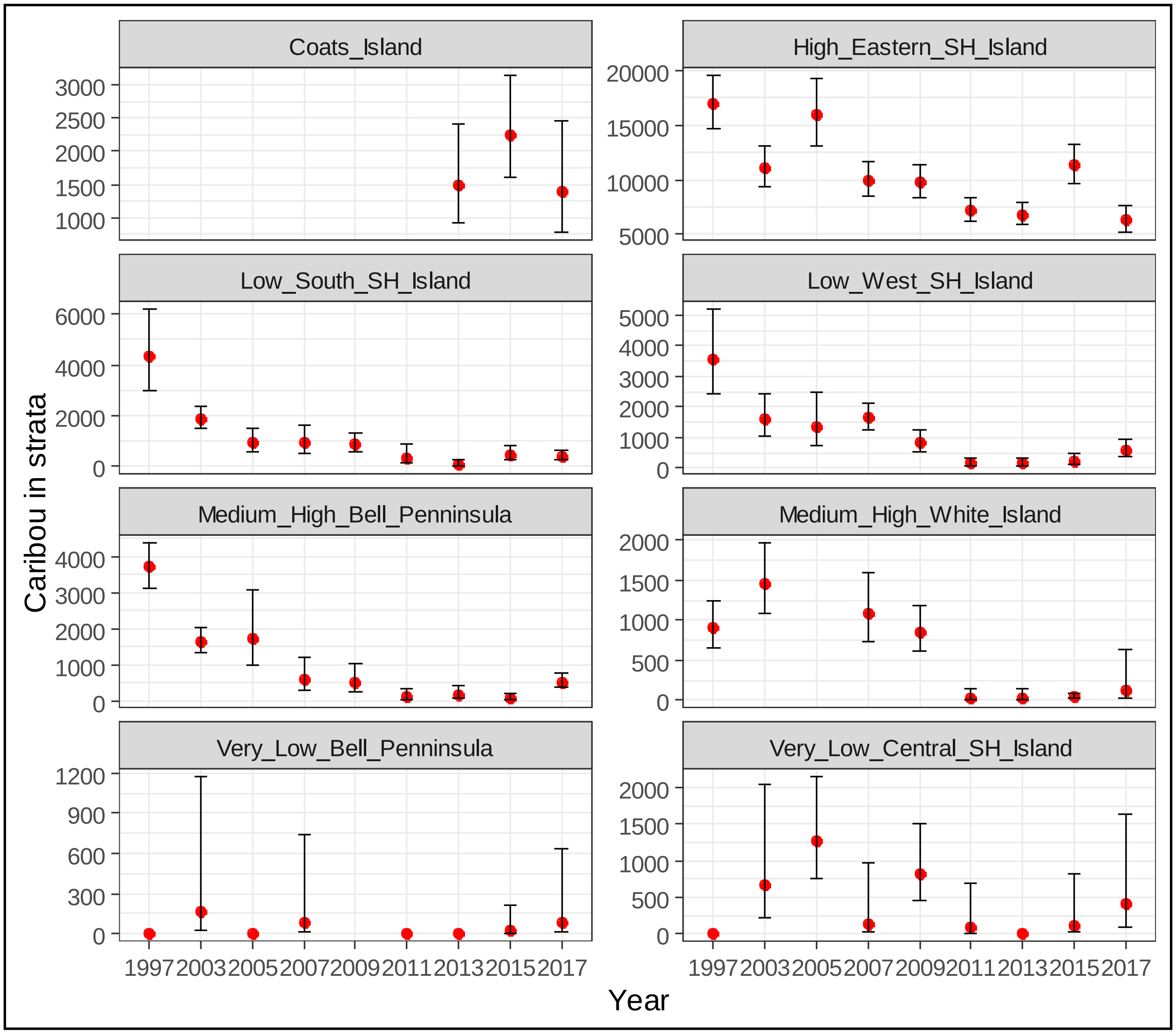

Figure 17. Strata-specific estimates of strata sampled using a strip transect estimator. Note that the y-scales are different for each graph.

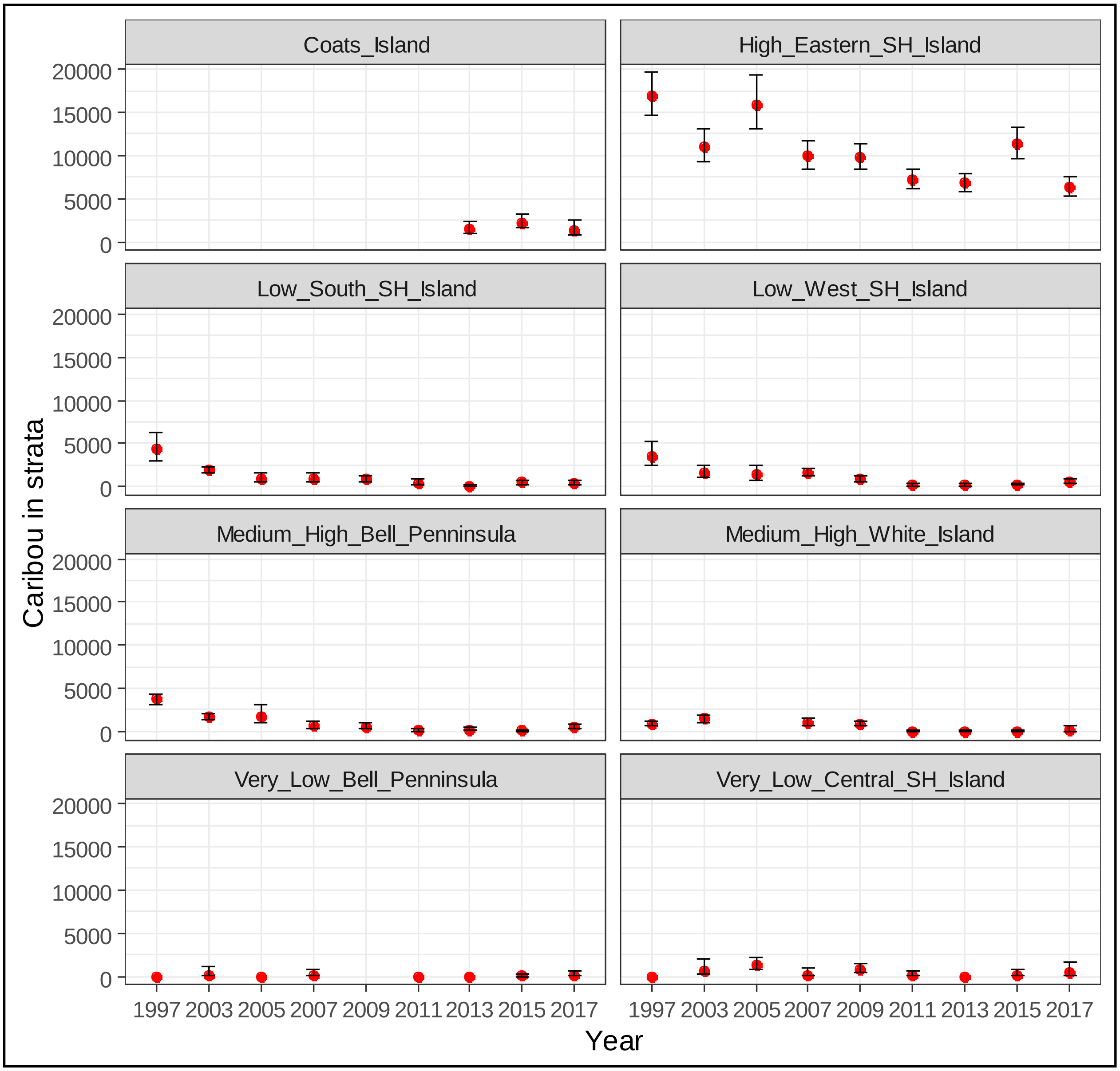

Figure 18. Strata-specific estimates of strata sampled using a strip transect estimator with the same scale used on each graph.

4.2.1 Dependent double observer analyses (2011-2015):

Dependent double observer pair data were collected using fixed-wing aerial surveys in 2011, 2013, 2015, and 2017. In 2017, we used binned distance markers on wing struts to allow for distance sampling methods, as described in the methods section of this report. Survey conditions, group sizes, and observer efficiency varied between each survey year. These data were explored graphically to help assess dominant forms of variation prior to identifying a statistical model for population estimates derived from the dependant double observer pair method. The distribution of group sizes was relatively similar during each survey year with larger groups observed in 2015 (**Figure 19**).

In general, smaller group sizes were more likely to be seen only by a single observer. Observers were placed into 12 pair combinations, of which 5 pairs switched between primary and secondary roles, and 7 did not. The assumption of the dependent double observer method is that the two observers have similar sighting probabilities and therefore, estimates may be biased when observers do not switch places during the survey. The sighting probability of pairs varied between observers for some pairs (i.e. in particular for pair 7) showing a higher relative frequency of only one observer seeing a group of caribou (**Figure 20**). A detailed listing of observer pairs is given in Appendix 1.

Between 1997 and 2011, all surveys were flown in early June close to or during the onset of spring melt. From 2013 to present, survey deployment was changed to early to mid-May (see methods) though no detectable variation in relative densities and their related strata were found. Regardless, snow cover varied each survey year with 2011 having a full range of snow cover and other years showing primarily high snow cover particularly 2013 and on following the change in survey timing to May. Sighting probabilities were lower in 2011 as shown by higher frequencies of single observer sightings (**Figure 21**). Cloud cover also varied for each year (**Figure 22**), with no discernable patterns.

Dependent double observer pair model selection, performed by sequentially calculating differences in Akaike's information criterion (AICc), suggested that sighting probabilities varied according to a combination of observer, year, size of caribou groups observed, and cloud and snow cover categorized in 25% intervals (**Table 6**). A total of three models were supported by differences in AICc values of less than 2. However, the difference (>1.51) suggested the most support for model 1, which also had the least number of parameters of the three models and would therefore produce the most precise estimates. Therefore, model 1 was used to infer covariates and population estimates. The support for year as a sightability term suggested that there were year-specific factors affecting sightability that were not accounted for by other covariates. Observer pairs in the analyses were reduced to the main pairs that exhibited lower sighting probabilities, given that a model with all observer pairs parameterized did not converge. Using this strategy, the main observer pairs that displayed lower or higher probabilities were accounted for with other observer pairs set to a mean value. The predictions of the most supported model (model 1 in **Table 6**) are shown graphically, demonstrating that sightability was lower in 2011 for both observer pairings and as a function of cloud and snow cover (**Figure 23 and 24**). Estimates from dependent double observer methods are compared to those from strip transects in a later section of the report.

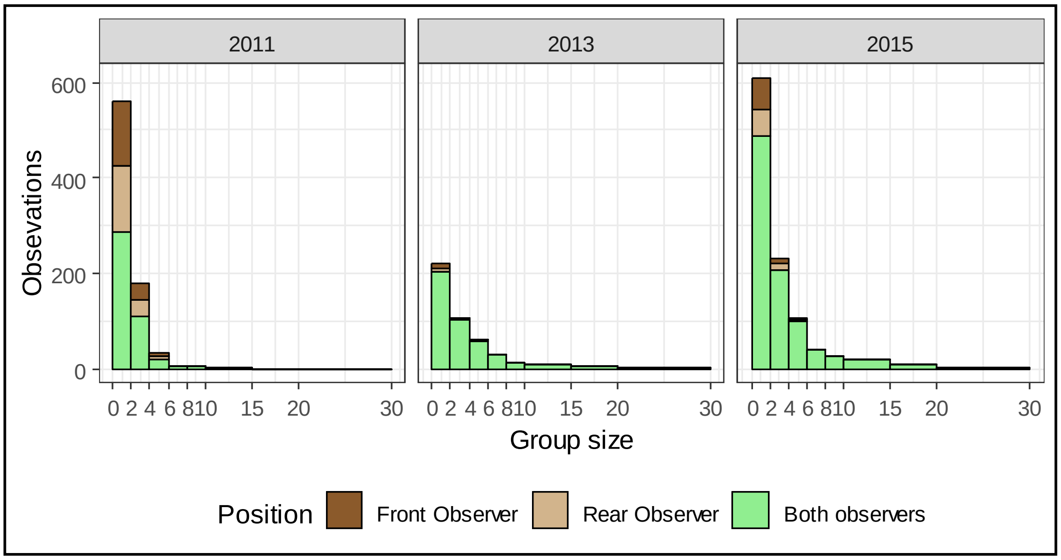

Figure 19. Group sizes of caribou observed each year for surveys conducted in 2011, 2013, and 2015 with frequency of sightings made by front, rear, and both observers.s.

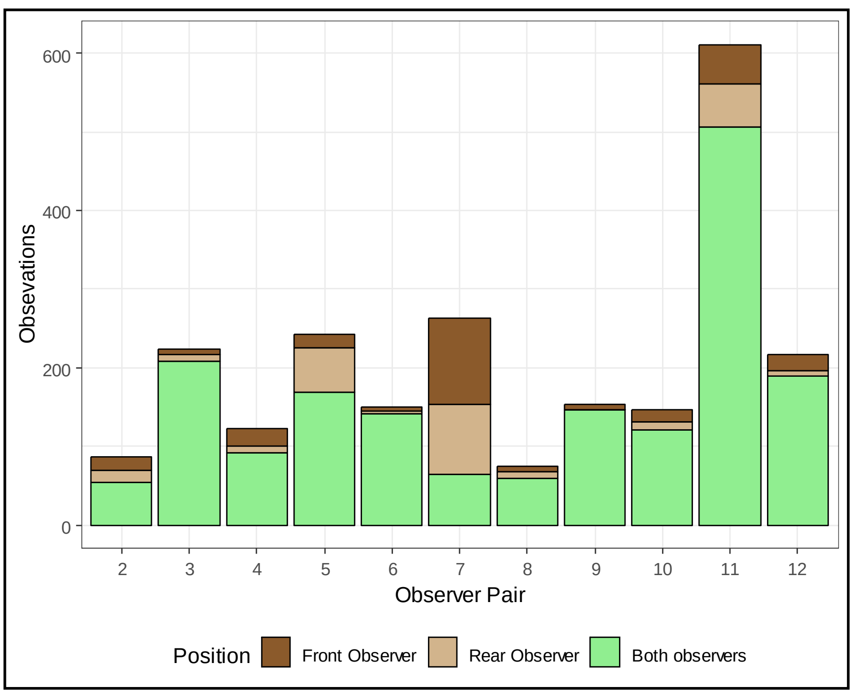

Figure 20. Observer pairings with frequencies of sighting by front, rear, and both observers.

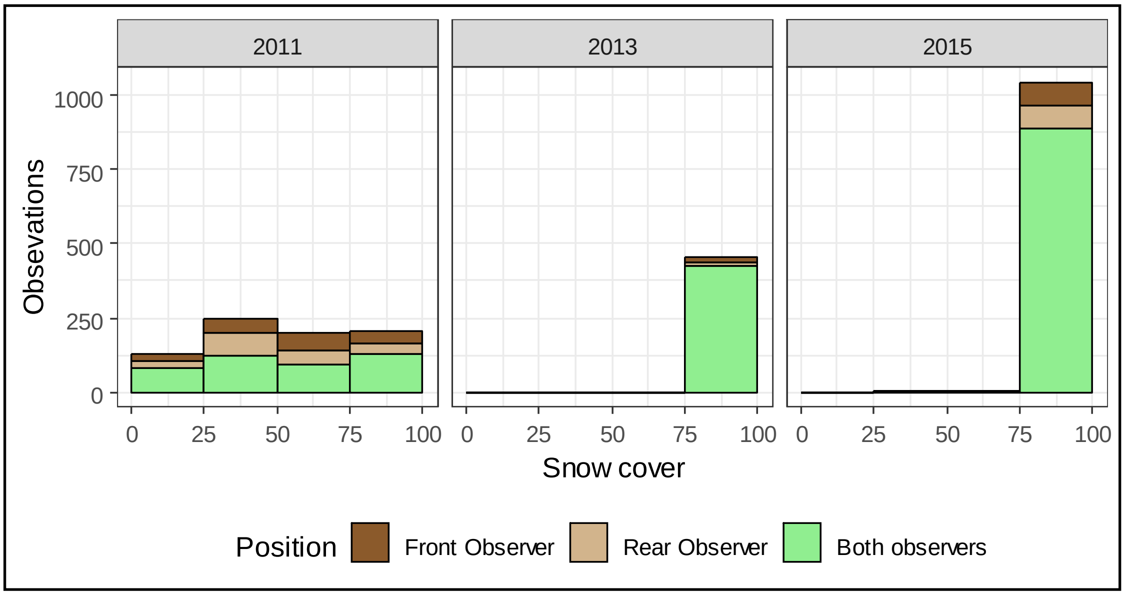

Figure 21. Snow cover during each year of the survey with frequencies of sightings by front, rear, and both observers.

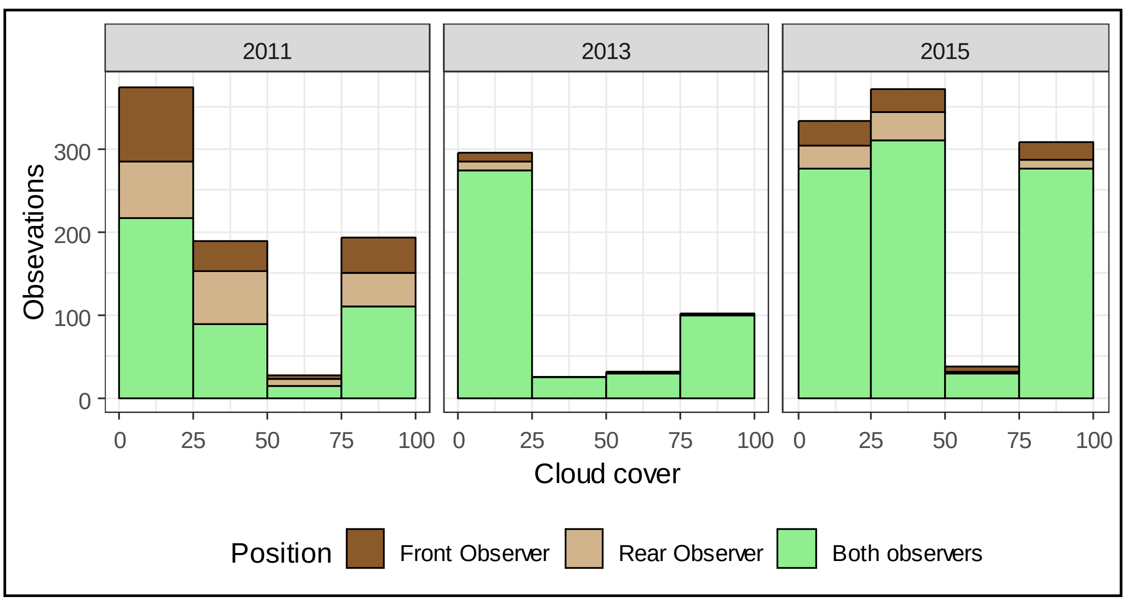

Figure 22. Cloud cover during each year of the survey with frequencies of sightings by front, rear, and both observers.

Table 6. Dependent double observer model selection results. Sample size adjusted Akaike Information Criterion (AICc), the difference in AICc between the most supported model. For each model (ΔAIC_c), AIC_c weight (w_i), number of model parameters (K), and deviance is given. See Table 1 for covariate definitions

No.	Model	AIC_c	ΔAIC_c	w_i	K	LL
1	**observers (reduced) +Year + size + cloud+snow**	1424.16	0.00	0.53	14	-698.0
2	**observers (reduced) +Year + size + cloud+snowc*size**	1425.66	1.51	0.25	15	-697.7
3	**observers (reduced) +Year + size + cloud+Year*size**	1425.91	1.75	0.22	16	-696.8
4	**Year + size + cloud + snow**	1456.59	32.44	0.00	10	-718.2
5	**observers (all)**	1463.83	39.67	0.00	11	-720.9
6	**size + snow + cloud**	1487.26	63.10	0.00	8	-735.6
7	**Year**	1493.91	69.75	0.00	3	-743.9
8	**snow + cloud**	1517.70	93.55	0.00	7	-751.8
9	**snow**	1538.96	114.80	0.00	4	-765.5
10	**snowc + cloudc + snowc * cloudc**	1565.15	140.99	0.00	4	-778.6
11	**size**	1597.33	173.17	0.00	2	-796.7
12	**Log(size)**	1608.79	184.63	0.00	2	-802.4
13	**Cloud**	1628.97	204.81	0.00	4	-810.5
14	**constant**	2666.43	1242.27	0.00	1	-1332.2

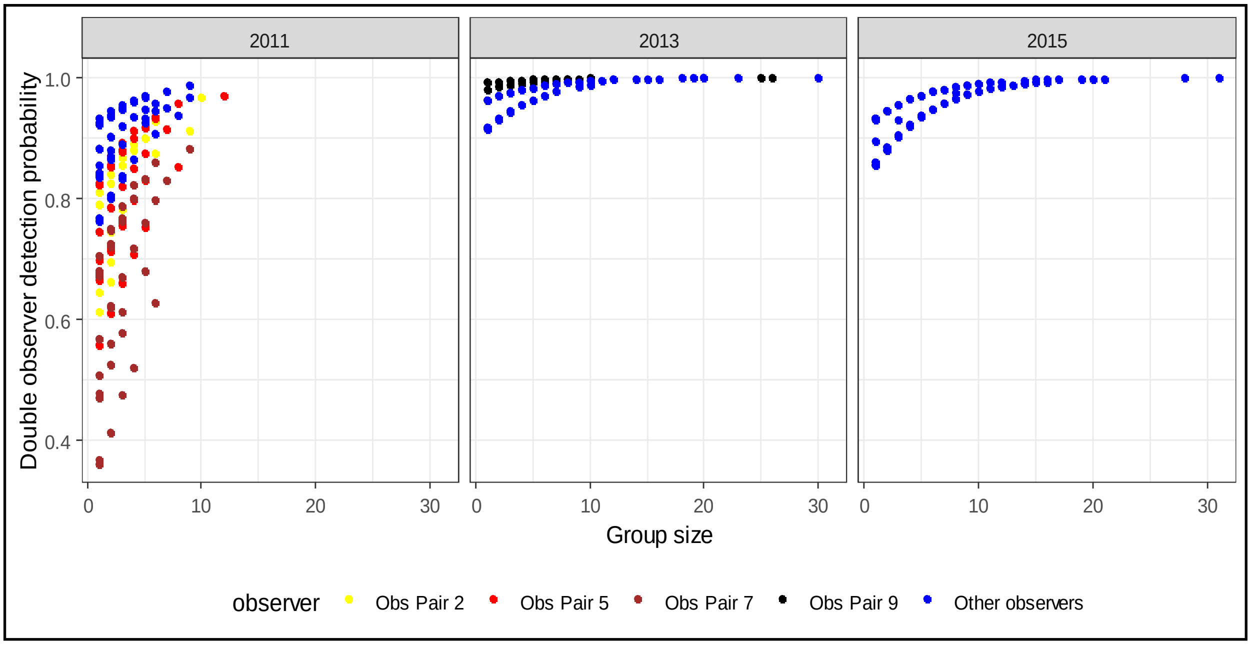

Figure 23. Dependent double observer detection probabilities as a function of year, group size, for selected observer pairs.

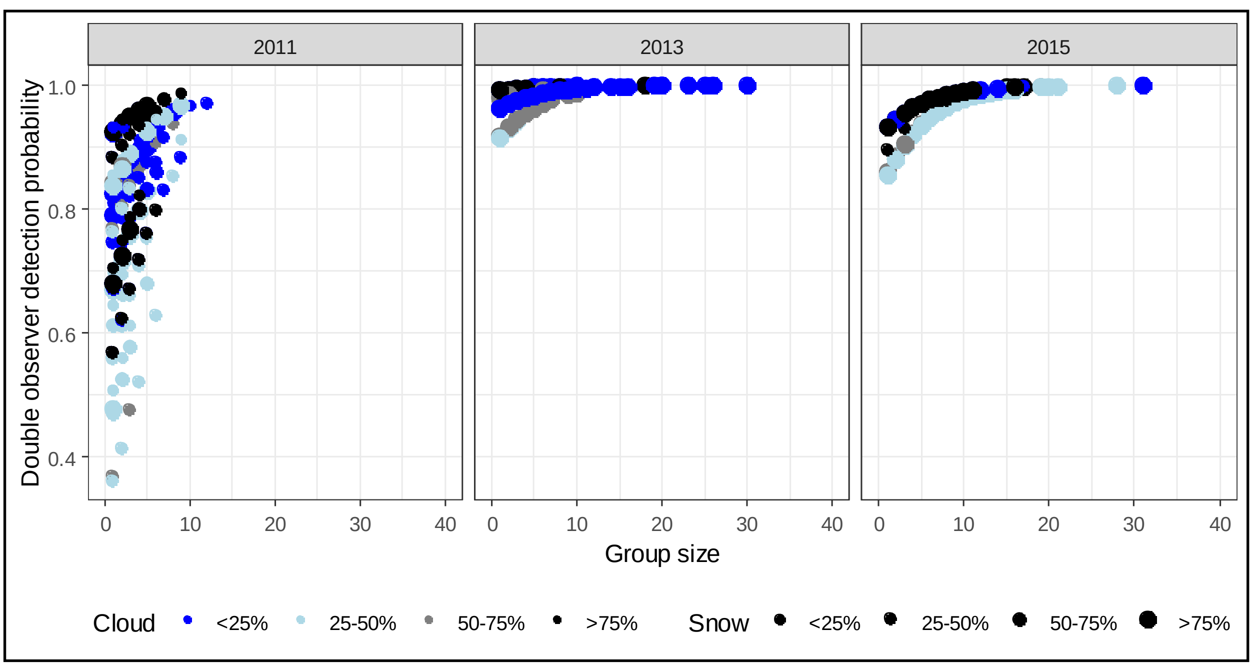

Figure 24. Dependent double observer probabilities as a function of year, group size, snow and cloud cover.

4.2.2 Distance sampling/double observer pair sampling in 2017:

During the 2017 survey, frequencies of observations by distance bins revealed different detection probability curves between observer pairs 1 and 2. Observer pair 1 had a higher frequency of observations near the aircraft whereas observer pair 2 had a higher frequency away from the plane. Compared to previous years of dependent double observer pair sampling, there was a higher frequency of observations from data recorders in 2017, suggesting a higher level of observation experience by the data recorders. To utilize these recorder observations, we categorized them as single observer observations and assumed that the data recorder had similar sighting probabilities to the other observers (**Figure 25**). Snow cover was greater than 50% in the area of most observations, and the results of the 2017 observations suggested that sightability was lower when snow cover conditions were below 50% (**Figure 26**).

Model selection proceeded by building distance sampling models with the mark-recapture model parameters held constant, and by initially comparing half normal and hazard rate models. Of these, the hazard rate model was the most supported, with observer pair and snow (continuous cover) as covariates. Once this model was selected, dependent double observer pair mark-recapture models were compared with observer pair and snow, as well as the most supported covariates. Group size (log transformed) was also supported as a distance sampling covariate (Model 1, **Table 7**). Goodness-of-fit for model 1 was marginal (chi-square=19.8, df=7,p=0.006), however most of the lack of fit came from the 600-1,000 meter distance bin which would have less influence on estimates given low observation frequency rates in this bin (**Figure 27**). An additional analysis was conducted, which used the first 2 distance bins of data to fit dependent double observer pair only models to the data, without the distance component (**Table 8**). The same suite of dependent double observer pair models was applied to the data set as used in previous years analysis and as listed in **Table 7**. According to this subsequent analysis, a model with observer, snow (continuous) and the log of group size was most supported. Population abundance estimates from this model were thus compared to the distance sampling and strip transect estimates.

4.2.3 Comparison of estimates from strip transect, dependent double observer pair, and distance sampling:

Comparison of strip transect, dependent double observer pair, and distance sampling estimates suggests reasonable agreement between estimates, with the confidence intervals from each method all overlapping. Estimates from the dependent double observer method when compared with the single observer jolly estimator were 6% higher in 2011, similar in 2013 and 2015, and 4% higher in 2017. In 2017, distance sampling estimates were 9.1% higher than strip transect estimates and 5% higher than dependent double observer pair estimates suggesting that distance sampling was better able to accommodate observations where one observer may be over sampling further distance bins (**Table 9**, **Figure 28**).

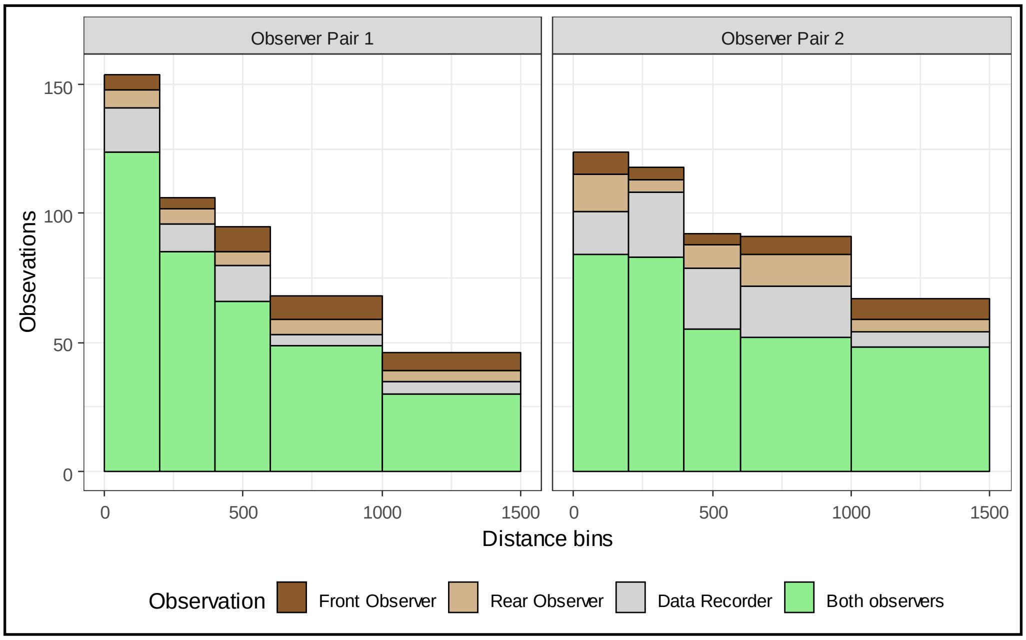

Figure 25. Frequencies of observations by distance bin for the 2 observer pairs in May 2017.

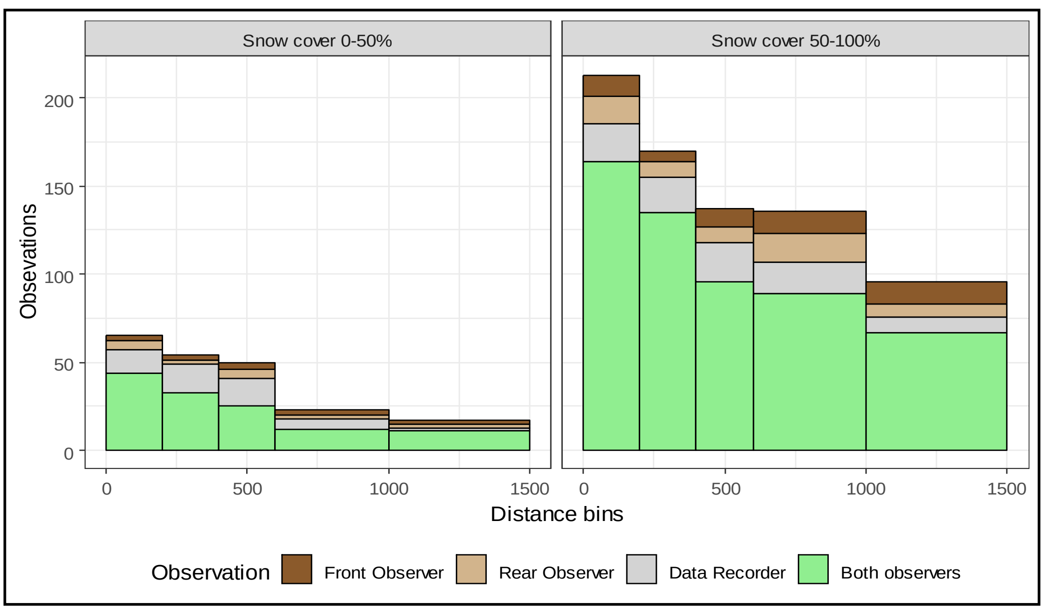

Figure 26. Frequencies of observations by distance bin for 2 levels of snow cover.

Table 7. Dependent double observer model selection results. Sample size adjusted Akaike Information Criterion (AICc), the difference in AICc between the most supported model for each model (ΔAICc), AICc weight (wi), number of model parameters (K) and deviance is given. See Table 1 for covariate definitions.

		Distance sampling	2x observer	Model fit				
No.	**DF**	**Distance covariates**	**covariates**	AIC_c	ΔAIC_c	w_i	K	LL
		Distance /Double observer models						
1	HR	obs+snowc+log(size)	obs+snowc	4000.0	0.00	0.95	8	-1992
2	HR	obs+snowc+log(size)	obs+snow	4006.6	6.59	0.04	10	-1993
3	HR	obss+snowc+size	obs+snow	4009.3	9.24	0.01	10	-1994
4	HR	obs+snowc	obs+snow	4010.8	10.75	0.00	9	-1996
5	HR	obs+log(size)	obs+snowc	4012.7	12.66	0.00	7	-1999
6	HN	obss+snowc+logsize	obs+snow	4019.2	19.16	0.00	9	-2000
7	HN	obs+snowc	obs+snow	4019.8	19.71	0.00	8	-2001
8	HR	obss+snowc	obs	4020.1	20.04	0.00	6	-2004
9	HR	obss+snowc	size	4028.0	27.94	0.00	6	-2008
		Distance sampling models						
10	HR	obss+snowc	constant	4031.2	31.14	0.00	5	-2010
11	HN	obss+snowc	constant	4040.2	40.11	0.00	4	-2016
12	HN	obs+snowc+size	constant	4040.2	40.15	0.00	5	-2015
13	HR	obs	constant	4041.7	41.66	0.00	4	-2016
14	HN	snowc	constant	4045.3	45.28	0.00	3	-2019
15	HR	size	constant	4047.0	46.96	0.00	4	-2019
16	HR	constant	constant	4047.3	47.27	0.00	3	-2020
17	HN	obs	constant	4061.1	61.09	0.00	3	-2027
18	HN	constant	constant	4067.3	67.22	0.00	2	-2031
19	HN	size	constant	4067.9	67.89	0.00	3	-2031

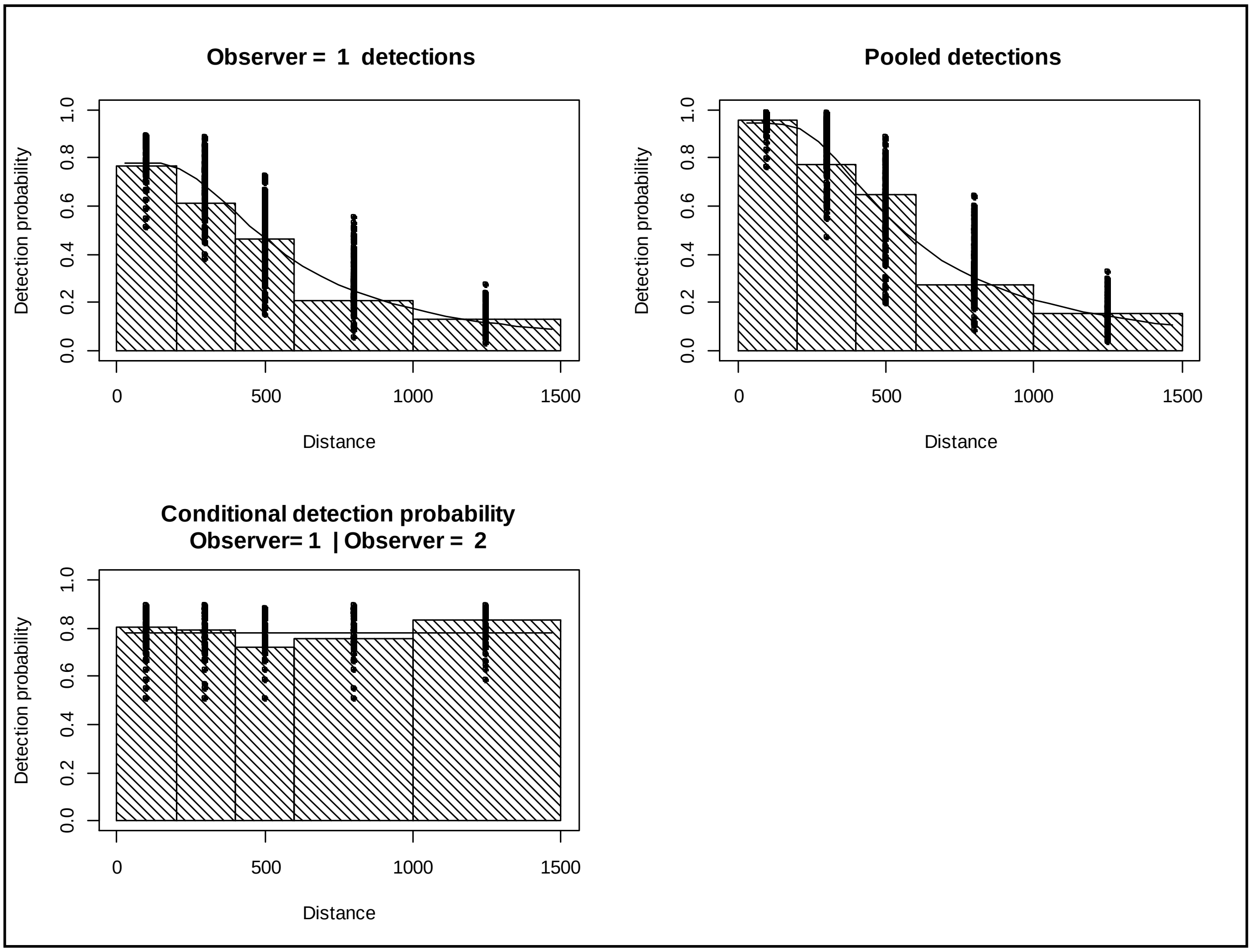

Figure 27. Graphical representation of goodness-of-fit of the most supported double observer model (Model 1, Table 7).

Table 8. Dependent double observer model selection results. Sample size adjusted Akaike Information Criterion (AICc), the difference in AICc between the most supported models for each model (ΔAIC_c), AIC_c weight (w_i), number of model parameters (K), and deviance is given. See Table 1 for covariate definitions

No	Model	AIC_c	ΔAIC_c	w_i	K	LL
1	obs+snowc+log(size)	1,193.0	0.00	0.40	4	-592.5
2	obs+snowc+size	1,193.1	0.07	0.38	4	-592.5
3	obs+snowc	1,194.7	1.70	0.17	3	-594.3
4	obs+snow_factor	1,197.8	4.75	0.04	5	-593.8
5	obs+snow_factor+cloud_factor	1,200.3	7.26	0.01	8	-592.0
6	constant	1,208.7	15.73	0.00	1	-603.4

Table 9. Comparison of estimates of Southampton Island caribou using strip transect, double observer, and distance sampling/double observer (2017 only)

Year	Method	Caribou counted	N	SE	Confidence Limit		CV
2011	Strip transect	1667	7,937	580.4	6,861	9,182	7.3%
2011	2x Observer strip transect	1667	8,442	691.9	7,171	9,937	8.2%
2013	Strip transect	1597	7,284	525.3	6,307	8,413	7.2%
2013	2x Observer strip transect	1597	7,287	557.2	6,255	8,490	7.6%
2015	Strip transect	3068	12,319	931.6	10,591	14,328	7.6%
2015	2x Observer strip transect	3068	12,368	1002.6	10,518	14,542	8.1%
2017	Strip transect	1685	8,436	680.8	7,184	9,906	8.1%
2017	Distance 2x observer	1653	9,200	796.4	7,755	10,915	8.7%
2017	2x Observer strip transect	1665	8,752	759.5	7,365	10,399	8.7%

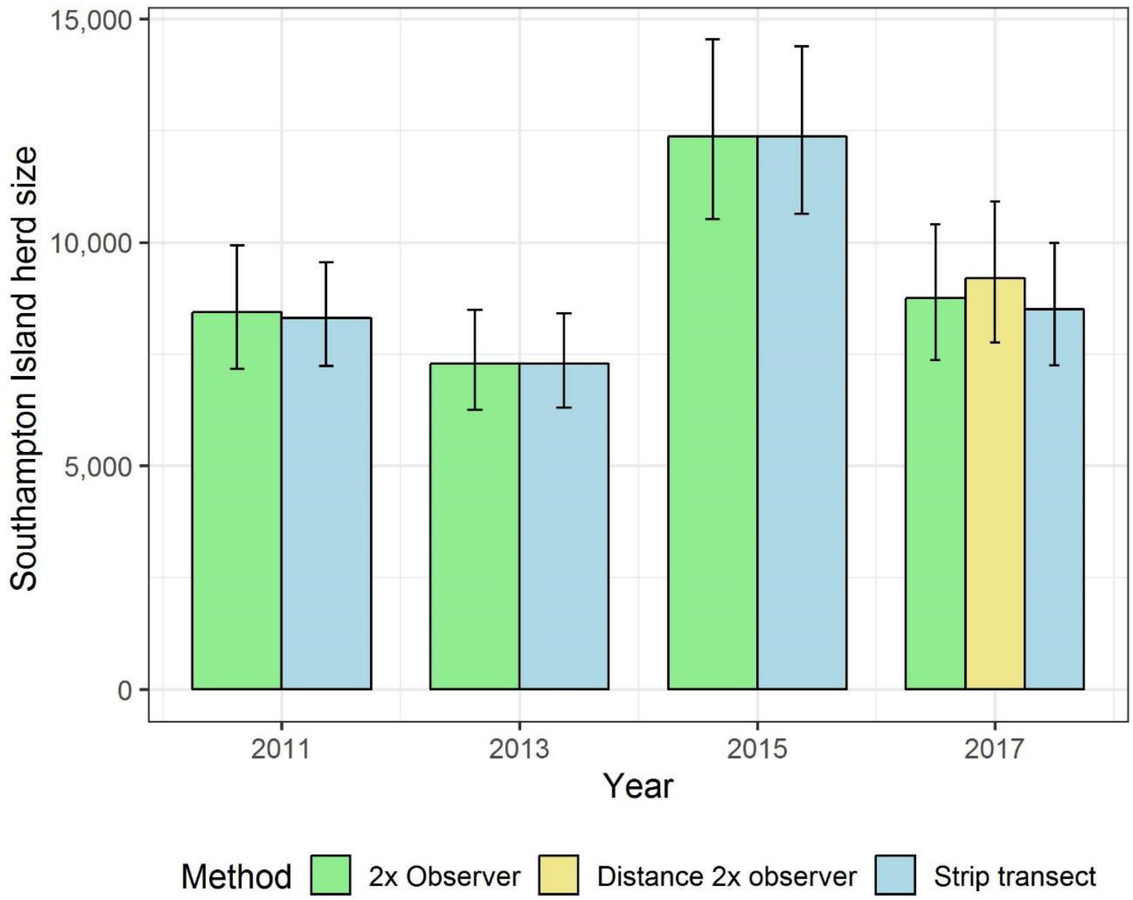

Figure 28. Comparison of Southampton Island caribou herd abundance estimates from strip transect, dependent double observer, and distance sampling/double observer analyses (2017).

4.3 Trend estimates:

Our trend analyses covers two separate phases of Southampton Island caribou abundance: prior to 1997 when herd abundance was increasing, and from 1997 to 2017 when the herd was declining. Prior to 1997, and since their reintroduction, the abundance of the SHI caribou herd was increasing. Despite a statistically significant increase between the May 2013 and May 2015 survey estimates, the SHI herd has exhibited an overall decline since 1997.

4.3.1 Trend from 1997 to 2017 (the decline phase):

Data from 1997 to 2017 included strip transect, dependent double observer pair, and distance sampling surveys. The use of different methods had minimal effects on the overall abundance trends identified. However, the best estimates for 2011, 2013, and 2015, based on model fit and lowest CV's, were dependent double observer pair estimates which accounted for sightability, especially in 2011. For 2017, the distance sampling estimate was least biased because of observer error. For this reason we used strip transect data for estimates from surveys up to 2009, followed by dependent double observer pair estimates for 2011 to 2015, and distance sampling estimates for 2017.

T-tests were used to compare the significance of the difference between sequential estimates (**Table 10**). Of the 8 survey estimate comparisons the 1997 to 2003, 2005 to 2007, 2009 to 2011, 2013 to 2015, and the 2015 to 2017 periods showed statistically significant change. Of these comparisons, only the 2013 to 2015 estimates showed a statistically significant increase in the SHI caribou population, all others displaying significant declines. Annual change in population size, based on a year to year comparison of estimates (expressed as ratios), varied between 0.79 and 1.30. SHI caribou abundance estimates from 1997 to 2017 are shown graphically in **Figure 29**. To estimate the effect of a potential immigration event on the overall trend, prior to the 2015 survey, an additive term was applied to model use to generate the 2015-2017 survey estimates. This term basically assumed that the SHI population was increased by a constant amount during this time due to immigration. These terms were both found to have a significant effect on the trend in caribou abundance (**Table 11)**. The year term provided an estimate of long term annual rate of change for the SHI population (0.91 CI=0.89-0.93) which was not, overall, affected by the immigration event. This translates to a 9% (CI=7-11%) decline in caribou abundance each year, from 1997 through 2017. The immigration term estimated the gross rate of increase (1.76, CI=1.3-2.4) in the SHI population between the 2013-2015 surveys, additive to the year term.

A plot of model predictions reveals good fit of the model to estimates with predictions intersecting the confidence limits of 7 of the 9 estimates (**Figure 30**). Namely, the model suggests that the herd declined at a constant rate from 1997-2014, followed by an immigration event sometime between May 2013 and May 2015 (Patkeau, 2015), and then continued to decline at a similar rate as it had previously, from 2015-2017 (**Figure 30**). Using this model, and assuming a constant rate of decline (9%) over the period, we estimated that approximately 5,024 caribou would have had to immigrate to SHI between May 2013 and May 2015 to account for the increased number of animals observed in May 2015. If the immigration event had not occurred, and the population continued to decrease at the 9% rate, then there would be approximately 4,200 caribou remaining on the island as opposed to the 9,200 estimated in the 2017 survey.

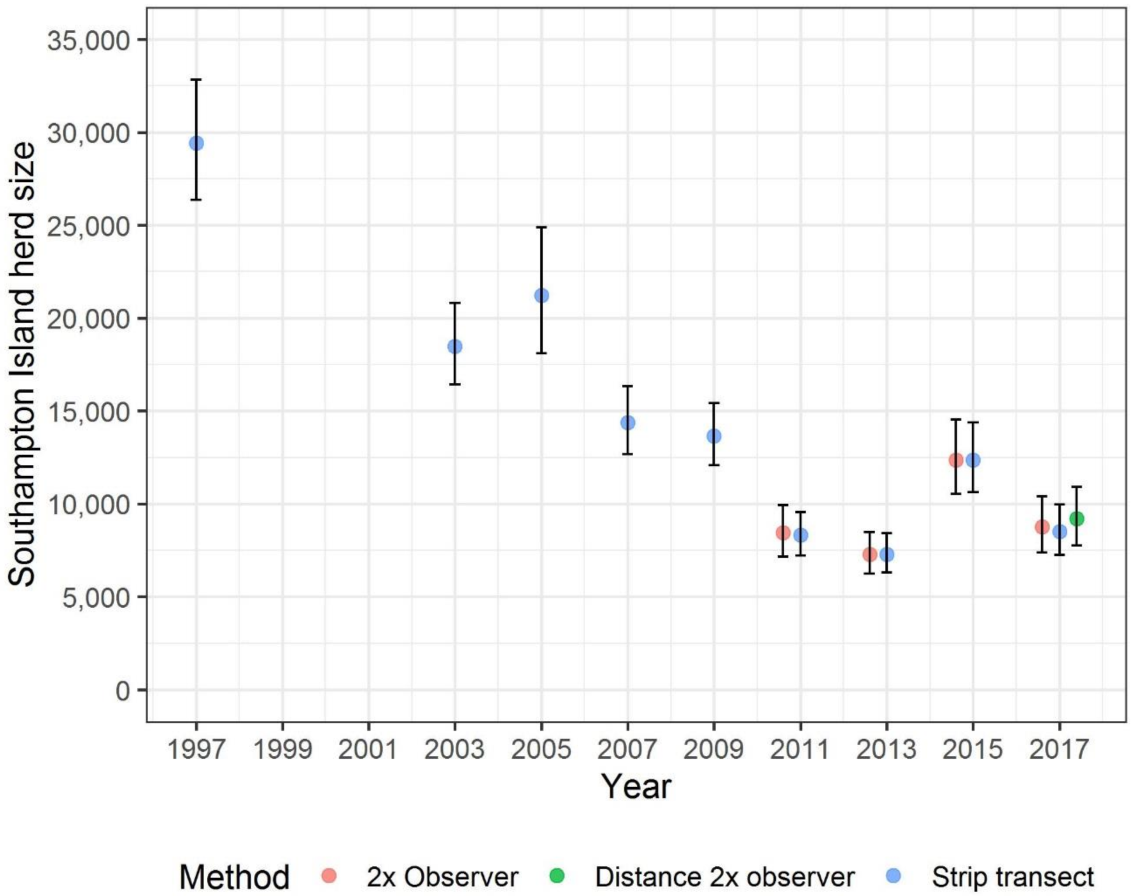

Figure 29. Comparison of strip transect, dependent double observer pair, and distance sampling/double observer pair estimates (2017).

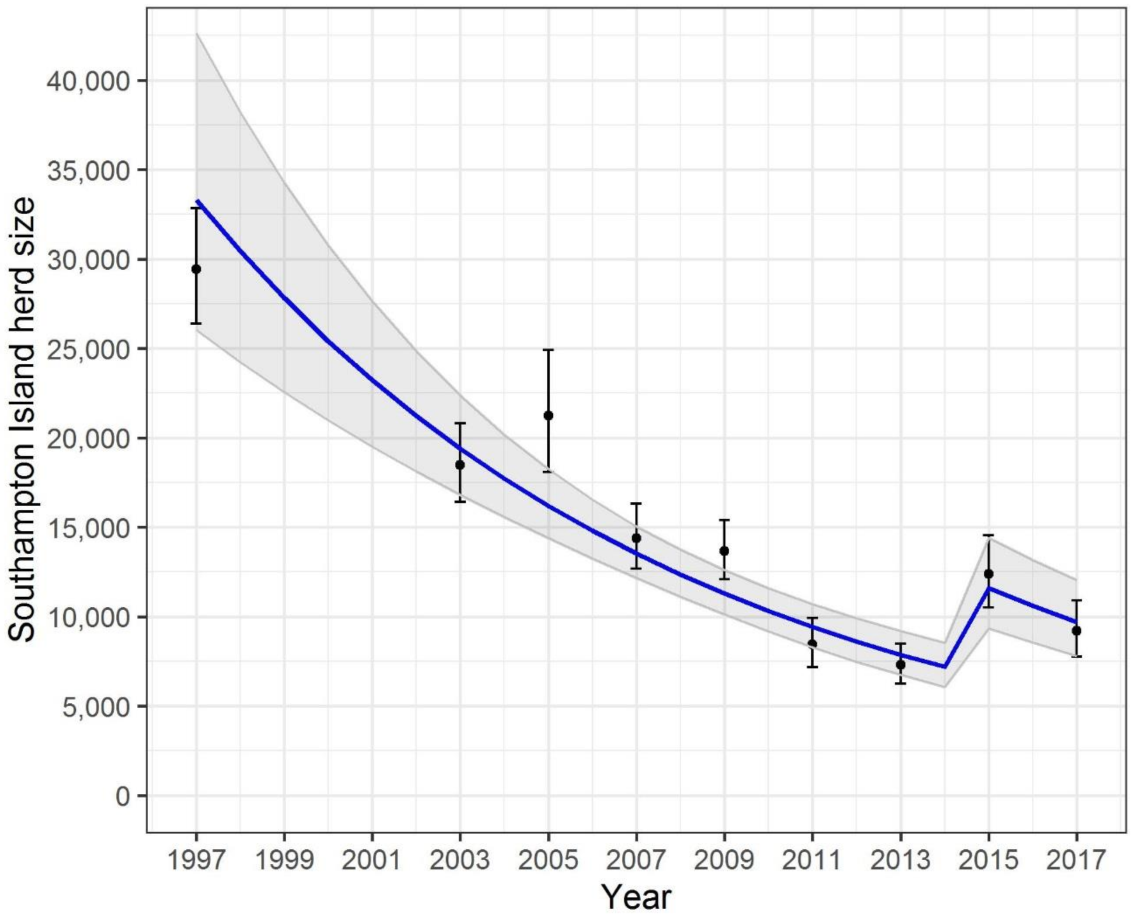

Figure 30. Predictions of herd size of the Southampton Island caribou population from the log-linear model (Table 11), which assumes a constant decline in population size with an immigration event that occurred before the 2015 survey. Confidence limits are provided as shaded regions on the plots.

Table 10. Estimates used for the 1997 to 2017 trend analysis of Southampton Island caribou abundance, with the results of t-tests comparing the estimates of successive surveys. Also shown are estimates of gross and annual change based on the ratios of successive estimates.

Year	method	N	SE	CV	df	ttest	df	p-value	Gross change	Annual change
1997	Strip	29,425	1622.5	5.5%	93					
2003	Strip	18,479	1099.8	6.0%	90	-5.58	163	0.000	0.63	0.93
2005	Strip	21,227	1701.8	8.0%	76	1.36	132	0.177	1.15	1.07
2007	Strip	14,389	914.6	6.4%	88	-3.54	117	0.001	0.68	0.82
2009	Strip	13,651	833.1	6.1%	80	-0.60	168	0.551	0.95	0.97
2011	2x Obs	8,442	691.9	8.2%	73	-4.81	151	0.000	0.62	0.79
2013	2x Obs	7,287	557.2	7.6%	59	-1.30	131	0.196	0.86	0.93
2015	2x Obs	12,368	1002.6	8.1%	59	4.43	92	0.000	1.70	1.30
2017	Distance	9,200	796.4	8.7%	134	-2.47	133	0.015	0.74	0.86

Table 11. Log-linear model parameter estimates for trend analysis (1997-2017).

Term	β	SE (β)	t	p-value	Confidence limit	
Intercept	36448.28	0.14	77.39	0.0000	27,708.8	47,188.1
Year (λ)	0.91	0.01	-8.37	0.0002	0.89	0.93
Immigration	1.76	0.15	3.68	0.0103	1.30	2.38

4.3.2 Trend from 1978 to 1997(the increase phase):

The historic data set (1978-1991) was added to the analysis to obtain an estimate of trends in the SHI caribou population during the phase of increase that occurred from 1978 to 1997. This was accomplished by adding terms to account for the decrease phase, which allowed us to estimate an annual rate of increase of 1.19 (CI=1.16-1.22), or, 19% (CI=16-22%), from 1978 to 1997 (**Table 12**). A plot model for these predictions is shown in **Figure 31**.

4.3.3 Sampling effort and error

A comparison of strip transect, dependent double observer pair, and distance sampling estimates suggest that the assumption of perfect sightability on the 400 meter survey strip was met in 2013 and 2015 with estimates being close for dependent double observer pair and strip transect estimates (**Figure 28**). In 2011, variability in observers and snow cover reduced the strip transect estimates compared to the dependent double observer pair estimates. In this context, the dependent double observer pair method provided a test of assumptions of the strip transect method and corrected estimates when the assumption of perfect sightability was violated. In 2017, distance sampling estimates were higher than dependent double observer pair and strip transect estimates. This may have been due to one of the observer pairs not putting enough survey effort to the distance bins closer to the aircraft (**Figure 25**), as indicated by different shapes of the detection histograms for the two observer pairs. This would have caused a negative bias in both strip transect and dependent double observer pair estimates and illustrates a potential issue with distance sampling; observers spending too much time looking out at further bins which are often easier to view than the closer bins. In the case of conditions of excellent sightability, this can lead to a significant over estimate. The dependent double observer pair method partially accounted for this by also estimating the sighting probabilities of observers near the survey line. The dependent double observer pair method assumes that the two observers in a pair have equal sighting probabilities. It is therefore essential that observers switch places half way through the day to ensure robust estimates from this method. Of the 14 observer pairings on surveys, 7 switched places which may have affected the overall quality of the dependent double observer estimates. If observers cannot switch places then an independent observer method should be considered especially when caribou density is not high.

4.3.4 Overview of Abundance and Trend Analysis:

Overall, trend analysis suggests that the SHI population has been decreasing at a rate of 9% per year since the 1997 survey. An immigration event in 2015 increased the population, however, comparison of the 2015 and 2017 survey estimates suggests the 9% decline continued, even after this immigration event (**Figure 30**).

Table 12. Log-linear model parameter estimates for trend analysis (1978-2017).

term	β	SE (β)	t	p-.value	Confidence Limit	
Intercept	907.80	0.18	38.8	0.0000	633.80	1262.22
Trend (1978-1997)	1.19	0.01	13.1	0.0000	1.16	1.22
Decrease-Intercept	350.46	0.54	10.9	0.0000	121.56	991.77
Immigration (2015)	1.92	0.17	3.8	0.0049	1.38	2.68
Year*Decrease	0.76	0.02	-13.4	0.0000	0.73	0.79

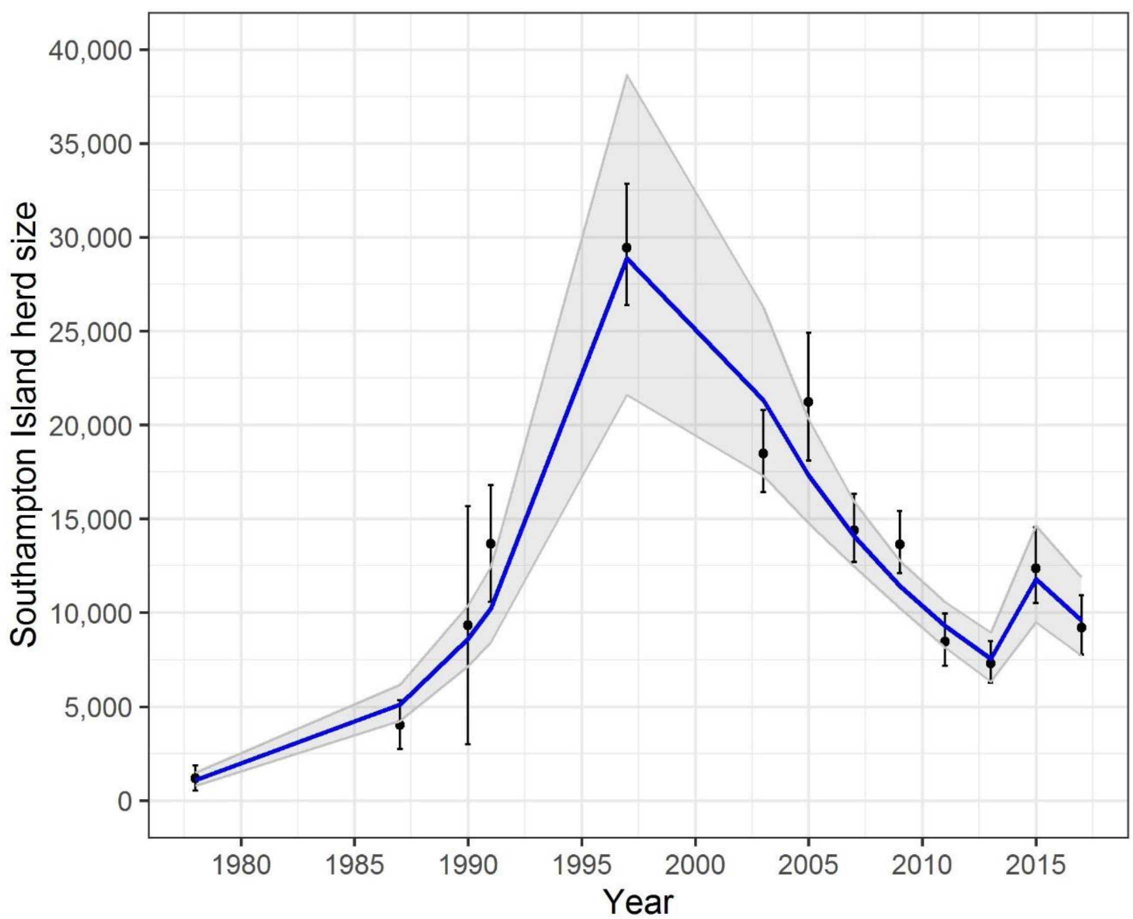

Figure 31. Predictions of herd size of the Southampton Island from the log-linear model (Table 12) which assumes a constant decline in population size after 1997 with an immigration event that occurred before the 2015 survey .

4.4 Effect of Disease on Abundance:

Brucellosis is an infectious disease caused by the Bacteria *Brucella*. Many different animal species including humans can become infected. The form of Brucellosis that occurs in wild caribou is *Brucella suis* Type IV. In caribou this bacteria occurs primarily within tissues of the reproductive system but also commonly occurs within leg joints (Williams et al. 2001; CDC 2016; Corbel, 2006). The bacteria can also be found in the milk, blood, urine and semen of infected animals (CDC 2016; Corbel, 2006). Animals can get the bacteria by either oral ingestion, direct contact with the mucus membranes of the eyes, nose, or mouth, or through breaks in the skin. Brucella can also be transmitted by contaminated objects (fomites) (Corbel, 2006). Some animals are carriers and can have the bacteria without showing signs of the illness. Animals in these cases can shed the bacteria into the environment for long periods, infecting other animals in the herd. Brucellosis can cause reproductive problems such as abortions, still birth and infertility. Other signs can include arthritis, swelling of the joints and testicles, and udder infections (mastitis) (Williams et al. 2001; CDC 2016; Corbel, 2006). Tissues and fluids associated with abortions, drainage of fluid from swollen joints, vaginal discharge, fetal fluids, and semen can be highly infective and can spread the bacterium into the immediate environment where uninfected animals can become infected through the ingestion of infected tissues and objects such as plants. The potential for environmental concentration of this disease makes Brucellosis a density-dependent disease. Areas of concentration such as migratory corridors, rutting areas and, particularly, calving grounds would represent some of the higher risk areas for the spreading of this disease (Williams et al. 2001; CDC 2016; Corbel, 2006). Predation and scavenging of diseased tissue can also contribute to the bacterium's spread throughout the environment.

Health monitoring of the SHI barren-ground caribou had its beginnings in 1988 when Heard (departmental correspondence) sampled 20 cows in March to determine their reproductive status and general condition. These small condition studies continued through 1991 (Adamczewski and Heard data) at which time the condition studies ceased. The analysis of condition was started up again in February 1996 in association with the initiation of the large scale commercial harvest in March 1993. Due to the small sample sizes in the early condition data, for the most part, these were not included in this analysis. The first samples did, however, give results that were consistent with hunter reports of caribou on SHI in excellent health and condition at this time. By 1995, the condition and productivity of the herd had changed little, an assessment that would remain up until the 2000 harvesting season when CFIA random blood testing identified the beginning of what would become a rapid induction of the bacterial disease *Brucella suis* serovar 4 in the SHI caribou herd (**Figure 32**). There is no evidence of this disease within this population prior to the 2000 harvesting season.

Concurrent with the decline from the 1997 to 2005 survey estimate, there were at first subtle, then more dramatic shifts in range use by 2005. Range use changed significantly as densities dropped in most areas, with the exception of the north central portions of the islands where use remained consistent between years although densities slowly dropped up to present (Figure 12 and 13). In addition, the first cases of *Brucella suis* were reported during the 2000 harvest year (1.7% of 400 animals tested) and had reached a prevalence of 19.5% in 2003, 28.6% in 2005, 48.8% by 2007, 39.1 % by 2009 and 58.8 % by 2011. Pregnancy rates, which are affected by Brucellosis, initially dropped from 93.1% in 2001 to 37.9% in 2005, and then increased to 64.4% in 2007. The hopes that the disease was declining in the population were dashed when a 2009 screening showed pregnancy rates dropping further to 44.3%. The last major condition study conducted in March 2011, prior to the application of a TAH, recorded pregnancy rates of 37% (**Figure 32**).

In 1992 the Canadian Polar Commission released a status report on Brucellosis in the Circumpolar Arctic (O'Reilly, 1992). In the report, O'Reilly summarized the incidence of Brucellosis across the Circumpolar arctic (**Table 13**). Brucellosis prevalence within the Southampton Island population reached a high of 58.9% in 2011 which represents the highest prevalence amongst any caribou and/or reindeer populations' worldwide (O'Reilly, 1992). Currently levels are unknown due to a cessation of the annual caribou condition harvest. With the human health issues associated with Brucellosis through either the consumption or handling of infective tissues, Coral Harbour residents are concerned over the future of their caribou herd.

4.41 Brucellosis and heard trend:

Concurrent with the rising prevalence of the reproductive disease *Brucella suis* was the reported declines in abundance from 1997 through 2013 (**Figure 32**). It appears clear that Brucellosis was a contributing factor to the steady declines observed in this population of caribou. However, with high commercial harvest rates of the SHI herd up to 2009, it is likely that both commercial hunting pressure and disease together, contributed significantly to a declining trend in caribou abundance. By 2003, three years following the first confirmed cases of Brucellosis in SHI caribou, pregnancy rates were still over 85% and the population was still over the hypothesized carrying capacity of the island of an estimated 15,000 animals (Oulett et al. 1996). With Brucellosis being a density dependent disease, it was decided by all co-managers that a further reduction in caribou abundance would be beneficial to the long term viability of the SHI population. In the meantime, continual monitoring and population assessments every 2 years would provide an early warning system, should the decline steepen.

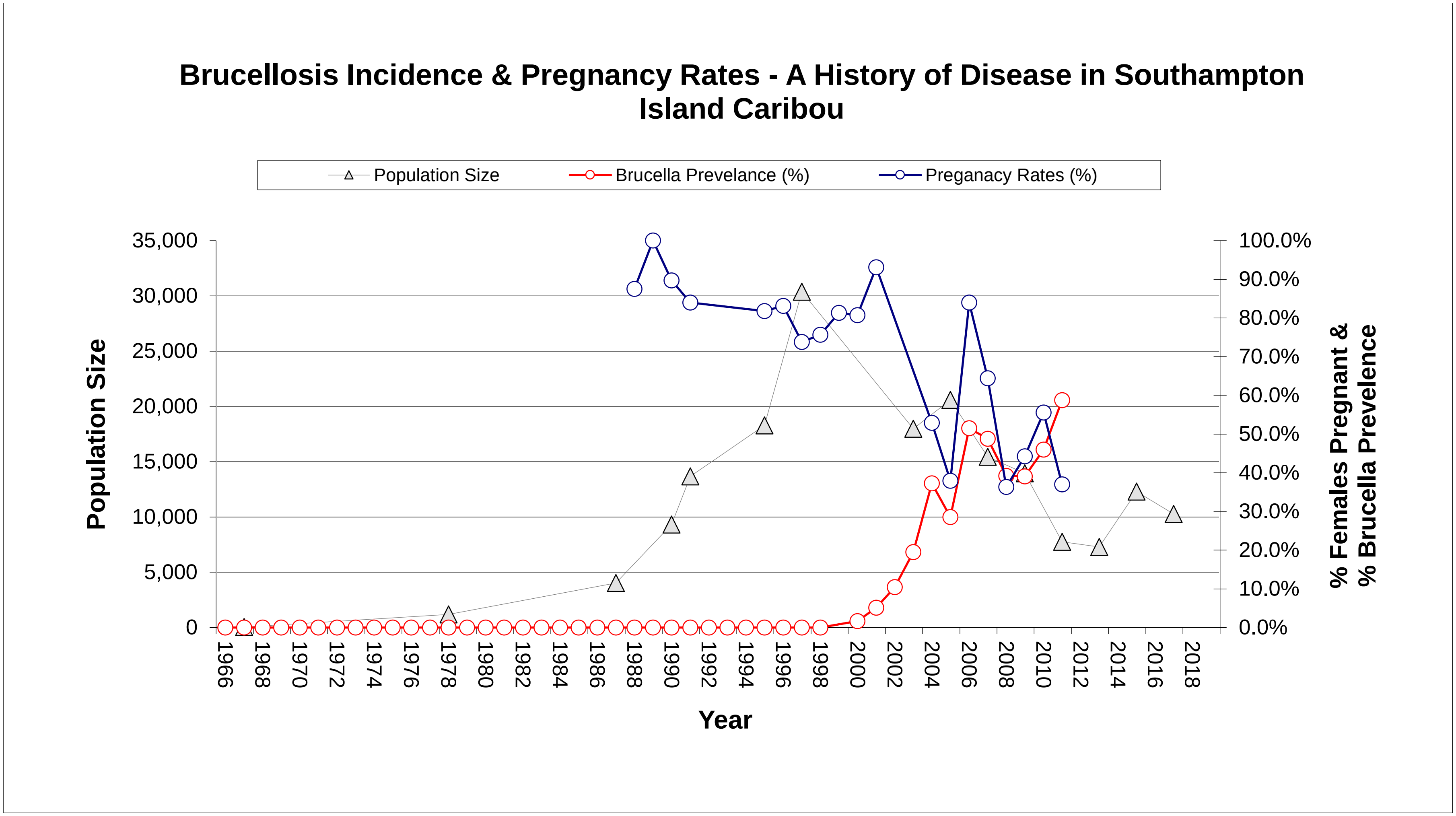

Figure 32. A history of abundance, pregnancy rates and *Brucellosis suis* prevalence for the Southampton Island caribou herd originally introduced onto the island from Coats Island in 1968.

Table 13. Circumpolar Incidence of Brucellosis in barren-ground Caribou and Reindeer across arctic North America (after O'Reilly, 1992).

Herd	Incidence (%)	Date	Remarks	Source
Southampton	Not Present	1990	75 samples	(NWT Wildlife notes)
Qamanirjuaq	4%	1966-68		(NWT Wildlife notes, 1983)
Beverly	< 2%	1983	118 samples	(Goldfarb, 1990)
Bathurst	Present	1981-1983	3 samples	(NWT Wildlife notes, 1983)
Baffin Island	14-35%	Mid-1980s	N Baffin highest	(O'Reilly, 1992)
Melville/Boothia	20-35%	1980s	17 samples	(O'Reilly, 1992; Gunn et al. 1991)
Ahiak	?			
Porcupine	15-20%	1980s	?	(O'Reilly, 1992)
Central Arctic	15-20%	1980s	?	(O'Reilly, 1992)
Western Arctic	</= 30%	1960-1980	?	(O'Reilly, 1992; Neiland et al. 1968)
Nechina	1-6.5%	1962-65	?	(Neiland et al. 1968)
George River	Not Present	1987-88	?	(Forbes 1991; Greenberg et al. 1958)
QEI Peary	Present	1980s	1 sample (P. of W. Island)	(Forbes, 1991)

4.5 Harvest:

Throughout the reintroduction of barren-ground caribou to SHI, wildlife managers of the time were vigilant in their on-going management of the herd. Management recommendations were, in all cases, based on research results, and particularly quantitative population estimates. In February 1978, the first caribou hunt since the 1968 introduction, was carried out on SHI. The quota was set at 25 bulls and was based on observations from a reconnaissance survey flown in 1977 that sighted a total of 172 caribou, 79 of which were adult males, 54 adult females, and 39 yearlings, suggesting a sex ratio skewed towards males (Kraft, 1978) (**Table 14**) (**Figure 33**). In August 1979, the TAH (quota) for bulls was increased to 50 largely based largely on the findings of the November 1978 population survey. Early in 1983 the first cow harvest was approved with a TAH set at 20. Regulations were developed along with this new TAH stipulating that 10 cows be harvested in the spring and the remaining 10 in the fall. The TAH was then raised from 50 to 250 bulls, and from 20 to 50 cows, based on recommendations generated following the 1987 population estimate (Heard and Grey, 1987).

During the 1988 harvesting year, concerns regarding the accidental harvesting of females seem to have led to the removal of the female quota and an increase in the male quota to 300 animals sometime in 1988. At this time, it was clearly indicated in the regulations that; “hunting zone J/2 (Southampton Island) was restricted to 300 male caribou.” In 1989 recommendations to increase the TAH to 400 caribou, of which 100 could be female were made. These recommendations were supported by Doug Heard who indicated the proposed increases were based on sound ecological principles (Renewable Resources Official Correspondence 140 007 005 & 150 001 005, October, 1989). Seasons for this new quota were recommended to be from October 1st to October 31st for males and April 1st to May 31st for females. By 1993, and in response to rapid population growth reported by Oullett in 1991, the TAH was removed (Oullett, 1992) (**Table 15**).

From 1993 up until the 2012 harvesting season subsistence harvest was not accurately monitored. In Nunavut monitoring of caribou harvest in the absence of a TAH is not mandatory. Although the 1991 NWMB Harvest Study attempted to assess wildlife harvest through hunter interviews, it is generally agreed that the final estimates are best guesses and may be misleading in some cases. For SHI, however, accurate records of harvest numbers and sex ratios (for most harvests) were kept as part of commercial harvests running consecutively between the harvesting years of 1992 through to 2007 and including 2009.

The first commercial quotas were established in 1992 and were set at 250 animals (gender breakdown unknown) (Junkin, 2003) (**Table 16**) (**Figure 33**). Despite the 1992 commercial allocation, it was not until 1993 that the first five caribou (of unknown gender), harvested for commercial purposes was reported since the herd's reintroduction from Coats to Southampton Island. Commercial quotas continued to rise to 1,000 animals in 1993, 5,000 in 1994 and 6,000 by 1997 (Junkin, 2003). Since 1993 there have been annual commercial harvests up to and including the 2009 harvesting season. Interestingly, a non sex-selective subsistence quota of 1,000 animals was re-instated in 1994 in an effort to offset an increase in the commercial quota from 1,000 to 5,000 over the same period (Junkin, 2003). By 1997, in response to survey results indicating the continued rapid growth of the population to 30,381 animals (Mulders, 1997), concerns about the caribou population having exceeding the Islands hypothesized carrying capacity of 15,000 caribou were being realized (Oullett et al 1994, Oullett et al 1993). In response to these concerns, the wildlife regulations were once again amended to allow an unlimited subsistence harvest and a non sex-selective commercial quota of 6,000 caribou.

Overall the commercial harvest was successful in reducing the population to the estimated carrying capacity of the Island of 15,000 caribou (Oulett et al. 1996). Current concerns however, are that continued high harvest rates, in excess of

6,500 caribou over the 2006 and 2007 harvesting seasons would drive the population too low to sustainably maintain the estimated subsistence harvest rate of 1,500 to 2,000 caribou annually. Additionally, there was the concern of rising Brucella prevalence and its observed impact on the reproductive potential of the SHI herd. The continued decline of SHI caribou following the 2003 survey estimate only heightened these concerns, and by 2007, when the population had dropped further to an estimated 14,389 adult and yearling caribou, discussions on ending the commercial harvest had begun. However, the harvest employed many local people and the political will to continue the harvest was high. Despite these pressures the harvest was cancelled by the Coral Harbour HTO in 2008 and only a small harvest of 843 was undertaken in March 2009. Between 1978 and 2009 an estimated total of 27,400 caribou had been harvested for subsistence purposes and 42,000 for commercial purposes yielding a total harvest of 69,400 caribou, of which 61% were taken for commercial purposes (**Table 16**). Since 2009 there has been no commercial caribou harvest. Results from the 2009 aerial abundance estimate showed no significant change between survey periods suggesting that the cessation of the harvest was having the net effect of slowing or stabilizing the population decline. But, over the same period, annual condition and disease monitoring tracked a steady increase in Brucellosis prevalence and a corresponding reduction in reproductive productivity (**Figure 32**).

Unfortunately the stabilizing effect lasted only a short period and by June 2011 estimates of population abundance dropped further to 8,442 adults and yearlings. With the commercial harvest having been stopped and the subsistence harvest remaining relatively constant at an estimated 1,500 to 2000 caribou annually, the reasons for this rapid decline appeared to now be related to the reported high prevalence of the reproductive disease Brucellosis. By March 2011, Brucellosis disease prevalence had reached a troubling 58.8% and spring pregnancy rates had plummeted to 37% (**Figure 32**). In addition to high rates of disease, around this time and despite the cessation of the commercial harvest, a new method of selling country foods was gaining popularity, and increasing harvests of SHI caribou. This new harvest pressure was developing from the growing demand for the sale of caribou meat on social media. A ripe market had opened up on Baffin Island where Baffin communities were struggling with declining caribou populations as well. When sales of caribou from SHI on social media began, 24,764 kilograms of caribou meat was sold and shipped from SHI in the first 8 months of sales, representing an estimated 710 caribou (**Figure 34**). Unfortunately the data provided by the airline was cutoff in January 2012 thus removing our ability to assess the internet sales and harvest totals, through export traffic, for the months of heaviest harvest (March, April, and May).

4.51 Harvest Management and Planning 2011 to present:

Meetings in the summer and fall of 2011 between the GN Department of Environment and the Coral Harbour HTO, and additional meetings with all stakeholders in the winter of 2012, led to a formal request by the Coral Harbour HTO to the GN and the NWMB to apply a TAH of 4 caribou per household (1,000 caribou) in an attempt to stabilize the decline through harvest management. Additionally the annual condition harvest of 100 animals, used to asses Brucellosis prevalence and pregnancy rates amongst other health and condition indicators, was discontinued in order to move all harvesting opportunities to local Inuit.

Another product of these meetings was the development of the *Southampton Island Barren-ground Caribou Population Management Plan* (2012),which was submitted to the NWMB for decision in March 2012. The plan outlined an agreement to establish a TAH of 1,000 caribou and a Non-Quota Limitation (NQL) protecting cow/calf pairs. Also in the plan was the specification of continued harvester-supported monitoring, and the continued assessment of SHI caribou population abundance every 2 years. The urgency of the situation lead to the NWMB supported and community requested establishment of a Ministerial

Management Initiative (through the Nunavut *Wildlife Act*) to immediately assign a temporary TAH.

By May 2013, the herd had further declined to an estimated 7,287 adult and yearling caribou, prompting the GN to recommend a further reduction to 2 caribou per household (500 caribou) with 100 caribou held back for the HTO to use as deemed appropriate, for a total of 600 caribou. The community rejected this recommendation, preferring to wait until the May 2015 abundance estimate had been made, to make a final decision. The community based its decision on hunter observations of reduced signs of Brucellosis within their catch and a general thought that herd health and pregnancy rates were improving. Continued reports of healthy caribou, fewer signs of disease, several reports of a possible movement of caribou onto the Island over the winters of 2014 and 2015, and a noticeable increase in calves in June 2014, preceded the May 2015 abundance survey. Consistent with community reports, the 2015 survey estimated a significant increase in adult and yearling caribou. In two years, the population had increased by 5,081 animals to 12,368 caribou, an estimate far higher than could be accounted for by reproduction alone. The community of Coral Harbour was not surprised with the result, attributing the increase to what they believe was the movement of a large group of caribou from the mainland onto the north end of the island. In an attempt to verify these accounts, the GN conducted a genetic analysis using SHI hunter provided tissue samples from 2014 and then comparing them to SHI samples from 2004 and samples collected on the mainland in the vicinity of Naujaat.

Table 14. History of the Southampton Island assigned subsistence harvest quotas (TAH) from 1978 to 1991. Harvest management prior to the first commercial allocation in 1992 (subsistence harvest estimated using government reports, HTO correspondence and personal communications with wildlife staff).

YEAR	Regulated Quotas (TAH)						Total Allowable Harvest (TAH)
	Subsistence				Commercial		
	Female (#)	Male (#)	No Sex Selection (#)	Total (#)	No Sex Selection (#)	Total	
1978	0	25	0	25	0	0	25
1979	0	50	0	50	0	0	50
1980	0	50	0	50	0	0	50
1981	0	50	0	50	0	0	50
1982	0	50	0	50	0	0	50
1983	20	50	0	50	0	0	50
1984	20	50	0	50	0	0	50
1985	20	50	0	50	0	0	50
1986	20	50	0	50	0	0	50
1987	50	250	0	250	0	0	250
1988	0	300	0	300	0	0	300
1989	100	300	0	300	0	0	300
1990	0	400	0	400	0	0	400
1991	0	400	0	400	0	0	400

Table 15. History of the Southampton Island harvest assigned commercial and subsistence Quotas (TAH) from 1992 to present (subsistence harvest estimated using government reports, HTO correspondence and personal communications with wildlife staff).

YEAR	Regulated Quotas (TAH)						Total Allowable Harvest (TAH)
	Subsistence				Commercial		
	Female (#)	Male (#)	No Sex Selection (#)	Total (#)	No Sex Selection (#)	Total	
1992	0	400	0	400	250	250	650
1993	no limit	no limit	no limit	no limit	1,000	1000	no limit
1994	NA	NA	1,000	1,000	5,000	5,000	6,000
1995	NA	NA	1,000	1,000	5,000	5,000	6,000
1996	NA	NA	1,000	1,000	5,000	5,000	6,000
1997	no limit	no limit	no limit	no limit	6,000	6000	no limit
1998	no limit	no limit	no limit	no limit	6,000	6000	no limit
1999	no limit	no limit	no limit	no limit	6,000	6000	no limit
2000	no limit	no limit	no limit	no limit	6,000	6000	no limit
2001	no limit	no limit	no limit	no limit	6,000	6000	no limit
2002	no limit	no limit	no limit	no limit	6,000	6000	no limit
2003	no limit	no limit	no limit	no limit	6,000	6000	no limit
2004	no limit	no limit	no limit	no limit	6,000	6000	no limit
2005	no limit	no limit	no limit	no limit	6,000	6000	no limit
2006	no limit	no limit	no limit	no limit	6,000	6000	no limit
2007	no limit	no limit	no limit	no limit	6,000	6000	no limit
2008	no limit	no limit	no limit	no limit	6,000	6000	no limit
2009	no limit	no limit	no limit	no limit	6,000	6000	no limit
2010	no limit	no limit	no limit	no limit	6,000	6000	no limit
2011	no limit	no limit	no limit	no limit	6,000	6000	no limit
2012	NA	NA	1,000	1,000	0	0	1,000
2013	NA	NA	1,000	1,000	0	0	1,000
2014	NA	NA	1,000	1,000	0	0	1,000
2015	NA	NA	1,000	1,000	0	0	1,000
2016	NA	NA	1,600	1,600	0	0	1,600
2017	NA	NA	1,600	1,600	0	0	1,600
2018	NA	NA	1,000	1,000	0	0	1,000

Table 16. A history of the Southampton Island actual harvest from 1992 to present. Harvest estimates include actual commercial harvest and estimated subsistence harvest (subsistence harvest estimated using government reports, HTO correspondence and personal communications with wildlife staff).

YEAR	Actual Harvest								Total Harvest (Estimated)
	Subsistence (Values Estimated)				Commercial				
	Female (#)	Male (#)	Unknown (estimated)	Total (estimated)	Female (#)	Male (#)	Unknown	Total (#)	
1992	0	400	0	400	0	0	0	0	400
1993	?	?	500	500	?	?	5	5	505
1994	?	?	500	500	500	500	1,000	1,000	1,500
1995	?	?	1,000	1,000	?	?	2,356	2,356	3,356
1996	?	?	1,000	1,000	?	?	1,839	1,839	2,839
1997	?	?	1,500	1,500	2,356	1,009	0	3,365	4,865
1998	?	?	1,500	1,500	2,069	887	0	2,956	4,456
1999	?	?	1,500	1,500	514	580	0	1,094	2,594
2000	?	?	1,500	1,500	1,170	996	0	2,166	3,666
2001	?	?	2,000	2,000	2,070	1,626	0	3,696	5,696
2002	?	?	2,000	2,000	959	2,875	0	3,834	5,834
2003	?	?	2,000	2,000	3,403	1,602	0	5,005	7,005
2004	?	?	2,000	2,000	?	?	3,200	3,200	5,200
2005	?	?	2,000	2,000	2,766	1,272	0	4,038	6,038
2006	?	?	2,000	2,000	2,892	1,136	0	4,028	6,028
2007	?	?	2,000	2,000	1,446	1,129	0	2,575	4,575
2008	?	?	2,000	2,000	0	0	0	0	2,000
2009	?	?	2,000	2,000	322	521	0	843	2,843
2010	?	?	2,000	2,000	0	0	0	0	2,000
2011	?	?	2,000	2,000	0	0	0	0	2,000
2012	?	?	1,000	1,000	0	0	0	0	1,000
2013	?	?	1,000	1,000	0	0	0	0	1,000
2014	?	?	1,000	1,000	0	0	0	0	1,000
2015	?	?	1,000	1,000	0	0	0	0	1,000
2016	?	?	1,600	1,600	0	0	0	0	1,600
2017	?	?	1,600	1,600	0	0	0	0	1,600
2018	?	?	1,000	1,000	0	0	0	0	1,000
Grand Totals				**39,600**				**42,000**	**83,675**

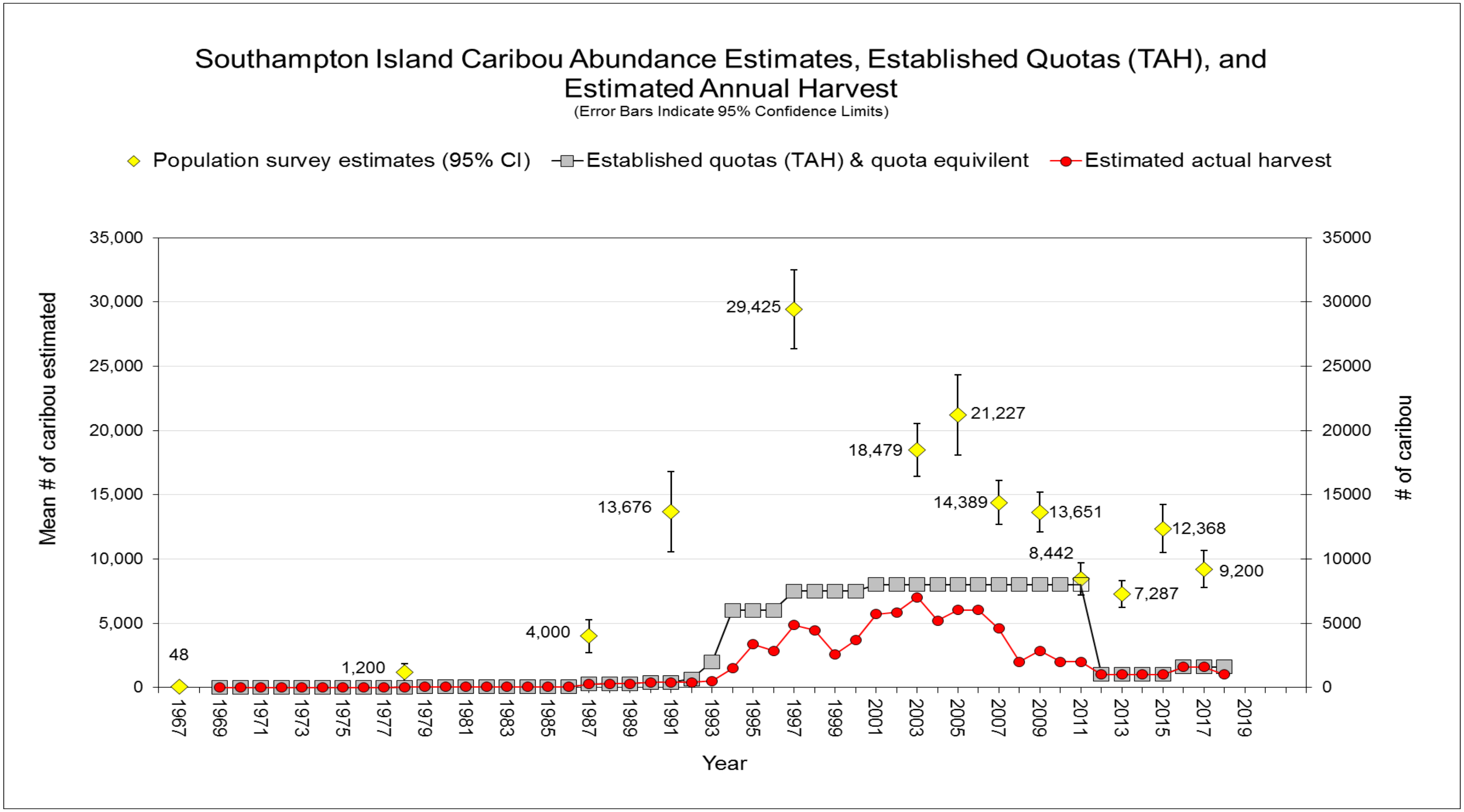

Figure 33. An examination of quota adjustment and actual harvest based on population estimates (Quota equivalents = estimated maximum subsistence harvest substituted for “no-limit” quota allowance values, Tables 1 and 2).

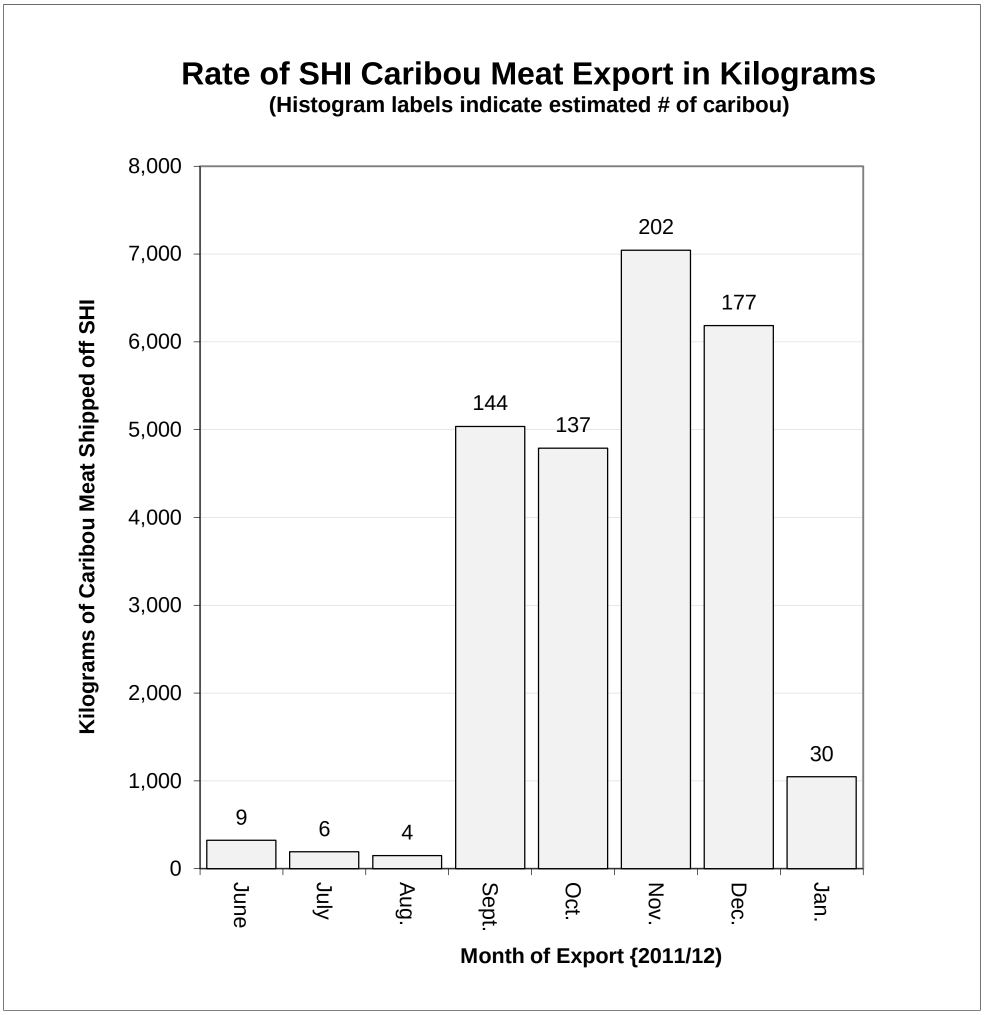

Figure 34. Caribou exports off Southampton Island primarily to Baffin Island communities. Data collected over an 8 month period in 2011/12.

4.6 Population Genetics:

The 2015 abundance survey results showed a statistically significant mean increase of 5,081 caribou from the previous survey in 2013, an increase that cannot be entirely accounted for by reproductive rates alone. The GN, in partnership with the Coral Harbour HTO, set out to try and confirm the possible mechanism of this increase. Based on information collected over two meetings with the Coral Harbour HTO, the primary mechanism forwarded by the HTO was the movement of caribou onto SHI. Hunter reports of many tracks coming onto the Northwest end of the island from across the sea ice suggested immigration was likely a behind the increase in caribou abundance. We sought to verify these observations through a genetic analysis of SHI tissue samples from 2014 (collected just following the reported movement) and 2004 (collected a decade prior to the suspected movement). Both these samples would then be compared with archived Qamanirjuaq caribou samples collected in 2012, and 2015 caribou samples collected in the vicinity of Naujaat, on the Kivalliq mainland. We employed Wildlife Genetics International (WGI) to analyze the results and test the validity of such a movement of caribou onto the Island.

Using Qamanirjuaq and Naujaat (Repulse Bay) samples to represent the mainland population, and starting out by using only the Southampton data from 2004 to start, WGI noted that the dramatic separation of mainland and island populations was not perfectly reflected across all individuals, even in 2004 (Paetkau, 2015) (**Figure 35**). Specifically, Qamanirjuaq individual C45 (partially red bar in group 2) and SHI individual 155 (partially green bar in group 4) were estimated to have ~ 35% ancestry in the 'wrong' population. These unusual individuals were previously dismissed as outliers, but that may have been premature: the stark differences in allele frequencies should have allowed accurate assessments of ancestry using 18 markers (Paetkau, 2015). Upon examining the 2014 samples, WGI found a marked shift between the 2004 and

2014 SHI genotypes, with 3% of the 2004 caribou being estimated to have < 90% SHI ancestry, versus 35% of individuals collected between 2013 and 2015 having < 90% SHI ancestry. Assuming that this shift is not the result of a change in sampling location — the NW region of SHI might show more mainland influence than the south — this change in the genetic composition of the population over the course of a decade is dramatic (Paetkau, 2015).

According to Paetkau (2015), the temporal shift was strong enough to leave little doubt that geneflow had occurred from the mainland to the island. To address the question of ancestry, Paetkau (2015) calculated the likelihood (Paetkau *et al.* 1995 *Mol. Ecol.*) that each genotype in the dataset would have been drawn from either the mainland (using Qamanirjuaq and Naujaat caribou herd DNA samples for allele frequencies) or the Southampton Island group (using 2004 data for SHI) (**Figure 36**). Paetkau concluded that with $P < 0.01$ that any genotype with a lower ratio did not have pure island ancestry, while ratios in excess of -7.8 ($P < 0.01$) had ancestry other than pure mainland.

With consideration to the number of tests conducted and associated hypothesis testing framework, WGI assessed the risk that the outliers are simply Type I errors. Having tested 86 individuals from the mainland, and 58 SHI individuals from 2004, a correction for multiple tests indicated critical values of 0.0006 and 0.0009, respectively, in order to achieve an 'experimentwise' $P = 0.05$, suggesting a genotype with a more extreme P than those that would be expected to occur through Type I error in 5% of similar datasets (Paetkau, 2015). The P-values estimated by GeneClass2 for C45 and 158 were 0.0003 and 0.0000, respectively, so these 2004 outliers cannot be explained by chance, even after correcting for the number of individuals tested (Paetkau, 2015). Paetkau therefore concluded that the evidence of movement in both directions (onto and off of the mainland) by 2004, was statistically meaningful. Indeed, both SHI individuals are statistically excluded as purebred members of either source population (mainland or island), indicating that they are members of the F1, or subsequent, hybrid generation (Paetkau, 2015).

Moving forward a decade, Paetkau (2015) found that 19 of the 127 new 2014 SHI caribou had a likelihood of $P < 0.01$ that they were from “pure” SHI caribou as represented by the 2004 samples. According to Paetkau 23 individuals produced a P between 0.05 and 0.01 which individually could be explained as outliers (Type I error). As a group, however, Paetkau believed there were too many outliers to be so easily dismissed, as Type I error for a dataset of 127 pure SHI animals. In total, Paetkau observed 19 individuals beyond the critical ratio for $P = 0.01$, and 42 beyond $P = 0.05$ suggesting a substantial mainland influence present in 2014 but not present in 2004.

Though the results do not support that a pulse of mainland individuals had moved onto Southampton Island recently, they also do not support that genetic isolation of the island herd has been maintained. Paetkau (2015) points out that samples collected on SHI between 2013 and 2015 did not appear to include any F0 (parental generation) immigrants from the mainland. Paetkau concluded that the analysis has documented that a large proportion of 2014 SHI caribou samples (about 1/3 of the current set) are of F1 (offspring generation) or subsequent-generation hybrid ancestry.

One possible explanation of the absence of apparent F0 immigrants from the mainland could be that such individuals arrived at the northwest corner of the island and took a generation or more to reach as far south as the region where the hunter samples were collected, which is more towards the southcentral extents of SHI. This however, cannot explain the statistically significant increase in caribou abundance along with the local reports of mainland caribou migrating onto SHI between the May 2013 and 2015 surveys. Possible reasons for this finding could be related to a sampling bias whereby hunter samples collected from early 2014 could have missed an immigration event occurring later in the winter. Though unlikely, consideration must also be given to the mainland comparative samples. Most of the samples were collected from areas close to Naujaat creating a second possible sampling bias that could have excluded more northern groups of caribou as potential source populations, such as caribou in the vicinity of Lyon Inlet. Clearly, additional genetic analysis needs to be undertaken to more accurately determine the cause of the hybridization event clearly documented sometime between 2004 and 2015. Overall we suggest that local hunter knowledge, and scientific evidence to date, all point to the arrival of a large contingent of caribou onto SHI from an area or areas not covered by SHI aerial survey extents.

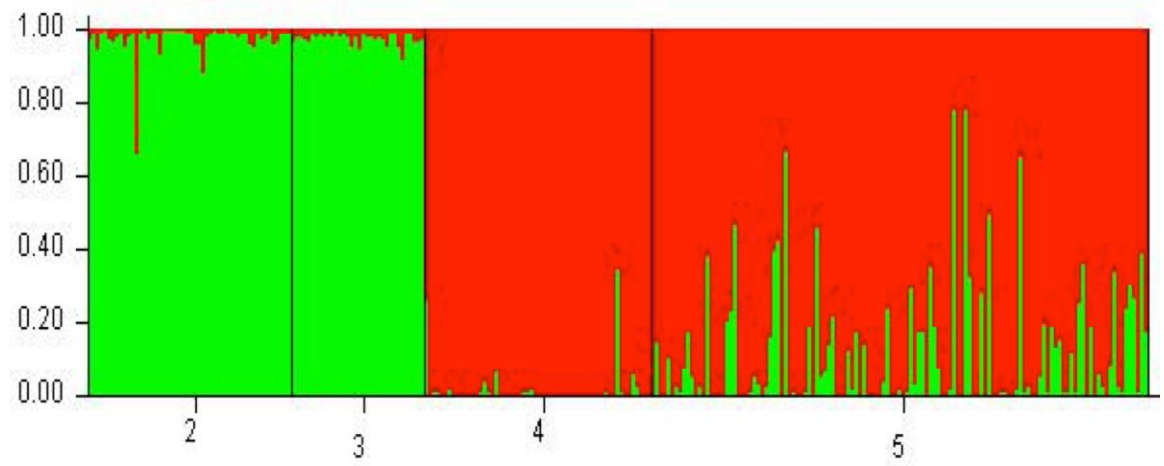

Figure 35. Structure results. Each column represents an individual, with its estimated proportion of mainland ancestry coded green, and SHI ancestry red. The ‘populations’ are Qamanirjuaq (2; w9741), Repulse Bay (3; g1616), SHI 2004 (4; w9741) and current SHI 2014 (5; g1616) (Paetkau, 2015).

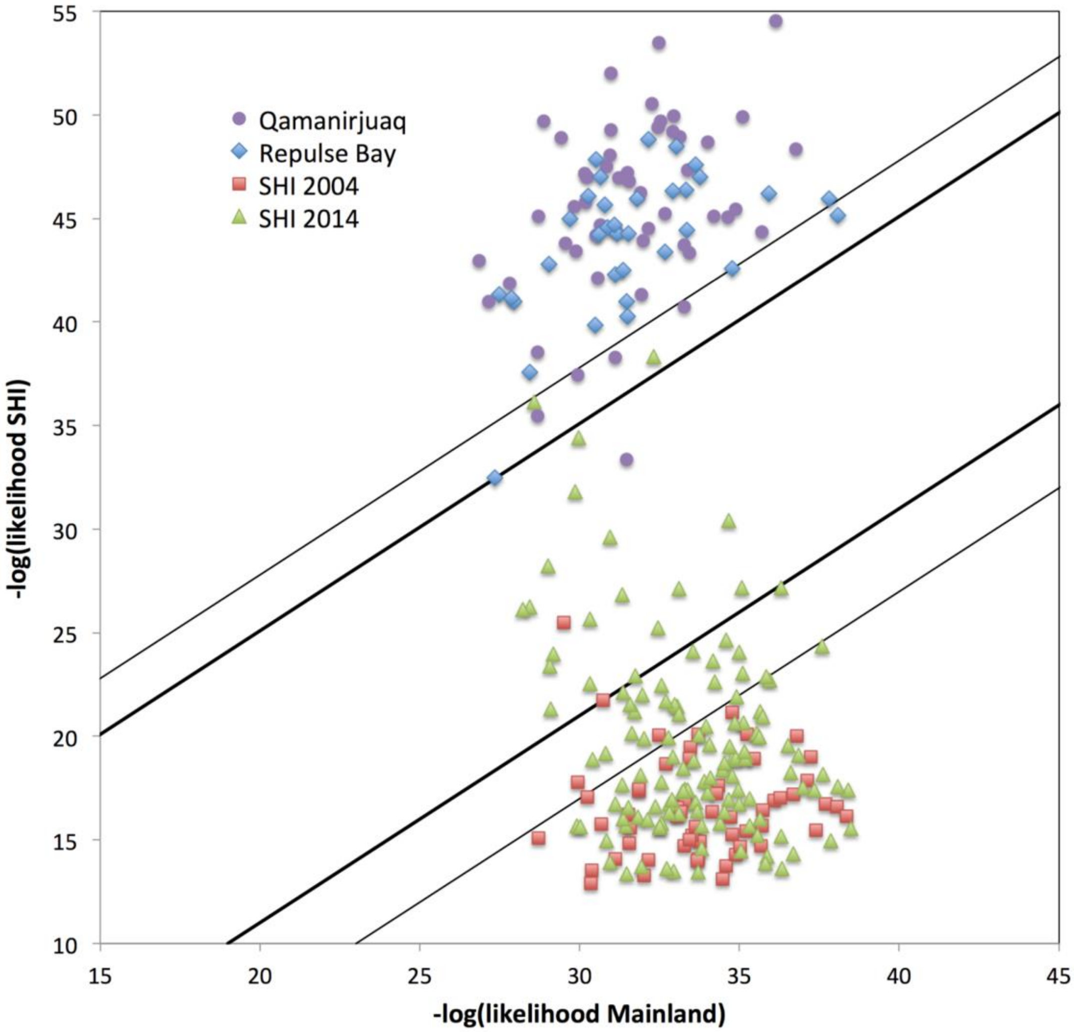

Figure 36. Likelihoods of occurrence based on mainland and (2004) island allele frequencies of caribou according to genetic analysis from different populations and years. Resampling in GeneClass2 indicated that 95% of purebred individuals are expected to have likelihood ratios outside the light lines, while 99% should sit beyond the heavy lines. Individuals between the heavy lines, including C45 (purple circle) and 155 (orange square) have genotypes that are rarer than 99% of individuals of either pure mainland or pure island ancestry. These include seventeen 2013–2015 SHI caribou (Paetkau, 2015).

5.0 Conclusions & Recommendations:

5.1 Aerial Survey Methods:

Overall, survey efforts from 1997 to 2017 were relatively precise (CV = 0.055 to 0.087) and were able to track two decades of decline within the Southampton Island caribou population. Methods changed over the period, namely from single observer pair configurations from 1997 through 2007, to dependant double observer pair configurations in 2009 to 2015, and finally to a composite of dependant double observer pair and distance sampling configurations, in 2017.

The dependant double observer pair configuration proved to be the most advantageous methodology, given that front and rear observers switch positions half way through each survey day, and that both front and rear observers are given the prescribed opportunities (see methods) to see the groups while flying along transects. The method reduced sightability errors common to the single observer pair method, and provides more precise estimates of wildlife populations. This method was the most effective at correcting estimates when the assumption of perfect sightability was violated. The dependant double observer pair method had other advantages. Incorporating more involvement of community members in research builds local support for the method and survey results, increases training opportunities for observers and improves research capacity in the territory, and incorporates co-management partners in research aspects of wildlife management.

Although the addition of distance sampling methods can further improve survey precision, the task of the observers becomes more challenging, and problems can arise when using observers with limited experience. In 2017, distance sampling estimates were higher than dependent double observer pair and strip transect estimates. This may have been due to one of the observer pairs not putting enough survey effort to the bins near the aircraft (**Figure 25**) as indicated by different shapes of the detection histograms for the 2 observer pairs. This would cause a negative bias in both strip transect and dependent double observer pair estimates. This illustrates a potential issue with distance sampling, observers spending too much time looking out at further bins which are often easier to view than the closer bins rather than surveying one strip more thoroughly. The dependant double observer pair method partially accounted for this by also estimating the sighting probabilities of observers near the survey line. In the 2017 case, the observer was identified using dependant double observer records and the error addressed.

Based on our analyses and experience, we suggest that the dependant double observer pair method is the most appropriate method to meet the rigours of quantitative assessment while promoting collaboration with co-management partners. Distance sampling methods, though exceptional in many respects, should only be deployed when experienced observers occupy all observer positions, and, in combination with the dependant or independent double observer pair configuration. As abundance dwindles on Southampton Island, greater consideration should be given to incorporating distance sampling into survey methods. This may mean working closer with community HTOs to ensure only experienced observers are chosen, to reduce errors which contradict the assumptions of statistical models used in population estimates.

5.2 Herd Trend:

The SHI caribou population peaked sometime between 1995 and 2000 and has, since then, declined by an estimated 9% annually, up until the 2017 survey estimate. A probable immigration event sometime between May 2013 and May 2015 significantly increased abundance by an estimated 5,082 caribou, however, by May 2017 the population trajectory seems to have fallen back into the 9%

annual rate of decline trend that was documented up until 2013. Reasons for the decline are likely related primarily to three separate mechanisms including harvest, Brucellosis prevalence, and icing and its effects on forage availability during some winters. Brucellosis likely had little influence on abundance trend until 2004 when disease prevalence reached an estimated 40%. As a result, we believe harvest was the main mechanism of decline between 1997 and 2004. One must keep in mind, however, that the reduction in abundance was the goal during this period, as the population was believed to be well beyond the island's carrying capacity of 15,000 caribou (Oullet, 1993). Since 2004, both the reproductive disease Brucellosis and harvest were likely the main mechanisms of decline. Unfortunately, at this point we are unable to ascribe which may have had the greater effect on the abundance of SHI caribou. This being said, by 2005, abundance was still above the hypothesized carrying capacity of SHI (Oulett, 1993), so the management goal of reducing abundance remained unchanged. By 2007, herd estimates were below the estimated carrying capacity of 15,000 caribou, however, declines in abundance seemed to slow between 2007 and 2009, based on our surveys. Additionally, Brucellosis prevalence was declining by 2009 and, based on hunter reports, general condition was increasing. As Brucellosis prevalence had been steadily decreasing from 2006 through 2009, and the declines over the same period were slowing, the management goals were amended by the Coral Harbour HTO to reduce the Islands commercial harvesting. Agreement was reached amongst all co-management partners to suspend the commercial harvest after 2009, in an attempt to further stabilize the decline and maintain an abundance that could support the subsistence harvest. Between 2009 and 2011, however, the caribou population significantly dropped by 5,209 animals, the greatest observed decline over any 2-year period. During this period trends in Brucellosis prevalence reversed and climbed to the highest recorded, and pregnancy rates dropped to below 40%, the second lowest recorded since 2000. Additionally, the unanticipated sale of caribou meat through social media, a new form of commercial harvesting protected as a right under the Nunavut Agreement, beginning in 2010, reached levels estimated to have exceeded the subsistence harvest over the 2011/2012 harvesting season. It appears that during this period, disease and harvest together were driving the population down. With the formal commercial harvest already stopped in 2009, the Coral Harbour HTO and GN had little option but to apply a TAH to reduce the subsistence harvest as an attempt to control the sale of caribou meat, primarily to Baffin communities, through social media.

The statistically significant increase in the SHI caribou population between May 2015 and May 2017, and subsequent decline of an estimated 9% between 2015 and 2017, has been difficult to explain. Genetic studies conducted as a follow-up to hunter observations suggesting a large group of mainland caribou had come onto the island from, the mainland sometime between 2013 and 2015, have yet to provide a conclusive answer regarding whether a migration event was the key mechanism of the increase. However, the genetic work did indicate that sometime between 2004 and 2015, a significant mixing of mainland and SHI caribou occurred. More analysis comparing consecutive years of SHI genotypes, with a more geographically broad collection of caribou genetic samples from coastal areas bordering SHI, will be necessary in order to more effectively explore possible mainland connections and reduce potential sampling bias that may be masking actual events. Although it is only a remote possibility, we believe that SHI caribou reproductive potential alone is unlikely to have accounted for the 41% increase estimated between 2013 and 2015.

5.3 Future Management:

Another survey planned for May 2019 will further assess the most recently observed decline in SHI caribou, however, based on our trend analysis we expect to observe further declines. Should a continued decline be confirmed, discussions with the Coral Harbour HTO and other stakeholders regarding the consideration of a substantial reduction in TAH will have to be arranged shortly following the surveys completion, in an attempt to try and safeguard against further decline and associated hardship to the residents of Coral Harbour.

The mechanisms driving the decline are multiple and difficult to isolate, suggesting that further research is required. It appears that the main drivers have been the disease *Brucella suis* Type IV, harvest (with emphasis on the sale of caribou meat through social media), and potentially poor winter weather in some years. Clearly the need to continue monitoring disease prevalence in SHI caribou is required if we are to understand present day infection rates and associated productivity for the herd. Recently, hunters have reported fewer caribou with signs of disease, and a noticeable increase in the number of calves observed in 2015 and 2016 suggest that the disease prevalence may be decreasing. If this is the case, and Brucellosis no longer represents a primary mechanism of decline, then harvest, along with weather and condition monitoring should become the focus of future monitoring for the SHI herd. Additionally, more effective means of monitoring the harvest, and any exports of caribou meat off the island, will be critical in understanding the true extent of the harvest. At present these tools are not available to enforcement officers within Nunavut, suggesting that further thought and required amendments to current harvesting regulations should be seriously considered by wildlife management organizations. Attempts to control the sale of caribou meat through social media have failed and consideration should be given to addressing this issue through amendments to legislation. In recent consultations with Kivalliq community HTOs, all communities expressed a willingness to address the problem in this way, suggesting that some mutual agreement could be reached to more permanently address this issue. If nothing is done to monitor this novel and growing mechanism of caribou meat sales, we fear the problem will grow more serious as more and more caribou populations within Nunavut are managed through the establishment of a TAH.

6.0 Acknowledgements:

We would like to thank to thank the Coral Harbour HTO for their support and expert advice provided throughout all the research programs covered in this report. We would also like to thank the NWMB and the DOE for their ongoing financial support of the Southampton Island caribou monitoring program. We are grateful to Nunavut Tunngavik Corporation for providing personnel to assist with aerial surveys as well as providing advice, over the last decade. We would especially like to thank the HTO selected observers and hunters whom made the the survey and condition programs a success. Those involved included; Aaron Emiktowt, Andy Nakoolak, Charlie Shapangac, Danny Pee, Darcy Nakoolak, Henry Nakolak, Leo Augotiuq, Leonard Netser, Logan Kudluk, Luke Eetuk, Markoosie Aulapik, Moses Noah, Nico Nakoolak, Noah Kudluk, Troy Netser, Wesley Sitinuar, and Willie Nakoolak. We apologize for any observers from pre-2003 surveys that may have been missed. We would also like to thank Keenan Lindell, Daniel Kaludjak, Joe Savikataaq, Jonathan Pameolik, Tyler Ross, Robert Karatak, Raymond Mercer, Sarah Spencer, Sharina Kennedy, Matthew Fredlund, and Sean Cooke for their participation in the aerial surveys as observers and data recorders. We would also like to thank our pilots including Dan Applebee (Misinnippi Air), Andrew Dennison (Air Tindi), Eddie (Skyward Aviation), Aron, Dan Montgomery (Air Tindi), Ted Dunnkier (Air Tindi), Amos (Arctic Sunwest), Darren (Skyward Aviation), Kevin Kawalchuk (Missinippi Air), Mike Podealuk (North Wright Air) and all the other pilots that have been involved in safely completing aerial surveys on SHI since the 1960s. We at the DOE would also like to thank our families for their unquestioning support and tolerance of our long absences in the field.

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Southampton Island Caribou HTO Consultation Report 2019

January 27th , 2019

Authors:

Keenan Lindell, Kivalliq Regional Wildlife Technician

Mitch Campbell, Kivalliq Regional Wildlife Biologist

Department of Environment, Government of Nunavut Arviat, Nunavut

Executive Summary

The Government of Nunavut, Department of Environment (DOE) Kivalliq Research Division traveled to the community of Coral Harbour on Southampton Island (SHI) to meet face to face with the Hunters and Trappers Organizations (HTOs). During this meeting we provided updates on the SHI Caribou survey in 2017, and addressed other issues concerning caribou, as raised by the HTO, and addressed questions regarding wildlife issues raised by the HTO members. Presentations with summary results of recent surveys and prevalence of Brucellosis were given by Mitch Campbell Kivalliq Regional Biologist, assisted by Keenan Lindell Kivalliq Wildlife Technician. This year we were grateful to have David Lee Wildlife Biologist for Nunavut Tunngavik Incorporated (NTI) join us for these consultations. His expertise on wildlife and the Nunavut Agreement was welcome and positive, and It was clear that the HTOs also appreciated his questions and knowledge.

HTO members were encouraged to ask any questions they may have on the subjects discussed. Additionally, we had questions of our own with regards to the members opinions and expertise on the current status and general health of caribou on the island. We aimed to create a casual yet professional atmosphere, where everyone would be comfortable speaking, for it is our goal not only to give, but to gain information as well from the HTO members who are amongst the most knowledgeable of wildlife issues within their hunting areas. We worked to generate a conversation between people rather than a one-sided presentation. This format seems to be successful and is beneficial for both parties where it creates trust and promotes communication and collaboration.

Preface

This report represents the Department of Environment's best efforts to accurately capture all of the information that was shared during the meetings with the Hunters and Trappers Organization of Coral Harbour. Keenan Lindell recorded audio of the meetings in order to ensure quality minutes, audio was deleted afterwards at the request of the HTO.

The views expressed herein do not necessarily reflect those of the Department of Environment, or the Government of Nunavut.

Table of Contents

1.0 Report Purpose and Structure

This report is intended to collate and summarize comments, questions, concerns and suggestions provided by the HTO in response to presentations given by Mitch Campbell Kivalliq Regional Wildlife Biologist with the Government of Nunavut. The Coral Harbour HTO was consulted on January 27th 2019.

2.0 Purpose of Tour

The presentations given were to discuss the newest information regarding the SHI caribou herd and to gain hunter knowledge of the overall health and numbers. Summary findings of the SHI caribou herd abundance estimate, population trend, Brucellosis prevalence and trend, survey transects flown as well as an update of mainland Kivalliq caribou herds and the potential for both immigration onto the Island or emigration off of the Island to Mainland range. The members were asked, whether they agreed with the information provided and the estimates generated. Members were asked of their observations over the last two or more years and how that may help inform on the research results being presented. Furthermore, all HTO members were asked if they would be interested in seeing and potentially participating in an Inuit Qaujimajatuqangit study of caribou to further incorporate IQ alongside science, into the wildlife research and management process.

2.1 Format of Meetings

The meeting was held in the evening at the HTO Office and ran just over 2 hours. Mitch Campbell gave a power point presentation via projector in English while Keenan provided translation when needed. The atmosphere was relaxed and interactive with the presentation lasting about one hour and forty five minutes with questions being taking whenever they came up.

3.0 Coral Harbour Meeting Summary

Date: January 27th, 2019

Representatives:

- GN-DOE, Kivalliq Regional Biologist: Mitch Campbell
- GN-DOE, Kivalliq Wildlife Technician: Keenan Lindell
- NTI, Wildlife Biologist: David Lee
- Naujaat HTO Board members
    - Chair Person, Moses Nakoolak
    - Vice Chair, Darcy Kakoolak
    - Manager, Natasha Ottokie
    - Member, Danny Pee
    - Member, Ayowna Emiktowt
    - Member, Lucassie Nakoolak
    - Member, Joe Saviakjuk

Duration:
2.10 Hrs.

Overview of Comments and questions:

The main topic of concern was Brucellosis. The community wanted to know what the prevalence levels are, how caribou contract the bacteria, how to tell if a caribou has it and if it can be eaten. A hunter was diagnosed with brucellosis in December 2018. Members mentioned that hunters are still shooting caribou with Brucellosis but a lot less than in previous years suggesting it's on the decline. Yet, hunters are catching caribou with lots of fat even in January. All members were disappointed and concerned that the SHI survey may not be funded this fiscal year. The HTO has lowered the TAH to 1000 voluntarily based on the results of the 2017 survey, but hunters stated there was a large die off of caribou in January 2018 because of freezing rain creating very thick ice. The HTO chair believes Wolf collaring is a great idea. Members are aware of online sales being a concern in the rest of the region but feel they are managing the hunters and not much meat is leaving Coral even though there is a demand. Certain members do not like the idea of collaring any animals; these same members are very enthusiastic about an IQ study.

4.0 Coral Harbour HTO Meeting Minutes:

Government of Nunavut

Department of Environment

Wildlife Division

P.O. Box 120
Arviat, NU X0C 0E0
Phone (867) 857-2828
Fax (867) 857-2986

Meeting notes

Function: Kivalliq Research Consultations: Coral Harbour

Subject: Southampton Island caribou research and research results update & Regional research updates.

Location: Coral Harbour

Date: January 27th, 2019 **Time:** 6:50 – 9:00

Duration: 2.10 Hrs

In Attendance

Name	Affiliation/Title
Mitch Campbell	GN Wildlife Biologist
Keenan Lindell	GN Wildlife Technician
David Lee	NTI Wildlife Biologist
Moses Nakoolak	Coral Harbour HTO Chair Person
Darcy Nakoolak	Coral Harbour HTO Vice Chair
Natasha Ottokie	Coral Harbour HTO Manager
Ayowna Emiktowt	Coral Harbour HTO Member
Danny Pee	Coral Harbour HTO Member

Lucassie Nakoolak	Coral Harbour HTO Member
Joe Saviakjuk	Coral Harbour HTO Member

Note Taker: Keenan Lindell

***** Keenan Lindell recorded audio of the meetings in order to ensure quality minutes, audio was deleted afterwards as agreed with the HTOs and would not be used for any other purpose. *****

Meeting Minutes

Opened with a prayer 6:50

Introductions 6:52

Mitch Campbell Presentation Kivalliq Research Consultations 7:00 – 8:45

Qamanirjuaq Caribou Update

Beverly Caribou Herd update

SHI Caribou 2017 Survey Update

- Showing a map where caribou were being sited from the aerial survey in 2005 vs 2017.
- In 2017 caribou in the same areas but a lot lower density.
- Explaining benefits of double observer co-operative method.
- 4 dedicated observers, 2 recorders.
    - More accurate estimate.
    - Miss fewer caribou with cooperative method.
    - Can calculate how many caribou are missed by both observers then add them to estimate up to 5% - 10% in some cases.
    - More community observers trained which means more community participation, capacity, and feedback.
    - Brucellosis Incidence & Pregnancy Rates 1966 – 2014 graph.
    - Tracking results through the years, from 1966 to 1999 no signs of Brucellosis. We started seeing the first cased in 2000 than it just exploded across the island.
    - The prevalence is now dropping based on hunter observations.
    - It would be good to know what hunters are seeing this harvesting season.

MC – it would be great to get the HTOs perspective on the current health and status of the SHI caribou population.

MN – I haven't herd really anything about Brucellosis in a while. I don't know about the others. I think they are pretty healthy right now. Even this time of year now they have about this much fat now. (About 2 inches I think)

MC – Wow that's great news. So the range seems to be in good shape. So right now my opinion is that I would not want to come in and do a harvest to access health, when the heard is low and the people have a greater need of tags. We want that whole harvest to go to the people. What we want to try start up again this year is the sample program; see if we can get that rolling. Pay hunters to take blood samples from their harvests and send them out for testing and monitor the brucellosis prevalence that way. I want to mention too that the HTO was the first to notice the outbreak and then we sampled for it. So we didn't find it, you folks saw it so we sampled it and found out what it was. Also it was the HTO who noticed the drop in prevalence so your HTO is very strong in providing us with IQ which has been way ahead of the science, which has been critical in the management of this herd. So let's keep that relationship going and stay in contact.

Feel free to contact us anytime you want, especially if you think something is wrong with the herd. And something else I just want to make clear, you probably already know this but brucellosis is what we believed played a major role in the decline in your caribou not subsistence hunting where the meat remained on the Island to feed Coral Harbour families. Even with the commercial harvest if you work out the numbers combining the subsistence harvest with the commercial harvest before the outbreak, it was not enough caribou to bring the population down. So we have been clear to mention that when the numbers were high it was not only hunting that brought it down, it was the disease plus a combination of other factors of which hunting was only one.

- SHI Herd Trend Graph – Herd was down in the 80's to around 5,400 but rose to 30,000 in 1997.
- 30,000 caribou for the island was not sustainable, without hunting the population crash would have been more severe.
- We hit a low point around 2013 to 7,200 but then we had a recovery. HTO said that caribou went onto the island from the main land and that they are seeing more calves. We did a genetic test on the caribou and that showed that the current SHI caribou had recently been heavily influenced by mainland caribou.
- Slight drop in 2017 to 8,300 but we figure the sweet spot is around 15,000.
- If the herd reaches an estimated 15,000 caribou, we can start discussing the removal of the TAH and NQL.
- If we are successful with adjusting the TAH to address the current declining status we are hopeful that the herd won't drop much further and eventually bounce back.

LN – I want to make sure that we are being understood. It's not just from the lack of food it is from the ice condition as well. We had freezing rain in January so that killed off many of the caribou.

JS – Someone shot a Brucellosis caribou last week.

MC – Okay, so you are still seeing them out there?

JS – Yes sometimes, but not as many as we've seen in the past.

MC- The mainland populations have brucellosis as well. It's a disease that's in all the herds. We think what happened is the caribou came from Coats Island where there is no disease that we know of. They were introduced onto Southampton Island and they either mixed with a mainland caribou or the disease was in the soil. Anyways they caught brucellosis but they didn't have any immunity to it, that is why we believe it had such a large impact. We are hoping that these Coats Island caribou mixed with mainland and built immunity so there will a lower prevalence of the disease over time.

AE – I have a question can fat caribou have brucellosis too?

MC- Yes they can.

FE – How can we tell?

MC – It's tricky, the problem with testing of Brucellosis is that it can't tell you whether the animal has had it or has it now, so whether its active or not. We know very little about the disease in caribou. If you find a caribou with swollen joints or a male with large testicles this is a sign of it.

AE - Can we cook the meat to get rid of it? The young people I think have been wasting meat because they are scared that they have brucellosis.

MC – Yes if you cook it thoroughly, it will kill the bacteria and be safe to eat. If you find a caribou with swollen joints or enlarged testicles, my advice would be to leave it. If it were up to me I would not risk it. We have a pamphlet to give people info on brucellosis at the wildlife office.

AE – How are they getting the disease?

MC- It is from fetal fluids that can be ingested or contaminate open any sores. If there are no cuts on the animal it won't get it, same with humans. If a hunter is cutting up a caribou with brucellosis, they could contract the disease if they have any cuts are scratches that allows the bacteria into the bloodstream.

DL – She brings up a good point because a lot of hunters are leaving caribou, many animals will scavenge from it then they can spread it to other animals. So someone was asking if they should bring it back to town to test or maybe incinerate?

MC – I would suggest that if a caribou is suspected of Brucellosis that you should not bring it close to town.

AE – Inuit never really heard of these kinds of things, we always ate caribou frozen and raw not worried about disease. Now we are scared to meat raw meat.

MC – Yes it is a bit scary. If you're not sure, cook it and you will be fine. I should mention too that if a caribou does get brucellosis it can get over the disease. It runs through their system, I'm not sure how long it stays in their body but it does get out eventually if it survives. So a caribou that had brucellosis you can safely hunt like two years later.

?? - My brother was diagnosed with brucellosis just last month.

MC – Okay very good to know, I think we need to start doing some screening. We won't expect to see it disappear right away it takes some years to lower the prevalence in a population though there is so little known we can't say how long.

DL – It's also difficult to tell the symptoms because they are just like a cold.

FE – How many percent of the caribou have brucellosis?

MC – In 2006 it was about 50% I think over time it is going down because caribou build immunity to it. When it first the herds immunity to it was low that's why we believe it spread so fast.

DL – All caribou herds have brucellosis but at like 2% or 3% because most have immunity to it.

MC – The good news is that people know about it and it can be eradicated from your body (Cured). The problem is when Brucellosis is not diagnosed for some time it will damage the body over years which can cause a lot of longer term effects/damage but if it's caught in time you can be completely cured of it and it's gone. Now that the health care system is aware of it they are keeping an eye out for it. I always tell people, if you think you were exposed to a diseased caribou, and if you're feeling sick after that exposure, you should ask for a blood test. If it comes back negative, go back a couple months later and get another one because it is a very slow growing bacterium.

AE – Thank you.

Proposed Programs

IQ Studies on Caribou

- GN has a pot of money to fund IQ studies on caribou.
- Administered but not run by GN, it can be run the way HTOs want it run and by who they want.
- Rankin has started with Isra and Warren.
- GN just needs a deliverable, some IQ knowledge to use along with Science won't be owned by GN.

LN – I can finally say good idea.

MC – It would be great to have this IQ collected and it is so valuable, it's tough for us because we are biologists and that's what we know, and there is so much IQ out there that is equally beneficial to our programs as the science. Science is only a part of the big picture. We also realize we are not the people to coordinate and control this we just want to fund it and include the knowledge in future management of caribou.

SHI Caribou Survey

- This has been a priority to survey this population every 2 years at least until recovery.
- 2017 survey showed a decrease since 2015.
- We are concerned if we do not survey in a 2 year rotation, we might get into a situation where we harvest too many caribou and tags will have to be lowered again.
- I have heard that your HTO have changed the TAH to 4 per household and that was your HTO that took care of that. What I suggest is that you send in a request to our department and NWMB to make the TAH change official to 1000.
- We can help out with a letter if needed.
- It's great you did it on your own but if someone were to challenge it that's where it can get tricky.
- We submitted to do this survey this year unfortunately it was declined not because it's not supported but because it was not a funding priority with all the other wildlife issues the DOE has to deal with.
- Rescheduled for May 2020
- We are still fighting to get money for it to go this May but right now we have not had any luck.

DN – Would it help if there was a support letter for this?

MC – Yes that would be helpful especially to mention that it is in the management plan to survey every two years and that you are concerned for your caribou getting dangerously low.

DN – Especially because in 2017, you did that survey, and the caribou were had a big die off that year after the survey.

MC – That is very important information to add to your letter and further reason to reassess the population. Also getting KWB to send a letter as well would be helpful.

MN – As you said we as the HTO are reducing the tags given out to 1,000 as we think the herd has declined since 2017 because of all the icing that occurred since the 2017 survey. We still need the GN to help lower the TAH so we don't overharvest the herd.

MC- That's really proactive of your HTO and we will be sure and put the request to lower the TAH in as soon as possible but will need your HTO to send a letter indicating this to the GN and NWMB.

DP – We had rain in January (it was like +2), and it started raining, 5 inches of ice on top of the snow. Caribou can't eat when ice is that thick.

DL – The TAH that you are recommending is based on the population estimate of the 2017. So it does not reflect the current population and what the community is saying about the die off in 2017, because you don't have that information.

MC – Exactly.

DL – So this is a really strong case for the HTO to tell the GN to not fallowing through with the management plan. This is one of the only populations with a TAH and the community is doing there end of it by managing and following the TAH but the GN is not following through and providing the information you need to manage the population.

MC – We will keep lobbying to try and get the funding but we need all the help we can get. We are always ready to come in and survey.

AE – When you were surveying, were there any spots you noticed where there were dead caribou?

MC – Not in the 2017 survey maybe one or 2 kill sites but that's it, it seemed to be ok during the period of survey.

AE – Did you also survey Coats Island?

MC – Yes, but the caribou also appeared to decrease on Coats Island. There are roughly about 800 caribou on Coats Island last we counted in 2017.

MN – We were hearing from hunters that they were seeing caribou on the north side.

MC – We will try to also survey Coats Island during the next survey if time and funding permit.

MN – You surveyed White Island?

MC – Yes we surveyed White Island as well.

KL – There wasn't many.

MC – No, White Island hasn't had many caribou on it for quite some time now.

AE – So Coats Island is at 800?

MN – Approximately, Yes.

AE - Why did they die? Sickness?

MN – Too much snow and ice I think.

MC – Yeah there seemed to be a die off. Prince Charles Island had a similar die off in the same year.

KL – That was ice too right?

MC – Yes and they got hit hard by that and deep snow.

AE – Is it due to climate change?

MC – It could be partly related, but for the smaller islands they do that because there is so much open water you get a lot of icing and the caribou there tend to go up and down in abundance.

DP – Did you do the survey on Baffin Island and what are the numbers?

MC – We did a survey there in 2014 and numbers showed about 5,500 for the whole island of which about 1,700 were on Prince Charles Island. We haven't been in there to survey since.

The information we have gotten so far is telling us that it is staying about the same though some areas in south Baffin seem to be slightly increasing though we can't confirm at this time.

MN – Last time I spoke to my brother in law who lives in Cape Dorset, and there they seem to be seeing more caribou.

MC – In the Kimmirut area, people are reporting more caribou. We were in there in the spring for composition and it was easier to find caribou which could be an indication of the same. Kimmirut HTO said that will be the first area that caribou will come back because that is a rough area and it is hard for hunters to get into that area. I think we are a few years yet before a positive recovery.

AE – They have been really taking the caribou here and they have been trying to tell their young hunters to be careful about the caribou. They are really conscious about the caribou and leading HTO on this issue.

MC – We use Coral Harbor a lot to explain how it works and how things should be done because you have had that history.

AE – There is demand from Baffin for caribou because of the fat and the income provided, but because of Calm Air, HTO, and Wildlife officer, they have been able to reduce the sales from this area.

Meeting adjourned 9 pm

Yes sorry, no harvesting females with calves.

Natasha Hattie Ottokie
Aiviit Hunters' and Trappers' Organization
Manager
Coral Harbour, NU
X0C 0C0
(T) 867-925-8622

From: Denis Ndeloh [mailto:DNdeloh@nwmb.com]
Sent: Thursday, May 23, 2019 4:44 PM
To: Aiviq HTA <aiviit@kivalliqhto.ca>
Subject: RE: Support

Hi Natasha,

Did you mean NOT harvesting females with calves? That is what the GN recommendation is.

From: Aiviq HTA <aiviit@kivalliqhto.ca>
Sent: May 23, 2019 5:31 PM
To: Denis Ndeloh <DNdeloh@nwmb.com>
Subject: Support

Hi Denis,

The Aiviit HTO supports the TAH recommendation to decrease to a 1000 for Coral Harbour for caribou harvesting and harvesting of females with calf.

Natasha Hattie Ottokie
Aiviit Hunters' and Trappers' Organization
Manager
Coral Harbour, NU
X0C 0C0
(T) 867-925-8622

SUBMISSION TO THE

NUNAVUT WILDLIFE MANAGEMENT BOARD

FOR

Information: **Decision: X**

Issue: 2017 Muskox (*Ovibos moschatus*) distribution and abundance, muskox management units MX-08, Boothia Peninsula

Background

- The Boothia Peninsula is an example of a location where muskoxen are re-colonizing their historical range. In 1985, the Boothia Peninsula was known to be devoid of muskox.
- In 1995, a muskox abundance survey in this area resulted in an estimate of 554 ± 205 (S.E) animals. Since then, community members in Taloyoak have indicated a consistent increase in muskox numbers.
- Hunters in Taloyoak fear that muskox will start negatively impacting the caribou calving ground on the Boothia Peninsula, as muskoxen displace caribou from their habitat.
- The current Total Allowable Harvest (TAH) of 66 for MX-08 was set on July 1, 2014 under the Muskox Total Allowable Harvest Order, and this annual limit has remained consistent since then.
- The Department of Environment (DOE) has engaged with the community of Taloyoak and respective co-management partners (Nunavut Tunngavik Inc., Hunters and Trappers Organizations (HTO), Kitikmeot Regional Wildlife Board). The DOE will continue to work closely with these groups to manage the muskox population of the Boothia Peninsula (MX-08) for sustainability in order to meet conservation, management, and food security needs of the ecosystem and local community.

Current Status

- Based on local knowledge, there is a need to re-evaluate the existing TAH of 66 to the meet current management needs. Community members in Taloyoak are requesting an increase in harvesting opportunities, to keep muskox numbers low and preserve habitat for caribou.

- A population survey was conducted, based out of the community of Kugluktuk, from August 7 to August 12, 2017 to determine the abundance and distribution of muskox in MX-08. During the survey, 702 adult muskoxen were recorded on transect resulting in an estimated abundance of 3,649 ± 316 (S.E.) animals in MX-08. The muskoxen population in MX-08 has increased since the last survey.

- This year the community members ran out of tags before the end of the harvesting year. The current quota has been filled, and they are requesting additional tags.

Consultations:

- The progress of this research and monitoring effort was communicated during the Kitikmeot Muskox Management Plan Face-to-Face meeting and shared with all HTOs during the Kitikmeot Regional Wildlife Board Annual General Meeting (KRWB AGM) in September 2017 and the KRWB AGM in September 2018.

- On April 23, 2019, the draft report and the management recommendation were discussed with the Taloyoak HTO board and community members. The HTO recommended increasing the current TAH and indicated that a harvesting rate of 6% (218 animals based on new population estimate) is not sufficient to maintain stable muskox numbers.

Accommodations:

- As a result of the consultations, changes were made to the report to include more local and traditional knowledge, including:
    - Additional information on muskoxen movements – animals might not only move from Prince of Wales and Sommerset Island, they can come from other areas.
    - Explanations on how muskox and caribou population dynamics are inversely related, and emphasizing the need to keep the caribou population healthy and close to the community.
- Although the DOE, the Taloyoak HTO, and the community members agree to increase the present quota, the HTO and the community members do not support a continued harvesting rate of 6% (TAH of 218) as this is not considered sufficient. They would like to keep the TAH, but increase the harvesting rate to 7-8%, which will result in a TAH of 255-288.

Recommendation

- *The Department of Environment is recommending to the Nunavut Wildlife Management Board an increase in the TAH of 66 to 275 muskoxen for the Muskox Management Unit MX-08.*

MUSKOX (*Ovibos moschatus*) DISTRIBUTION AND ABUNDANCE, MUSKOX MANAGEMENT UNITS MX-08, BOOTHIA PENINSULA, AUGUST 2017.

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Department of Environment
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Ministère de l'Environnement

REPORT ON MUSKOX DISTRIBUTION AND ABUNDANCE, MUSKOX MANAGEMENT UNITS, MX-08, AUGUST 2017

Summary

This short document is a summary of the information provided in the report entitled: "Muskox (*Ovibos moschatus*) distribution and abundance, muskox management units MX08, Boothia Peninsula, August 2017."

This report is a document that puts the research into context, identifies the research methodology used, describes the results, and provides future monitoring and management recommendations

The Government of Nunavut has jurisdiction for the management of muskox in Nunavut and along with consultations with co-management partners, is responsible for conducting research and monitoring (population surveys), to inform the management process. This report provides scientific information and recommendations to help decision-makers manage muskox in this management unit.

This summary is based on the information in the full English version of the research report on the muskox of the Boothia Peninsula done in August 2017. The original English copy of the report has been provided for reference.

Information

The Boothia Peninsula is an example of a location where muskoxen are re-colonizing their historical range. In 1985, the Boothia Peninsula was known to be devoid of muskox. A decade later, 61 muskoxen were seen on transect during surveys that provided an estimate of 544 animals, and they seems to have continued to increase in number. Thus, the environmental conditions on the Boothia Peninsula seem to be optimal to promote muskox population growth.

The community of Taloyoak is the only community harvesting this population. Taloyoak Hunters have commented on the higher numbers of muskoxen sightings. They are concerned that muskox will start negatively impacting the caribou calving ground on the Boothia Peninsula. Inuit traditional knowledge for the area indicates that muskoxen displace caribou from their habitat.

Based on local knowledge, there is a need to re-evaluate the existing Total Allowable Harvest (TAH) of 66, relative to current management goals. Taloyoak hunters are requesting an increase in harvesting opportunities to keep the muskox numbers relatively low and preserve the caribou calving grounds. A reassessment of the muskox population in MX-08 was necessary to reassess the TAH.

Objectives

This project aims to address concerns of Inuit, as well as to provide new scientific information for 2017. Therefore, the main objectives of this study of MX-09 are to:

1. Determine the total estimated number of muskox
2. Determine muskox distribution and density; and
3. Determine calf:adult ratio and group size.

Methods

Study Area

The study area is the muskox management unit MX-08, which includes the Boothia Peninsula and a portion of the mainland. The area lies between M'Clintock Channel to the west and the Gulf of Boothia to the east, and is separated from MX-06 to the north by Bellot Straight. The southern boundary of MX-08 is shared with muskox management unit MX-11.

Survey area

To maximize the coverage area investigated, anticipated muskox distribution patterns were obtained from past ground surveys, hunter observation, and Inuit Traditional Knowledge. According to Traditional Knowledge, muskoxen have increased in numbers and they are now uniformly distributed over the entire Boothia

Peninsula. Based on this change, the whole management unit was surveyed at 20% coverage, with 8 km spacing between transect lines, with no strata of different effort allocation (Figure 1).

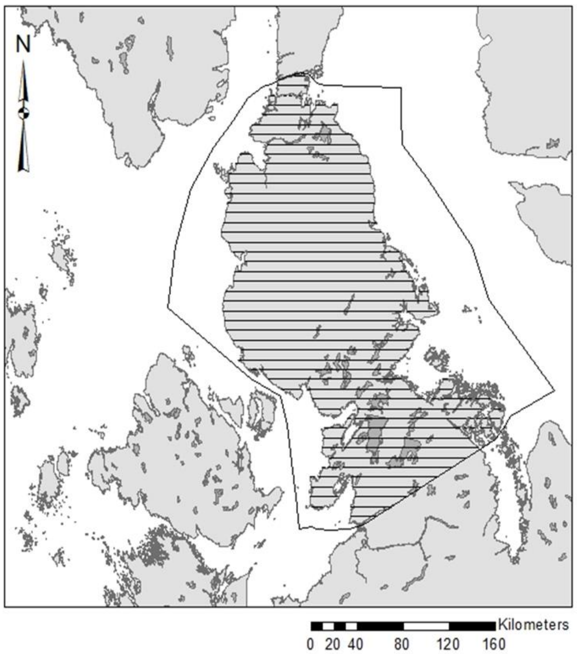


Figure 1: Transect lines flown in August 2017, representing 20% coverage, of the muskox management unit MX-08.

Aircraft configuration

A systematic transects line survey was flow with a fixed-wing single engine turbine aircraft; a grand caravan. The transect lines were surveyed at a speed of 160 km/hr at an altitude of about 121 meters above ground level (AGL). The strip transects included 800 meters on each side of the aircraft. Observers on both side of the plane were responsible for continuously searching for, spotting, and counting muskox including the number of calves. Incidental sightings of caribou, polar bear, wolverine, and wolf were also recorded.

Results

Distribution

The survey was conducted from the community of Taloyoak from August 7 to August 12, 2017. During the survey, 170 groups of muskoxen were seen, both on and off-transect. Larger groups of muskoxen, 16-19 adult animals, were mainly distributed from Cape Farrand to Abernethy Bay within 40 km from coast. It was the first time that muskoxen were recorded south of Cape Cambridge, close to Acland Point at their southernmost distribution (Figure 2).

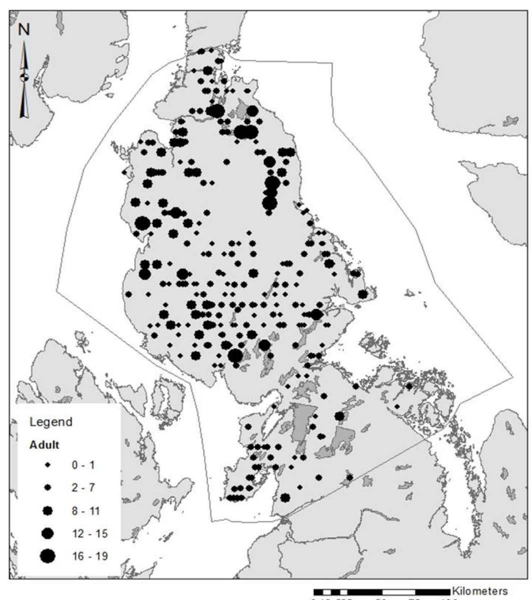


Figure 2: Muskox distribution, on and off transect, in the management unit MX-08 during the survey, where the number of animals per group was classified into groups of 0-1, 2-7, 8-11, 12-15, and 16-19 animals.

Group Characteristic and estimate

The majority of groups observed were small groups of 2 to 7 adults. The average number of adults (+1 year and older) per group was 5 ± 4.45 (S.D.). During the visual survey 702 adult muskoxen were counted on transect. Overall, the muskox density of the study area was low at 0.084 muskox / km^2. The estimated number of muskox in the management unit MX-08 is 3,649 ± 316 (S.E.) (Figure3). This shows that this population has increased considerably since the last estimate. Thus, the observations of local hunters are supported by the population status identified in this survey.

Recommendations

Based on these results and consultations with the community of Taloyoak and the Taloyoak HTO, the DOE makes the following recommendation: the Nunavut Wildlife Management Board increase the TAH of 66 to 275 muskoxen for the Muskox Management Unit MX-08.

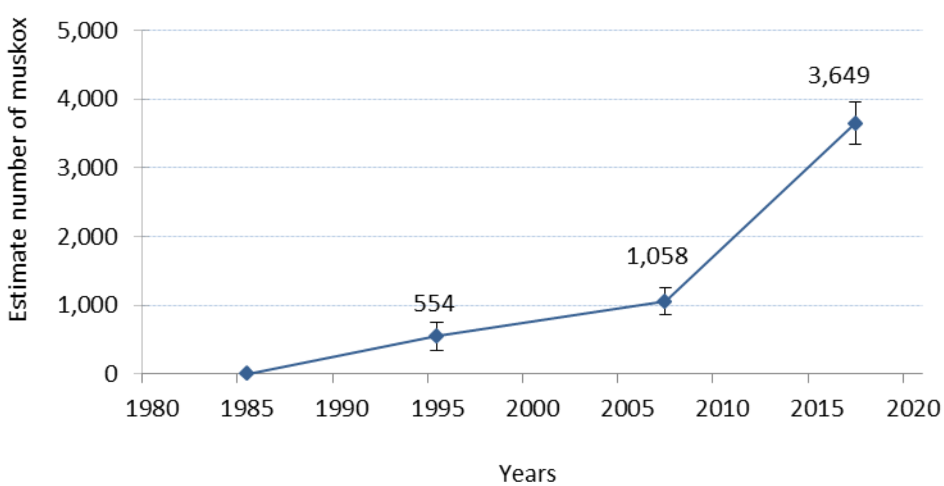


Figure 3: Muskox population estimate for MX-08 over time, estimated from aerial surveys from 1985 through 2017

MUSKOX (*Ovibos moschatus*) DISTRIBUTION AND ABUNDANCE, MUSKOX MANAGEMENT UNITS MX-08, BOOTHIA PENINSULA, AUGUST 2017.

Lisa-Marie Leclerc[1]

Version: February 2019

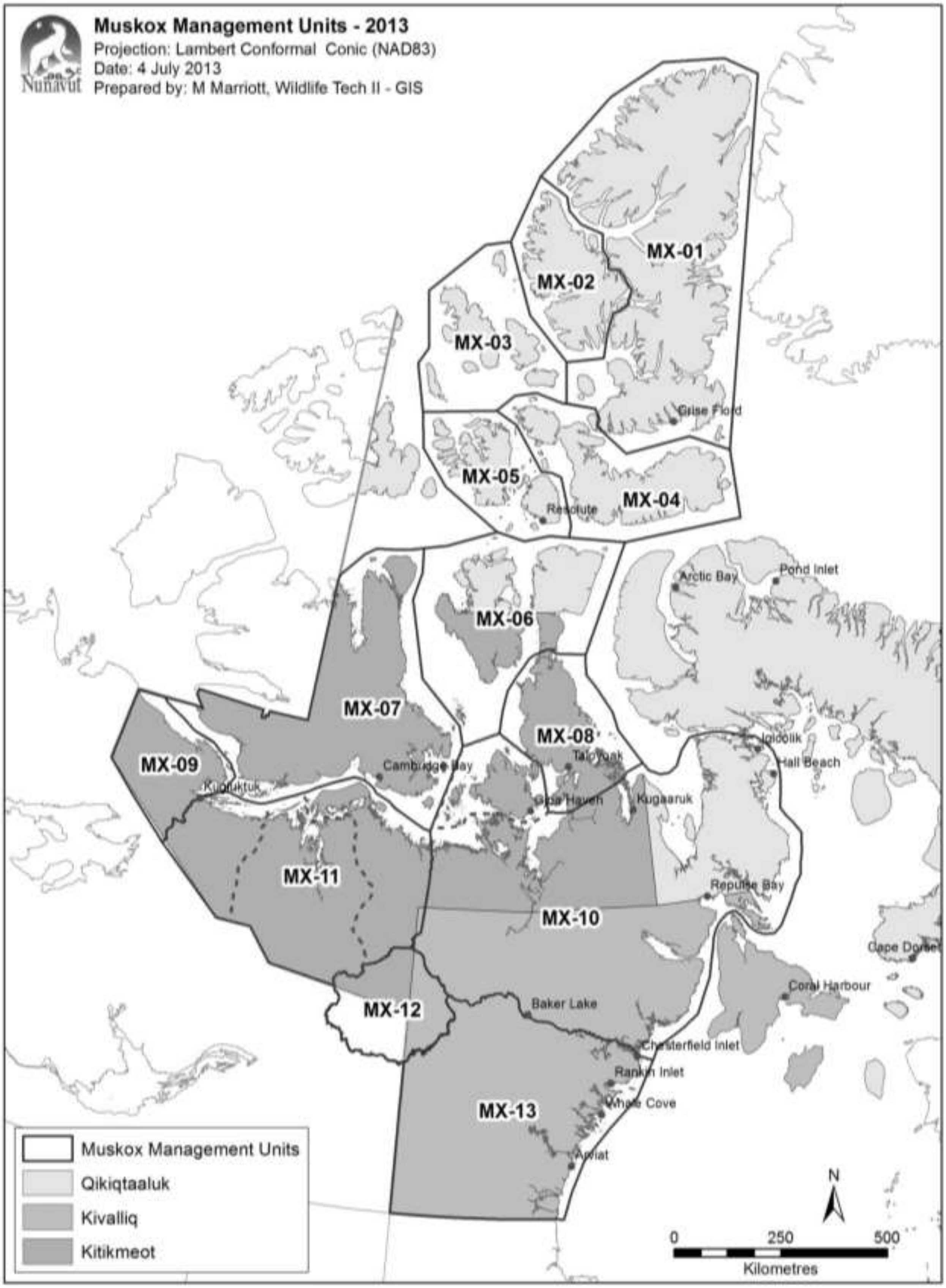
[1]Wildlife Biologist Kitikmeot Region, Department of Environment

Wildlife Research Section, Government of Nunavut Box 377 Kugluktuk NU X0B 0E0

NUNAVUT DEPARTMENT OF ENVIRONMENT

WILDLIFE RESEARCH SECTION

KUGLUKTUK, NU


Muskox Management Units - 2013
Projection: Lambert Conformal Conic (NAD83)
Date: 4 July 2013
Prepared by: M Marriott, Wildlife Tech II - GIS
Nunavut
MX-01
MX-02
MX-03
MX-04
MX-05
MX-06
MX-07
MX-08
MX-09
MX-10
MX-11
MX-12
MX-13
Grise Fiord
Resolute
Arctic Bay
Pond Inlet
Igloolik
Hall Beach
Cambridge Bay
Taloyoak
Kugluktuk
Gjoa Haven
Kugaaruk
Repulse Bay
Cape Dorset
Coral Harbour
Baker Lake
Chesterfield Inlet
Rankin Inlet
Whale Cove
Arviat
Muskox Management Units
Qikiqtaaluk
Kivalliq
Kitikmeot
N
0
250
500
Kilometres

Executive Summary

A systematic strip transect survey of the Boothia Peninsula was undertaken in summer 2017 to determine the abundance and distribution of muskox. The survey took place from August 07 to August 12. A total of 8,317.71 km^2 were flown, representing 20% coverage of the total study area (43,238 km^2). During the survey, 702 adult muskoxen were recorded on transect resulting in a population estimate of 3,649 ± 316 (S.E.). Calves represented 14% of the adult muskox seen and the average number of adults per group was small, 5 ± 4.45 (S.D.) The muskox density was of 0.084 muskox / km^2 in the management unit. This is an increase of muskoxen in MX-08 from what have been estimated previously, and it is consistent with the reported local knowledge. Thus, an increase in the current harvest rate could be supported by this current population estimate, as well as continuing the monitoring, harvest reports, and health monitoring program. A survey cycle of 5 years is advisable for this Muskox Management Unit or sooner if traditional knowledge indicates a significant change in the population trend, so harvest rate could be review.

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Introduction

The mechanism driving muskox population dynamics is not well understood. In the early part of the 1900s, hunting pressure drove muskox numbers close to extinction and reduced the distribution to a few limited pockets in the Canadian Arctic (Spencer 1976; Gunn 1984). To stimulate recovery, the existing muskox populations in Nunavut were managed to foster a continued colonization of the historic range (Gunn, 1983). While muskox are currently re-colonizing historical habitat in the central and eastern Canadian Arctic, most muskox populations have been increasing in the last few decades, inhibiting the monitoring of long-term population variation. Therefore, there is limited information available to determine how muskox populations naturally cycle.

The Boothia Peninsula is an example of a location where muskox is re-colonizing their historical range. Previous surveys on the Boothia Peninsula were conducted in 1985, 1995, and 2006. In 1985, the Boothia Peninsula was known to be devoid of muskox (Spencer Bay HTO pers. Comm; Gunn and Ashevak 1990). A decade later, 61 muskoxen were seen on transect providing an estimate of 554 ± 205 (SE) animals (Gunn and Dragon, 1998). According to hunter observations, muskox numbers around Taloyoak have been increasing since 1995. During the latest population survey, in 2006, muskox abundance for Boothia Peninsula was estimated at 1,100 ± 253 animals from the 562 adult muskoxen seen on transect (Dumond, 2007). Based on the location of sightings between the 1995 and 2006 surveys and local knowledge, muskox appear to occupy the Boothia Peninsula from Somerset Island, north of Amittaryouak Lake, moving southward reaching a southern limit at Cape Cambridge (Gunn and Dragon, 1998; Dumond, 2007). In 2006, areas of higher muskox density were found in the vicinity of Murchison Promontory and Pasley Bay. Thus, the environmental conditions on the Boothia Peninsula seem to be optimal to promote muskox population growth.

Taloyoak Hunters have commented on the higher numbers of muskoxen sightings. They fear that muskox will start impacting negatively the caribou calving grounds on the Boothia Peninsula. It is part of Inuit traditional knowledge that muskoxen displace caribou from their habitat. Muskox feeding pits or the destruction they cause to ground cover might prevent caribou from feeding in the area or the strong muskox musk might deter caribou. However, muskox and caribou have been co-habiting in the Arctic for thousands of years, where their ranges overlap temporally and spatially. Even today, there is no clear scientific evidence determining an negative impacts related to the muskox-caribou relationship, as this inter-species relationship is difficult to isolate from confounded variables in the wild. Thus, traditional knowledge might be a more powerful tool to understand in inter-species relationship.

In 1995, there was no muskox quota in the area that was previously part of MX-09 due to the very low number of muskoxen on the Boothia Peninsula. However, a quota of 20 tags for Prince of Wales Island and 12 tags for Somerset Island were assigned to these two harvest zones (Gunn and Dragon 1998). After the 2006 population survey was completed, a Total Allowable Harvest (TAH) of 20 was set. Assuming that this quota was filled on a yearly basis, a harvesting rate of 6% would have led to a slow decline, as the harvesting rate will be higher that the population yield. (Tener, 1965). Despite this risky management approach taken with limited knowledge on the population demographics, recent local knowledge has indicated that the muskox numbers have still continued to increase.

Based on local knowledge, there is a need to re-evaluate the existing TAH relative to the management goal. Taloyoak hunters are requesting an increase in harvesting opportunities to keep the muskox population relatively low so they can preserve the caribou calving grounds. A reassessment of the muskox population in MX-08 is necessary to revisit the TAH. It is also important to make sure that there is enough incentive in place to reach the harvesting rate in order to achieve the goal of keeping the muskox population relatively low. Thus, this project aims to first provide an update of the current muskox population in the muskox management unit MX08. Consistent with other muskox surveys, the Nunavut wide monitoring approach will be used. This scientific information will be provided and paired with traditional knowledge to review existing management strategies and promote a sustainable harvest of muskox for future generations of Inuit allowing for the co-habitation of caribou and muskox on the Boothia Peninsula.

Objectives

This project aims to address the concerns and requests of Inuit hunters, as well as to provide up to date scientific information for management purposes. Therefore, the main objectives of this study are:

1. Determine the estimated number of muskox;
2. Determine muskox distribution and density;
3. Determine calf crop and group size.

By doing so, it will be possible to have better information on current muskox abundance and distribution in the muskox management unit MX-08. Information on group structure, calf production, group size, and density is essential to gain insight on the relation between these variables and population dynamics.

Materials and Methods

Study Area

The study area is the muskox management unit MX-08, which includes the Boothia Peninsula and a portion of the mainland. The area lies between M'Clintock Channel to the west and the Gulf of Boothia to the east, and is separated from MX-06 to the north by Bellot Straight and the southern boundary is shared with muskox management unit MX-11. The Boothia Peninsula is the northernmost extension of the Canadian mainland and the North American Continent. The area is rich in topography with plains, lowlands, plateaus, and rolling bedrock hills (Dyke, 1984).

This management unit is part of the Northern Arctic Ecozone, which has two Northern Arctic Ecoregions. The southeast and the north part are characterized by Boothia Peninsula Plateau and a small portion of the southwest by the Victoria Island lowlands (Environment Canada, 1995). Due to the spatial heterogeneity of the area, the Arctic tundra vegetation cover is influenced by the soil moisture, nutrient availability, snow cover, wind exposure, and microclimate differences defining dwarf-shrub health or moist to wet sedge meadows (Laidler *et al.,* 2008).

Vegetation covers in the Victoria Island Lowlands are dominated by *Saxifraga oppositifolia, Dryas integrifolia*, and *Sali*x spp., and the wet areas are characterized by sedges, cottongrass, saxifrage, and moss (Walker, 2000; Environment, 1995). Remaining upland areas are part of the Boothia Peninsula plateau, which have a mid-arctic eco-climate. In the upland the vegetation is discontinuous, and dominated with tundra species (Environment, 1995). Vascular plants are found in bedrock cracks and depressions where it is well irrigated by runoff and protected from winds (Walker, 2000).

Survey Area

Prior to survey, no reconnaissance survey was undertaken to maximize the coverage area investigated. Instead, anticipated muskox distribution patterns were obtained from past ground surveys, hunter observations, and Inuit Traditional Knowledge/*Inuit Qaujimajatuqangit* (IQ). According to *IQ,* muskox has increased in numbers and they are now uniformly distributed over the entire Boothia Peninsula with no specific aggregation. Based on this change in distribution, the whole management unit MX-08 was surveyed at 20% coverage with no strata of different effort allocation (Figure 1).

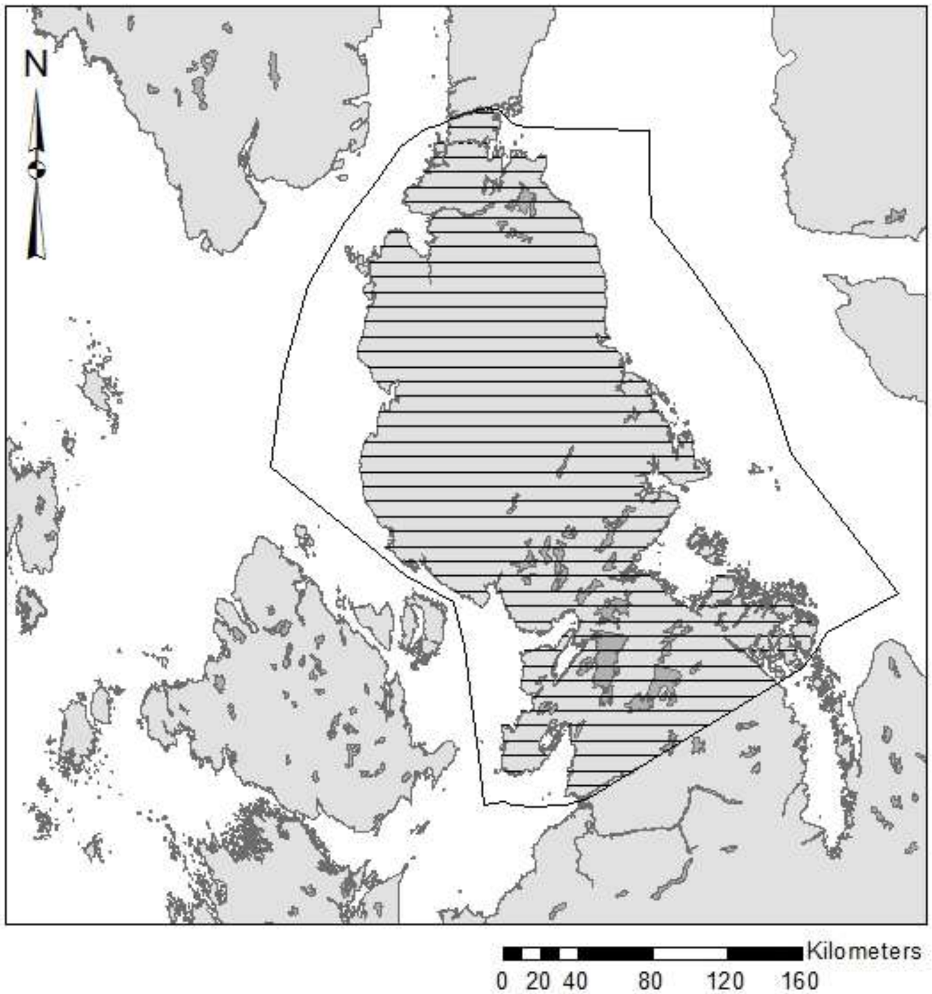

Figure 1: Transect lines representing 20% coverage of the muskox management unit MX-08.

To increase the precision of the survey areas, ESRI'S ArcGIS software with an adapted survey design tool was used to randomly plot the transect lines until the desired percentage of coverage was achieved. The tool allows the user to determine the precise number of transects and the distance between each transect line required in function of the transect strip width and the total area of the management unit. Orientation of the transect lines within the stratum was determined in function to have the most homogeneous and shorter transect line length under the assumption that muskox are randomly and uniformly distributed on the landscape (Figure 1).

Table 1, below, summarizes the total area, the percentage of cover, the total number of kms of transects of different length, the number of lines, the resulting distance between each transect line and the orientation of the transect lines. In sum, the management unit, MX-08, of 43,238 km^2 was surveyed with a total of 5,198 km of transect lines, which represented 46 transect lines of different length at a spacing of 8 km (Table 1).

Table 1 Characteristic of the study area and the transect lines per stratum in the Management Unit MX-08.

Stratum	Total area (km^2)	Percentages (%)	Total transect lines (km)	Number of lines	Distance between transect line (km)	Orientation
1	43,238	20	5,198	46	8	East-West
MX-08	43,238	----	5,198	46	----	----

Aircraft configuration

A systematic transects line survey was flown with a fixed-wing single engine turbine aircraft, a grand caravan. The transect lines were surveyed at a speed of 160 km/hr and the survey altitude of about 152 meters, which was mostly maintained following the relief of the study area using a radar altimeter. The pilot responsibilities were to monitor this air speed and altitude while following the pre-programmed transect on a Geographic positioning system (GPS). The strip transect was 800 meters on each side of the aircraft, for a total transect width of 1.6 kilometers. The pre-determined transect width of 400 meters was set on each wing based on calculation using the formula of Norton-Griffiths (1978) and others (Gunn and Patterson 2000; Howard 2011).

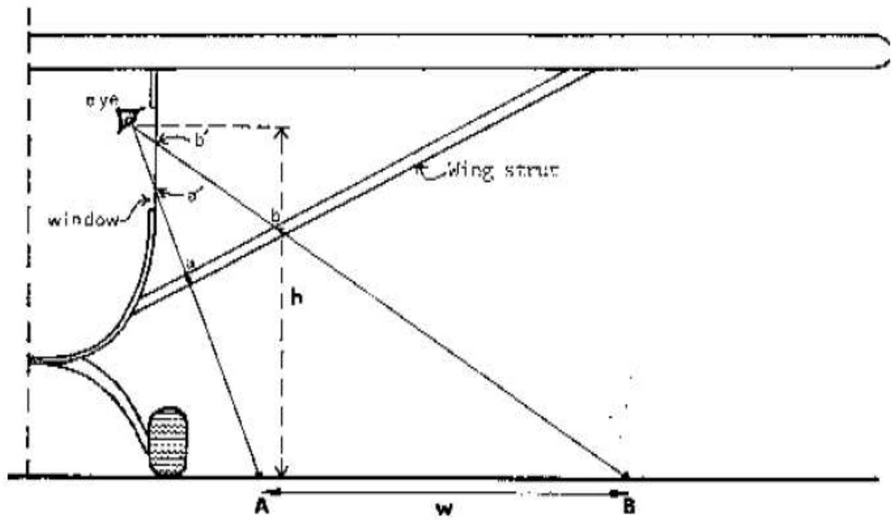

Figure 2: Schematic diagram of aircraft configuration for strip width sampling North-Griffiths (19878). W is marked out on the tarmac, and the two lines of sight a'-a-A and b'-b-B establish, whereas a'- and b' are the window marks.

$$w= W*h/H$$

Where, W= the required strip width; h= the height of the observer's eye from the tarmac; and H= the required flying height.

The entire survey was set up with an observer/recorder crew: two recorders, one left side observer and one right side observer. Each left and right observer and a recorder were divided into a team. Observers were responsible to continuously searched for and counted muskox; the number of calves (5-6 months old) were counted when they were conspicuous while on transect. No sex and age classification count were systematically attempted. The data recorded included the number of muskox and GPS locations. Only counts of adults were used in the final population estimate. Even if this survey focused on muskox, additional sightings of other species were also recoded, such as caribou, polar bear, and wolf.

Analyses

As this survey focused mainly on obtaining an estimated number, only unambiguous classification criteria were used to determine the number of calves and adults. The group was then broken down into adults (female/male) and calves (Howard 2011). The flying height and speed did not allow for accurately distinguishing male from female muskox from horn size and shape. Therefore, the proportion of calves per female cow was not determined, and no information on the recruitment or productivity was generated. The group structure was however described such as calf:adult ratio, mean group size, and the number of single lone bulls encounter.

To determine the number of muskoxen in the study area, only the adult muskoxen sightings recorded on transect were analyzed using Jolly's Method 2 for unequal sample sizes (Jolly 1969) using a coefficient limit of 95%. Such methodology was previously used for the survey of Boothia Peninsula in 2006. The population estimates for fixed-width strip sampling using Jolly's Method 2 for uneven sample sizes (Jolly 1969; summarized in Caughley 1977) are derived from the following equation:

$$\hat{Y} = RZ = Z\frac{\sum_i y_i}{\sum_i z_i}$$

Where $\hat{Y}$ is the estimated number of animals in the population, R is the observed density of animals (sum of animals seen on all transects $\sum_i y_i$ divided by the total area surveyed$\sum_i z_i$), and Z is the total study area. The variance is given by:

$$Var(\hat{Y}) = \frac{N(N-n)}{n}\left(s_y^2 - 2Rs_{zy} + R^2 s_z^2\right)$$

Where N is the total number of transects required to completely cover study area Z, and n is the number of transects sampled in the survey. s_y^2 is the variance in counts, s_z^2 is the variance in areas surveyed on transects, and s_{zy} is the covariance. The estimate $\hat{Y}$ and variance $Var(\hat{Y})$ are calculated for each stratum and summed. The Coefficient of Variation (CV = σ/$\hat{Y}$) was calculated as a measure of precision.

Density, the number of muskoxen per unit area (muskox/km^2), will be determined using the number of adult muskoxen seen on transect divided by the total area of the study area. Lakes and stream areas will be not subtracted from the total area calculations used in muskox density (Statistical analysis based on Campbell and Setterington (2001)).

The area occupied by muskox and the time of the survey within the study area was determined. Thus, the distribution of muskox was illustrated by plotting each muskox sighting on and off transect, based on their precise geospatial position captured with GPS. In addition, the number of animals composing each group was highlighted using an increasing size of circles to represent groups of 0-1, 2-7, 8-11, 12-15, and 16-19 animals.

Given the importance of predators, Polar bear (*Ursus maritimus*) and Arctic Wolf (*Canis lupus arctos*), we collected standardized information of predator sightings in the management units using the predator index (Heard, 1992). The predator index reports all predator sightings per species against the total number hours flown, also including the ferry time in this case. It is then possible to have a yearly trend, as the number of predators observed is expressed per 100 hours for this particular time of the year.

Results

The survey was conducted out of the community of Taloyoak from August 07th to August 12th, 2017. The management unit was surveyed in 40 hours, including on transect and ferrying flights from Taloyoak airport to the start of the transect lines. Low ceiling and fog prohibited the ability to survey continuously from the North to the South of the study area. Therefore, some sections were left to be completed at a later time, when the weather was permitting. The sedentary muskox behavior (Adamczewski *et al*., 1997) reduces the probability that an individual will move any great distance within the short survey time frame.

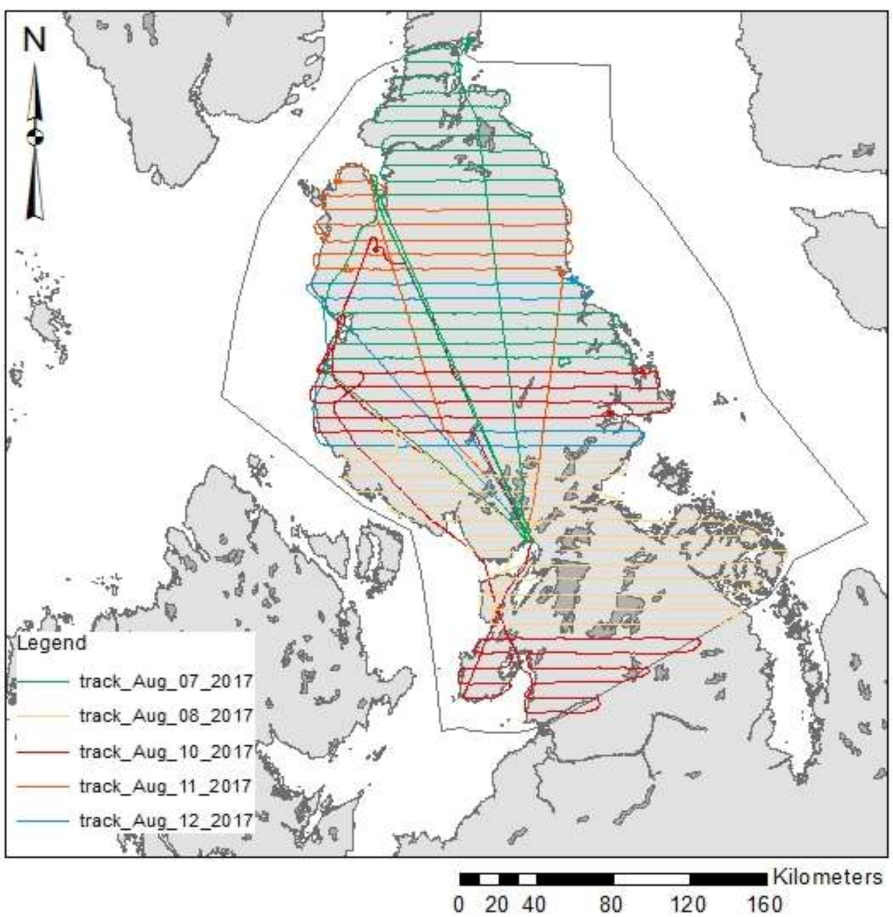

Figure 3: Daily tracks completed to cover 20% of the muskox management units MX-08 from August 7th to 12th.

Distribution

The adult muskox distribution in the management unit is represented in Figure 5 below. During the survey, 170 groups of muskox were seen on and off transect. The large groups of muskox, 16-19 adult animals, were distributed from Cape Farrand to Abernethy Bay within 40 km from coast. Additional muskox aggregations were found around the Wrottlesley River valley in the small portion of the southwest by the Victoria Island lowlands. Very few groups were located at high elevation (594 meters) in the central north part of the Peninsula, as muskoxen appeared to avoid the Boothia Peninsula Plateau. It was the first time that muskox observations was recorded south of Cape Cambridge, now reaching close to Acland Point at their southernmost distribution.

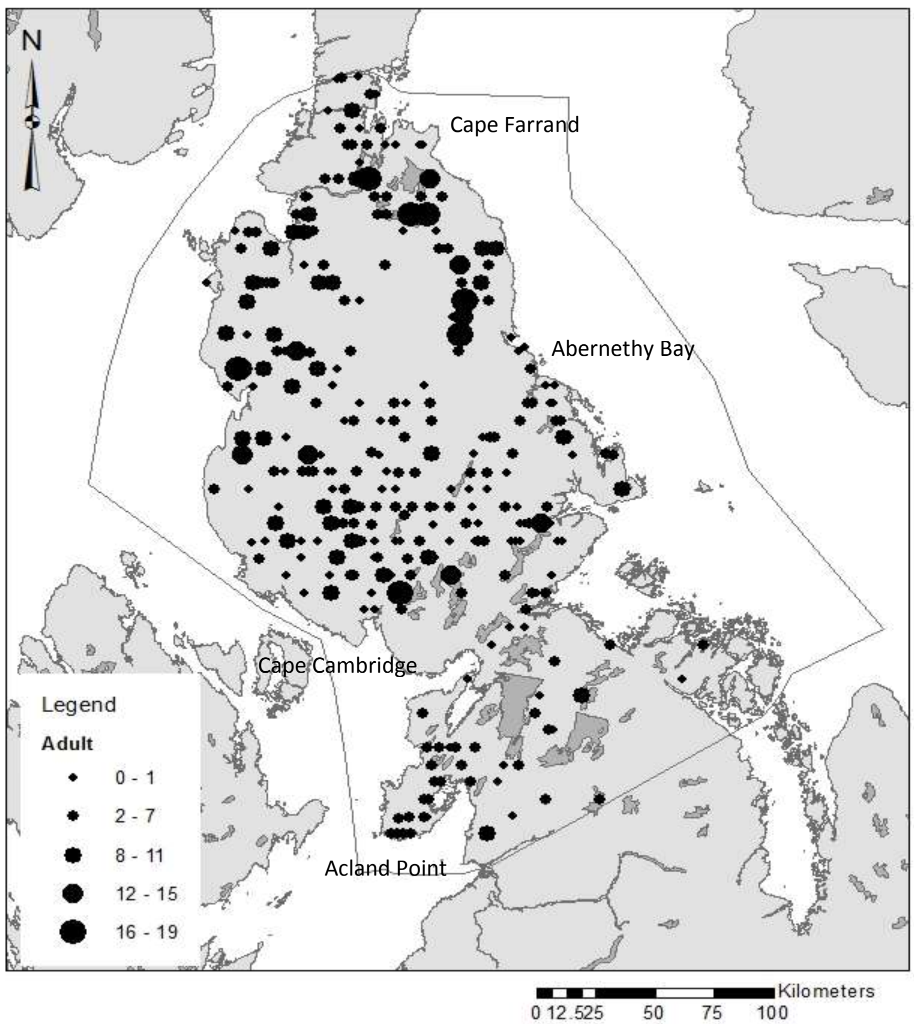

Figure 4: Muskox distribution on and off transect in the management unit MX-08 during the survey where the number of animals per group was grouped as 0-1, 2-7, 8-11, 12-15, and 16-19.

Group Characteristic

During the survey, 139 groups of muskox were recorded on transect, where 26 were single lone bulls. The majority of the groups (41%) were very small groups of 2 to 7 adults (Figure 5). The average number of adults (+1 year and older) per group was 5 ± 4.45 (S.D.) where calves were not included in the group size. The highest number of adults counted in one group was 19.

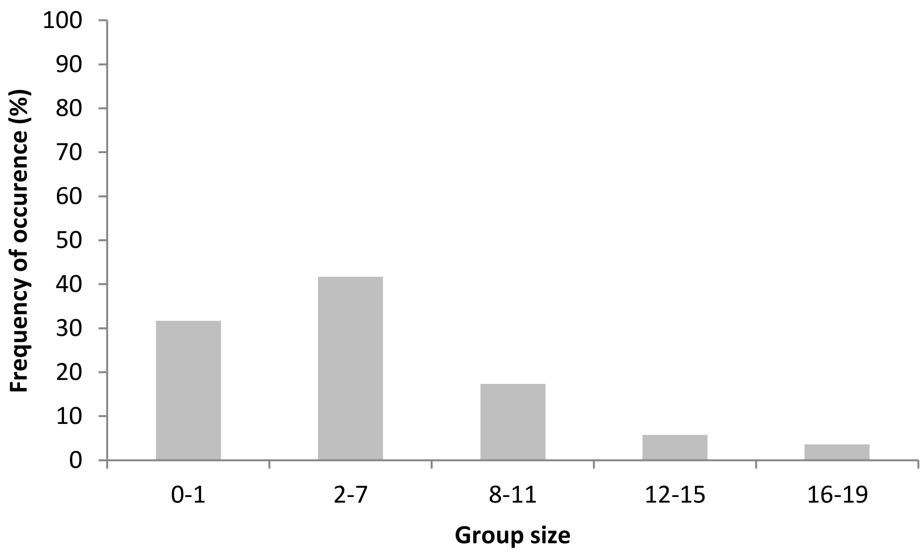

Figure 5: Frequency of occurrence (%) of adult muskox number per group size, grouped as follow 0-1, 2-7, 8-11, 12-15, and 16-19.

Nonetheless, the calf to adult ratio was determined for each group of muskox seen on transect. Since the identification was done from a fixed-wing, it was impossible to distinguish the sex of the adult or yearling based on the horn shape and length. Close to half the group seen (45%) did not have any calves. For the group that had calves, most of them had at least one calf, but some larger groups had up to 4. Most of the groups that had a larger proportion of calves were located north of the Boothia Peninsula, south of Murchison Promontory and west of Cape Farrand, and in the Wrottlesley River valley (Figure 6). The overall proportion of calves to adults was 14%.

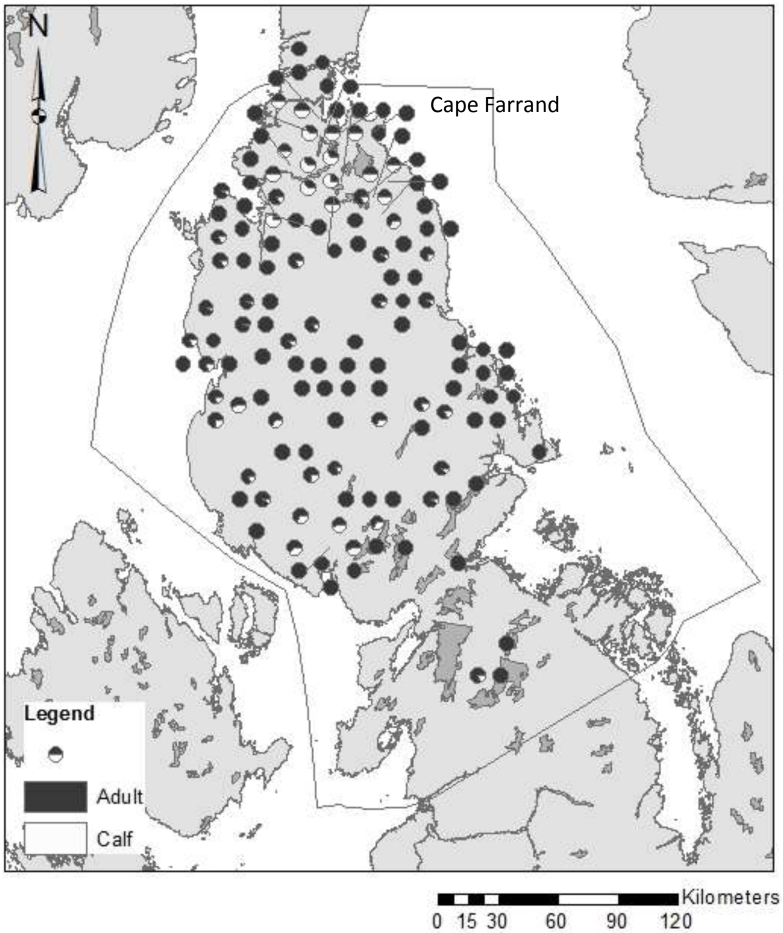

Figure 6: Proportion of calves per adult muskox in each group observed on transect in the Muskox Management Unit MX-08.

Estimate

The percentage of the overall cover of the management unit surveyed with 8,317 km^2 represented 20% of the total study area (43,238km^2). During the survey, 702 adult muskoxen on transect were recorded. The estimated number of muskox in the management unit MX-08, totaled 3,649 ± 316 (S.E.) ($p<0.005$, $t = 1.676$, $N = 184$ and $n = 46$). For this estimate, the total number of transect at 100% coverage was 184 (N) and 46 (n) transect lines were surveyed (Table 2). Overall, the muskox density of the management unit was 0.084 muskox/km^2.

Table 2 Muskox estimate in the Muskox management Unit MX-08

Stratum	Area Survey (km^2)	Total area (km^2)	Muskox on Transect	Estimate	Standard error (S.E.)	95% CL (±)	CV
MX-08	8,317	43,238	702	3,649	316	530	0.09

* p<0.005, t = 1,676, N = 184 and n = 46

Predator sighting (wolves, polar bear and grizzly bear)

In 2017, during the 40 hours of flying within the management unit, 2 wolf and 7 polar bear sightings were recorded. The wolves were found on the southern part of the study area; 1 wolf west of Josephine River and south of Netsilik Lake where four wolves constituted the pack. These two locations were overlapping with caribou sightings (Figure7). Being located between two polar bear management units, the M'Clintock Channel and the Gulf of Boothia, it was probable to observe polar bears. Indeed, 1 female and two cubs were observed on the Cape Hobson and a lone adult was seen a few kilometers inland off the shore of M'Clintock Channel. The remainder of the sightings were on the Gulf of Boothia, with seven polar bears and a female with a pair of cubs observed between Abernethy Bay and Mary Jones Bay. No grizzly bears were seen during the survey. Predator sightings, using the predator index, (Heard, 1992) reveled 13 wolves/100 hours and 25 polar bears/100 hours.

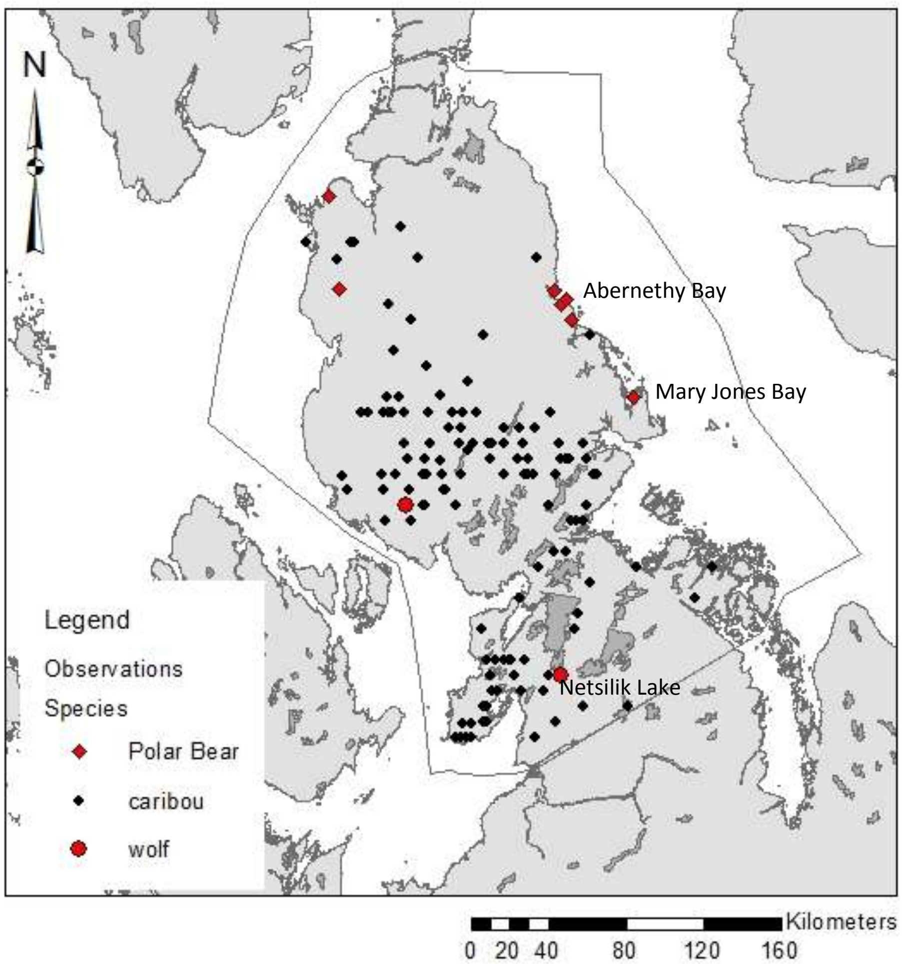

Figure 7: Locations where Polar Bears and Wolves were observed in the Muskox Management Unit MX-08 in relation to caribou distribution.

Discussion

Distribution

Despite the fact that traditional knowledge indicates that muskox inhabited the Boothia Peninsula long ago, it is common knowledge that muskox were not found in this management unit in the 1980s (Gunn & Dragon, 1998). Early in the 1990s, muskox started to move south of Somerset Island colonizing the northern part of the Peninsula, where their distribution remained consistent for a decade (Dumond, 2007). In 2017, although the majority of the muskox were still located north, they re-colonized most of the Peninsula reaching a new southern limit. Favorable environmental conditions and adequate forage, low number of predator (no grizzly bear) would have either contributed to increase the immigration rate or herd productivity. Muskox are now found in close proximity to the community of Taloyoak, as far south of Arcland Point, which can provide new harvesting opportunities. If these muskoxen are from the Arctic Archipelago, a subspecies genetically and morphologically distinct from the mainland muskox, it will be interesting to track their expansion and monitor the exchange between these two subspecies once their ranges overlap.

Group Characteristic

The number calves represented 14% of the total number of adult muskox observed on transect. This ratio is normally associated with a population that would be increasing, since it has been establish that a calf recruitment rate of 10.5% is necessary to keep the muskox population stable (Freeman, 1971). Since the calf ratios have known to vary greatly between years, long term data is needed in order to determine a trend (Reynolds, 1998).

Small groups of muskoxen was characteristic of the Boothia Peninsula, with an average group number of 5 ± 4.45 (S.D.), which is consistent with the mean group size of 6 established in 2007 (Dumond, 2007). Comparatively to King Williams Island where the muskoxen are known to increase in number rapidly, larger groups, 13 ± 8.40 (S.D.), were observed at the same period of the year (Leclerc, 2015).

Abundance Estimate

The extent of the harvest zone MX-09 remained relatively the same after the creation of MX-08 when each muskox management unit in Nunavut was reviewed in 2015. The major change, is that the new unit, now called MX-08, did not include the southern portion of Somerset Island, but starts at the northernmost coastline. This similarity allowed the 2017 study to be compared with previous population estimates.

Surveys of the Boothia Peninsula have occurred sparsely since the 1980s. In 1985, during a survey, no muskoxen were seen. Local knowledge has indicated that the presence of disease or parasites caused an abrupt decline in the muskox number. It is only in 1995 that muskox started to re-colonize the area and resulted in an initial population estimate of 554 ± 205 SE. The community members of Taloyoak mentioned a consistent increase in the muskox number. This observation triggered a second survey, in 2007. This survey confirmed the local knowledge and the muskox numbers were then estimated at 1,058 ± 198 SE. Recently, with this continuous increase, muskox have been recorded to be close to the community of Taloyoak and they would like to re-adjust the Total Allowable Harvest. In 2017, the estimated number of muskox reached 3,649 ± 316 SE, which is the highest number to date. There will likely be a recommendation for the NWMB to consider an increase to the current harvesting rate after consultation and discussion with the Hunter and Trapper Organization in the affected community of Taloyoak.

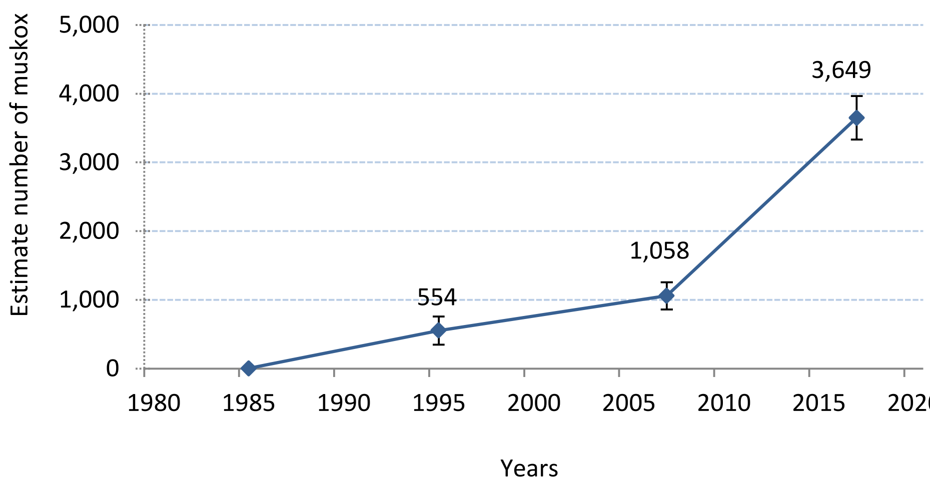

Figure 8: Muskox population estimate for MX-08.

Density

Muskox density was 0.084 muskoxen / km^2 on the Boothia Peninsula. In this management unit, the muskox has a density higher to the overall density on Victoria Island, 0.074 muskox / km^2, but is lower to that of King William Island where the muskox population has also increased (0.1123 muskox/km^2) (Leclerc, 2015). The mechanism driving muskox density is still not fully understood. Heard (1992) noted that group size in not generally related to muskox density. These qualitative comparisons between areas, highlight that density might fluctuate spatially and temporally.

Predator sighting (wolves, polar bear)

The number of known muskox predators was minimal. Only two wolves were observed, and at close proximity of caribou, their main prey. Wolf predation on muskoxen is common, with packs or single wolves observed following and killing muskox. No Grizzly bears were found on the Boothia Peninsula. The relatively low abundance of predators would benefit calf recruitment and female survival, promoting an increase in the population. 25 polar bears 100 hours were seen, but polar bear are known to feed on a mainly marine based diet and are not known to predate on muskox and should not contribute to regulate muskox population.

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Muskox distribution and abundance Muskox Management Unit, MX08, Boothia Peninsula

Taloyoak HTO

Lisa-Marie Leclerc
Government of Nunavut
Department of Environment

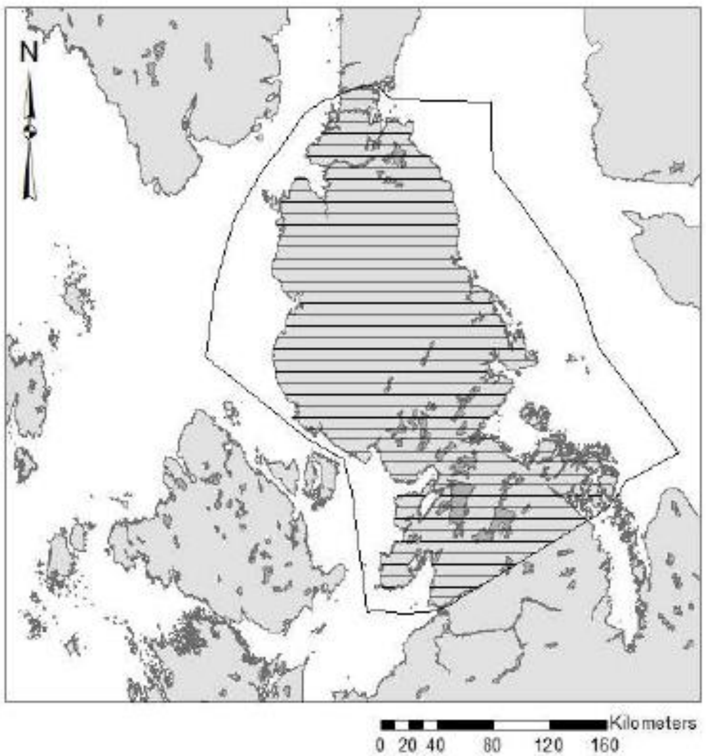
June, 2019

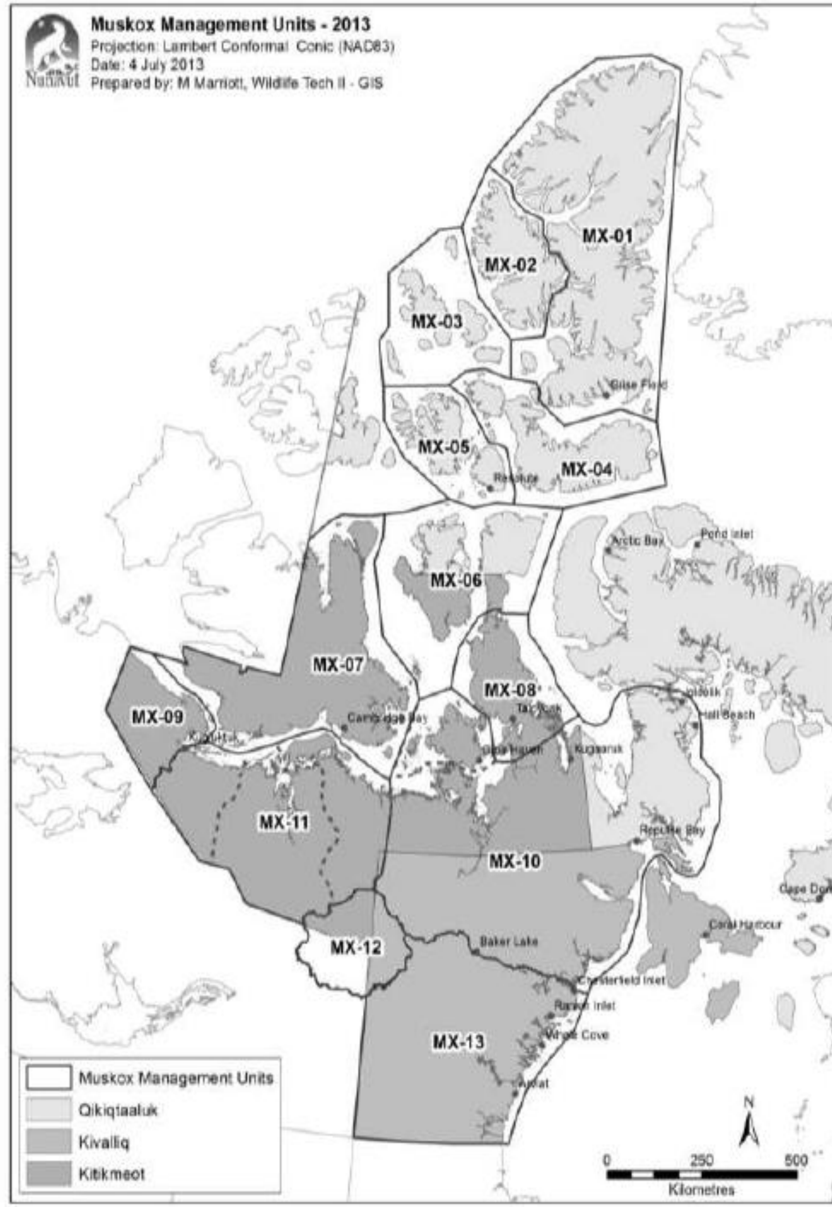
The Government of Nunavut would like to:

Inform the Board of the progress in research and monitoring on the Muskox Management Unit MX-08 in 2017, and provide current management recommendations

Survey Area

- MX-08, last estimate in 2006 was 1,100 muskoxen, with 158 adults on transect.
- Concerns, muskox-caribou interaction.





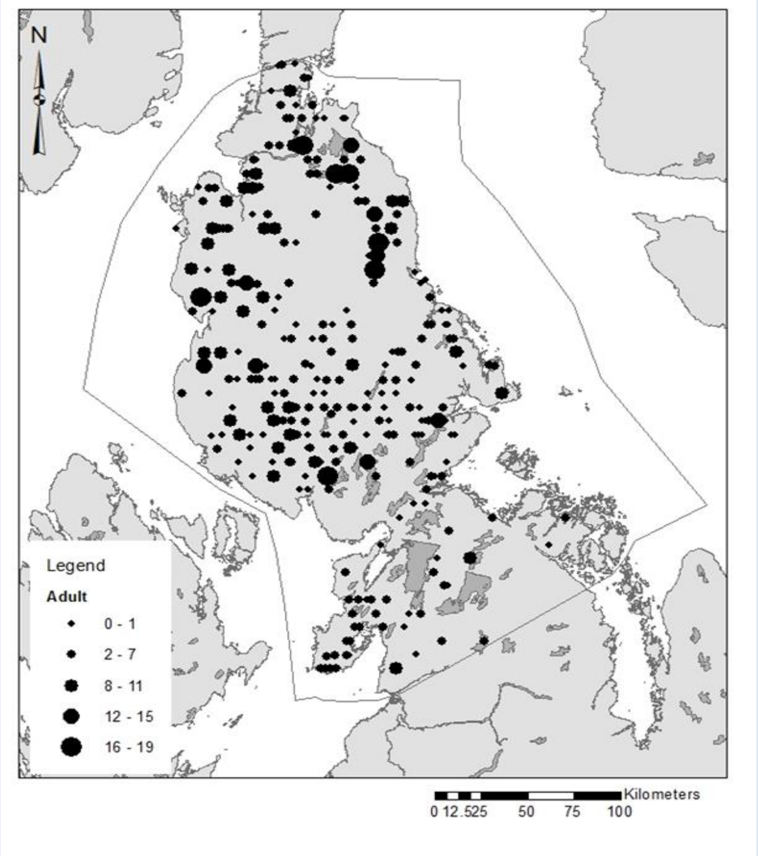
Monitoring

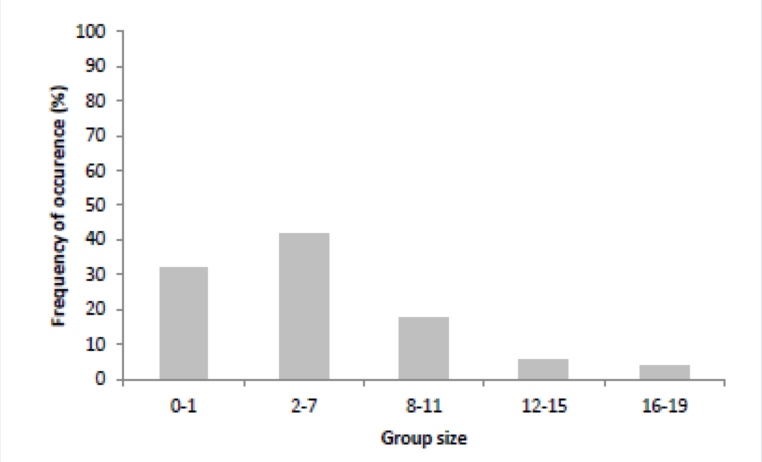
- Survey completed in August 05 to August 13, 2017

- 702 adults counted on transect

- 41% of the group were small groups of 2 to 7 adults.

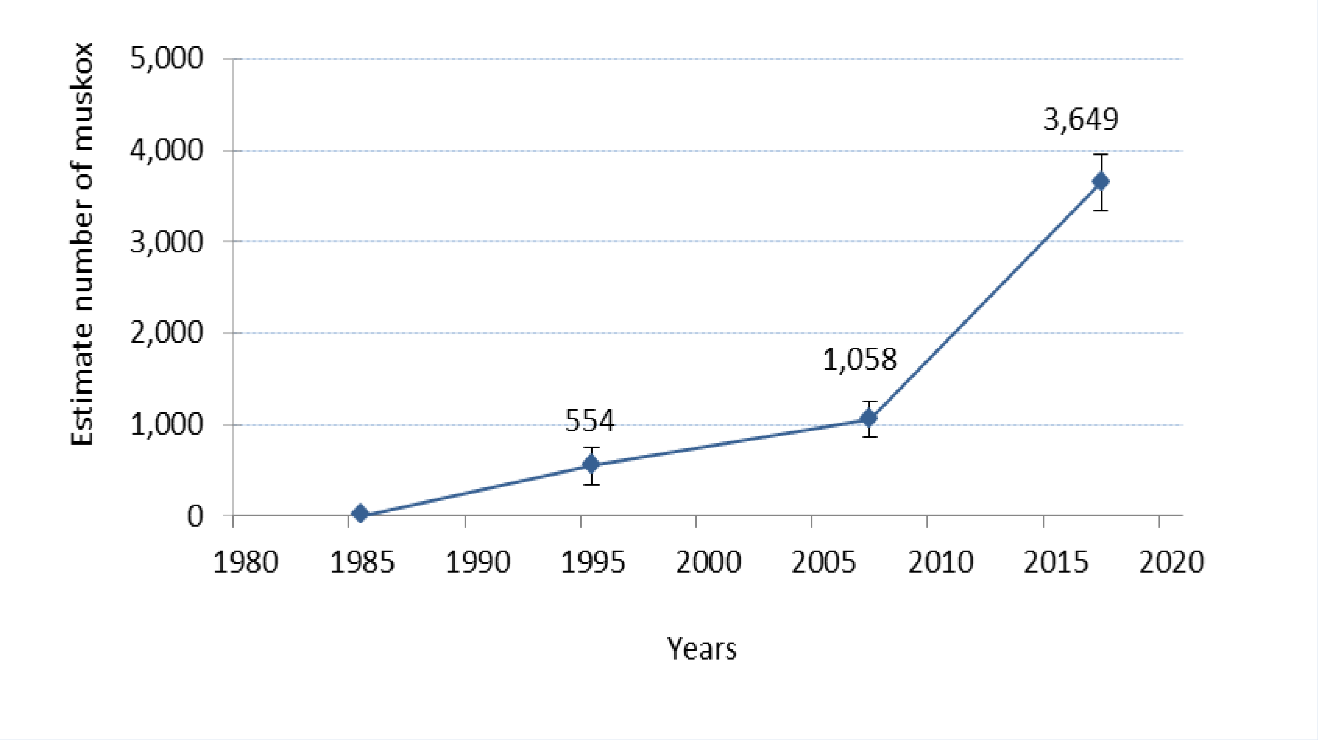
- The calves to adults ratio was 14%.





MX08- population estimate

There is an increase in muskox number with an estimate of 3,649 ± 316 SE



Predators

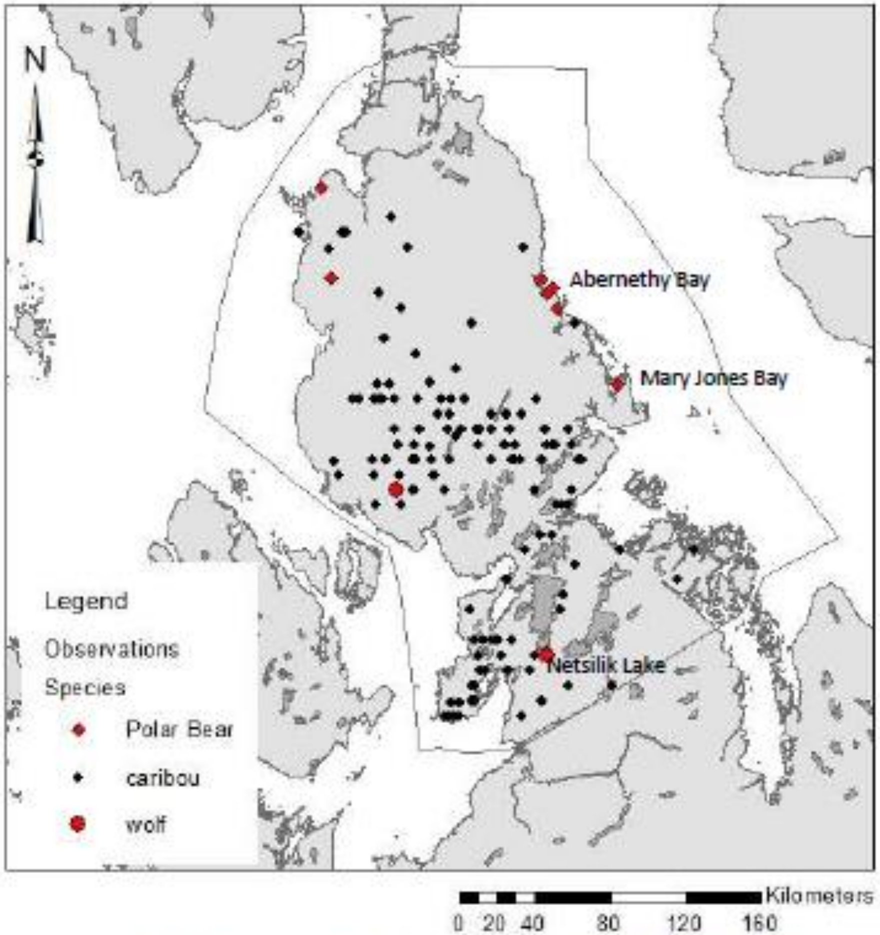


Figure 7: Locations where Polar Bears and Wolves were observed in the Muskox Management Unit MX-08 in relation to caribou distribution.

Management - Discussion

What is the HTO's management objective?

Are all tags being filled?

What is the community need?

The Government of Nunavut recommendations

Based on survey results and community and HTO consultations, the following, current recommendation is made for managing muskoxen in Muskox Management Unit MX-08:

The Department of Environment is recommending to the Nunavut Wildlife Management Board to increase the current TAH of 66 to up to 275 muskoxen for Muskox Management Unit MX-08.

HTO Consultations on muskox distribution and abundance, Muskox Management Units MX-08

April 2019

Department of Environment, Government of Nunavut Iqaluit, Nunavut

Executive Summary

Government of Nunavut, Department of Environment (DOE) representatives conducted a consultation with the Hunters and Trappers Organization (HTO) of Taloyoak and the community members of Taloyoak on April 23, 2019. The primary purpose of these consultations was to better inform the HTO and community members of the results of the 2017 abundance estimate of MX-08 and discuss the management recommendations that they would like to see implemented. The consultation was also a way to receive and collect additional local and traditional knowledge insights.

The Taloyoak HTO agrees with the survey results, which show that muskox numbers in the management unit have increased considerably. The current Total Allowable Harvest is 66 tags, or a harvest rate of 1.8% of the current population estimate of 3,469 animals. This level of muskox population growth is of concern for the community members and harvesters. The harvesters would like to increase the present quota to keep muskox numbers lower to allow the preservation of caribou, and their habitat, around the community. The DOE suggested an increase of the harvest rate to 6%, which constitutes an increase from 66 to 218 tags. The Taloyoak HTO and the community members support an increase, but they would like to see a higher percentage harvest rate as they consider 218 tags to be too low. DOE supports the request for a higher Total Allowable Harvest (TAH) and has offered to work closely with the HTO and community to bring the number of tags to 275 (a harvest rate of 7.5%).

This report attempts to summarize the comments made by HTO board members and the public during these meetings.

Preface

This report represents the Department of Environment's best efforts to accurately capture all of the information that was shared during consultation meetings with the Hunter and Trapper Organization and the public.

The views expressed herein do not necessarily reflect those of the Department of Environment, Nunavut or the Government of Nunavut.

Table of Contents

1.0 Report Purpose and Structure

This report is intended to collate and summarize comments, questions, concerns, and suggestions raised during a consultation held with the Taloyoak HTO and public on April 23, 2019 about the results of the muskox distribution and abundance survey of the muskox management unit MX-08, and management recommendations. The summary and notes herein reflect only what was shared during these meetings.

2.0 Purpose of Consultations

The primary purpose of the meetings organized and led by DOE was to engage the HTO and the public in an ongoing dialogue on the survey results of the muskox management unit MX-08 and solicit feedback on the latest survey report, gather additional local knowledge, and discuss future management recommendations. The results from the 2017 population survey were communicated during the meeting.

2.1 Format of Meetings

The meetings were held during the evenings and were 1 to 2 hours in length. Meetings were facilitated and lead by the Regional Biologist and the Regional Wildlife Manager, who were also the primary presenters. The local Conservation Officer was present as an observer. The presentation format was informal and HTO Board members and the public were invited to ask questions or raise concerns and recommendations. It was an open dialogue.

3.0 HTO and Public Consultation Summary

The objectives of the meeting were made clear to the HTO and the report was provided to them prior to the meeting. By doing so, the HTO Board members were already familiar with the information and could be engaged in a more meaningful way. In the eastern side of Kitikmeot Region, the muskox are not valued in the same way as for more western communities. Muskoxen are seen as a threat to the displacement of caribou, the community's preferred country food, and therefore it is felt that muskox numbers should be kept relatively low to preserve the caribou calving ground on the Boothia Peninsula.

3.1.1 Taloyoak HTO Consultation Summary - 2019

Issues: Muskox distribution and abundance in muskox management unit MX-08, Boothia Peninsula, August 2017. The number of muskoxen in this management unit is increasing considerably.

Date: April 23, 2019

Representatives:
DOE: Lisa-Marie Leclerc and Kevin Methuen, David Anavilok

HTO: Joe Ashevak (Chair), George Aklah, Kovalak Kootok, Tommy Aiyout, Jayko Neeveacheak, Bruce Takolik, John Lyall.

Summary of the Discussion:
During the presentation (Appendix 1), HTO members made comments and asked questions to ensure an understanding of the research methodology and results. The HTO members supported the survey results as they are consistent with their observations on the land.

The HTO members gave additional information on where muskox could be moving into the area from. Since in the 1980s, there were no muskox on the Boothia Peninsula, it was stipulated that the muskox was coming from Prince of Wales and Somerset Island. However, today, it seems that they are coming from other directions, such as west and the south of the Peninsula. It was also discussed that the Boothia Peninsula muskox might start to interbreed with the mainland muskox.

For the HTO members, this increase of muskox is very concerning, as normally, an increase of muskox is associated with a decline in caribou. Local knowledge mentions that the muskox displaces caribou if they are too abundant. The HTO sees that the muskox are now overpopulated in the area and they need to be kept under control. In addition, they would like to conduct a caribou survey to make sure that the Boothia Peninsula herd is still healthy in number, as other herds of caribou are known to be declining in the western Kitikmeot region.

Concerning the harvest rate, the tags are currently being filled. This year, all the tags were assigned, and the community is currently looking to access more tags. The HTOs would like an increase in the TAH, higher than what the DOE originally recommended (a TAH to 218). The HTO would like to keep the TAH system, but have a harvest rate of 7 to 8%.

Recommendation to the GN:
The GN and HTO of Taloyoak recommend an increase of the TAH to 7-8% in order to better control the increase of muskox on the Boothia Peninsula.

3.1.2 Taloyoak Public Consultation Summary - 2019

Issues: Muskox distribution and abundance in muskox management unit MX-08, Boothia Peninsula, August 2017. The number of muskox in this management unit is increasing considerably.

Date: April 23, 2019

Representatives:
DOE: Lisa-Marie Leclerc and Kevin Methuen, David Anavilok

HTO: Joe Ashevak

Summary of the Discussion:
During the presentation (Appendix 1), people present made comments and asked questions to ensure an understanding of the research methodology and results. The community members supported the survey results as this is consistent with their observations on the land.

Two community members would like to see mostly an open harvest on the muskox, 90% or no TAH. They feel strongly that a suggested TAH of 218 is not adequate. A higher harvesting rate will be needed to keep the muskox growth under control, so caribou can prevail on the landscape. It was also emphasized that there is a limited amount of tags, and this is a problem for accessing tags. There is a problem with hunters using cheap and small ammunitions, as well as leaving harvested skinny caribou on the land, as Baffin Island people ask for top quality fat caribou. These concerns were brought forward since these actions contribute to meat wastage. There is a need to continue working together to address these problems.

However, some community members expressed that they do not have a TAH for the caribou and that causes problems. The younger generation does not follow old traditional rules and are prone to overharvest. Muskox are a lot of work to clean and skin, and some people might just leave most of the meat and carcasses behind. Another community member proposed a future increase to 270 tags, which appears to be a good compromise.

This year, all the tags were assigned, and the community is currently looking to access more tags. The public would like seek an increase in the TAH. However, the public has a different view as to either remove the TAH or have a higher TAH than what is currently proposed.

Recommendation to the GN:
The community members of Taloyoak recommended an increase of the TAH, but do not see a suggested increase in TAH to 6% (218 tags) as sufficient. While some community members would like the TAH system to be removed, others would like to keep it to avoid overharvesting. Some community members recommended a TAH of 270, which could balance the position of different people in the community.

4.0 Conclusion- Next Steps

The DOE will finalize the muskox report with the additional comments provided during the meeting and distribute it to the co-management partners. Since 2017, population survey results have been discussed at the Kitikmeot Regional Wildlife Board Annual Meeting in 2018 and now with the HTOs, public, and other co-management partners. Key information on the increase of the muskox number in the muskox management unit MX-08 has been communicated. In addition, recommendations to the NWMB would be made to increase the current TAH. This position is supported by the Taloyoak HTO (Appendix 2).

5.0 Muskox Management Units MX-08 estimate results and management recommendations minutes

HTO consultation

Date: 23 April 2019 @ 7:00PM MT to 9:00PM MT

Subject: HTO Muskox Meeting, MX-08

HTO Comments:

- Ahiak herd not wintering near Taloyoak anymore
- HTO Chair: we want big meeting on caribou
- there is confusion about Ahiak and Boothia herd
- HTO Chair: big jump in Muskox numbers are natural cycle
- we worry about numbers growing and fewer caribou
- Muskox are coming from all directions
- September around Taloyoak good time to survey caribou
- Pretty good caribou numbers on Boothia Peninsula
- Calving grounds scattered all over Boothia Peninsula
- HTO Chair: caribou are changing their migration timing, patterns
- We are very concerned about future caribou declines
- HTO Chair: we want higher than 6% of population estimate (for muskox tags)
- We want meat plant for Muskox in the community
- Lots of caribou wastage; they leave skinny ones dead on the land, keep fat ones only to sell to Baffin

Public consultation

Date: 23 April 2019 @ 7:00PM MT to 9:00PM MT

Subject: HTO Muskox Meeting, MX-08

DOE Presentation:

- With the collaboration of with the community member, we went and surveyed Boothia Peninsula to know how much muskox they were. So MX/08, which is the Boothia Peninsula, the last population estimate was in 2006, where 1100 was counted with 158 adult muskox on transact. As you know, the community of Taloyoak is very concerned with muskox/caribou interaction and there was a lot of observation, apparently, since 2006, the muskox numbers were increasing. So we did a survey from August 5th to 13th, 2017. On that survey, we counted 702 adults on the transect. So 41% of the group that we've seen, which are all those little black dots, were a small group from 2 to 7 per group and the larger group was 19. So we know that muskox groups could be way larger during the winter, as they seem to aggregate. So those small numbers in the group might just be seasonal. The calf to adult ratio was 14%, which is really good for muskox, so they're doing good. One of the big difference between the 2006 survey and 2017 survey is how far the muskox are progressing south of Boothia Peninsula. The survey area stops here. So that doesn't mean there's no muskox here either. They might be there, we just didn't survey that part. So from that survey in the square in MX/08. The muskox number was actually 3649 muskox. That's a very big increase from the last survey. When we fly the survey, we count the muskox and write them down, we also look for predators and also caribou. This figure here on the black dot show the caribou and the red triangle, the diamond, that's the polar bears and the 2 red dot are actually the wolves that we saw.
- Based on this increase, we're suggesting at this time, keeping the rate of harvest the same at 6%. This would see a change in the TAH, from 66 to 218 tags. This is just our suggestion but the real reason we're here is to get your input which is very valuable to many changes in the TAH.

Q&A Session:

Community member:

- The Boothia Peninsula never had muskox before but they used to be at Prince of Wales Island. I am wondering if there's still muskox at Prince of Wales Island?

DOE:

- It seems that the muskox we're seeing now (Boothia Peninsula) is coming from Prince of Wales Island and Somerset Island. There's still muskox on Prince of Wales Island and Somerset Island, some of them might have migrated and multiplied in Boothia Peninsula.

Community Member:

- Did you survey the amount muskox in Prince of Wales Island?

DOE:

- Yes it was done in 2016-2017. So we did survey Prince of Wales Island and Somerset Island in 2016-2017.

Community Member:

- I thought there was a decline in caribou.

DOE:

- No, we saw caribou during the transect but we were not counting them, we don't know when it's the best time to count caribou so we're going to work with the HTO and come back to the community and have more meetings to know if the caribou are doing well or not but we don't know

Community Member:

- As a hunter, I believe, even if you don't count them, I want to go (hunting). Following the migration, they get more and get less and as a hunter I know they migrate.
- In the past, they used to hear from elders that some animals come and some years they're not here and some years they're abundant. It was the old saying from the elders that they'd be plenty in some years and some years they're not all out there. (IQ Knowledge).
- Once the HTO's management objective, are all the dates being filled? My hunting and personal view on this, I believe you 218 tags are open for this year?

DOE:

- Hopefully it'll start in July, first we're discussing the number, it is going to be an increase? We're suggesting 218, it might be more. Hopefully that increased TAH will take place in July.

Community member:

- At 218 personally a joke to me. For the many years of asking, community members stressing. And you're saying there's about 1200 muskox and that our elders are speaking about the muskox and caribou interacting with each other is a very big concern. I suggest you open 90% of the tags that you have for muskox. There's only limited tags right now and we all know within our community that we are first to get muskox tags before we can go out (hunting). There are a few more muskox tags repeatingly going to the HTO office and there's no tags available. So that's just adding on to the problem having the tag system program with our muskox. And the other thing on the caribou and muskox, we really need to work together. There are instance, there are things happening within our community. The caribou hunting season starting in August. That's when the caribou starts passing through here. One of our number one problem is the human activity and what I mean by human activity, the stores are selling full metal jackets, the specific rifle I don't know exactly what it is but you can order a rifle for 80$ on eBay. Can't define that specific rifle that's cheap and cheap ammunition and there will be a whole bunch of caribou. It's not just caribou, they're wounding all kinds of other animals and no caliber rifles that's number two. Number 3, people from Baffin island are asking for top quality fat caribou and experience hunters are going out and hunting these caribou and if they don't catch a fat caribou they're leaving it there so that's number three problem. These are the areas that we need to get rid of or do something about. Thank you.

DOE:

- I just wanted to say first and foremost thank you very much for voicing those concerns, we take those concerns very seriously and we really appreciate the ethical harvesting and people not wasting meat, so in regards to that, we'll make sure that we're increasing patrols to those areas to crack down on wastage of meat and people using illegal ammunition as well. That's something we can do from the enforcement side, so thank you.

Community member:

- That's another thing to think about, I'm always here to help with the snow patrols, yes, but there's only a handful of people doing illegal activity. If you check with Canadian North and First-air waybills. You'll easily find out where those that are selling for money, for quick cash, or on facebook sell/swap. Those are the areas where you should be looking foremost.

DOE:

- Just to follow up on the 6%, 90%, clearly what I'm hearing is 66 tags is not working out, there's a more need for muskox in the community and I think we can accommodate that, what would be the number that would satisfy the need in the community?

Community member:

- I would like to see non tag harvest for muskox with no tags, and more young hunters can catch how they could in any season, all winter and spring. If there's no tags, it would be better, open to everyone
- Most harvesters try catch what they need and he thinks all hunters would do the same, most do and he just likes to see an increase on what they are allowed to catch.
- There was mention about the use of rifles and calibers too weak for animals but big animals they only debone animals and 223. Is the right caliber for caribou but the lower 22's shouldn't be used for big animals.
- Thank you like I said earlier, open 90% of the tags of your (Can't understand what he is saying). We're really fine about the muskox here, one of our elders speak those muskox here. And we know they are migrating here and there's too many, they're out numbering the food most importance to caribou. Like I said, open 90% of tags that we purposed, 218 is a joke to me. That's not just gonna cut it.
- When you hunt caribou, you have a tag, so we can hunt, that's what we want. That's a problem these days because we got no tags. Some younger people tend to over hunt and leave some out on the land. If we have a tag on muskox, this might become another problem, like over harvesting. From my knowledge, muskox is longer to work to skin and clean than caribou. If younger people over hunt too many in one day, they might not be able to clean them off. We gotta think about this one too, we gotta keep our animals healthy. If we have tags, that's okay with me. The tags are not enough now, muskox multiplied more and we can ask for more tags but I think it's better to have a tag system, just to say how many harvested in one year.
- Me personally I suggest 270 tags.

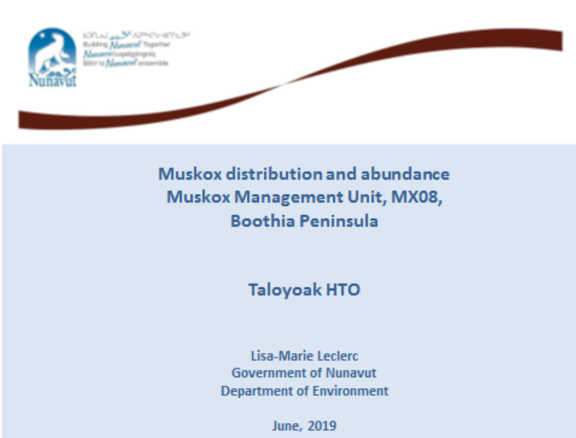
DOE:

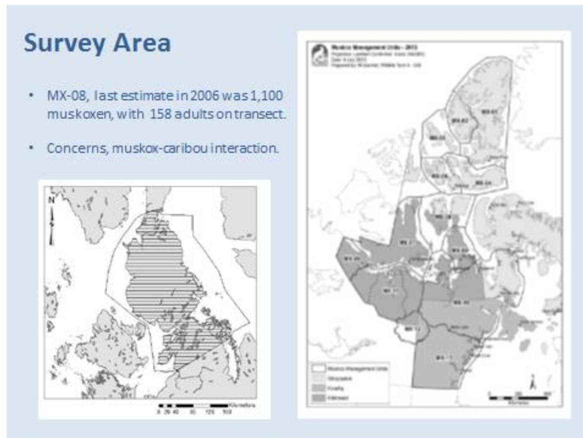
- I'd just like to thank everybody for coming tonight and providing your input. It's very valuable to the management process, so thank you very much. We'll work with your local HTO and hopefully have some updated numbers for July, for the next hunting season. Personally it was my pleasure to come to your community for the first and meeting you all, and look forward to coming here for future.
- In conclusion, I'm really happy for the feedback that we had tonight, muskox are doing well, but maybe too well for the community, we need to keep them in balance and we need to also take into consideration the community need so we'll take all your feedback and there was a HTO member that was also here tonight so they hear you too and by working together I'm sure that we can find a solution that works best for everybody

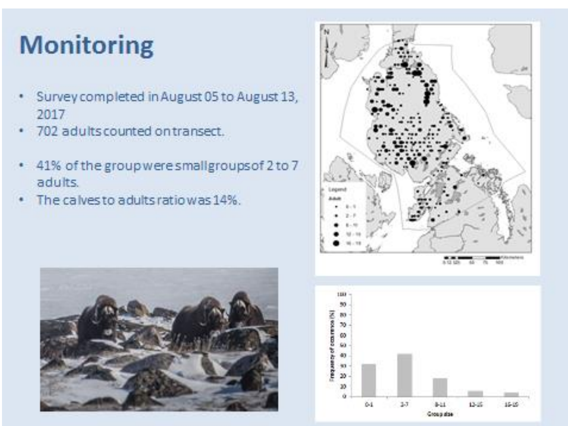
Appendix I

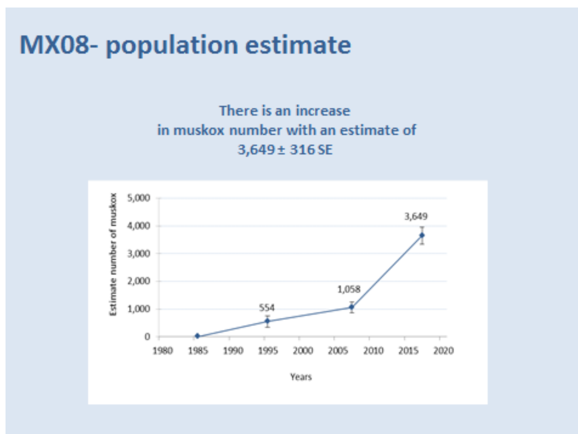
PowerPoint Presentation 2019

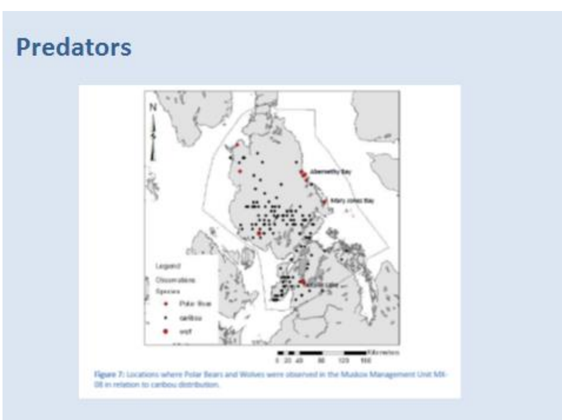
Here below the presentation:











Appendix 2

Email of Support from Taloyoak Hunters and Trappers Organization

Smith, Caryn

From:	Jimmy Oleekatalik <taloyoak@krwb.ca>
Sent:	April 29, 2019 6:50 PM
To:	Leclerc, Lisa-Marie
Cc:	England, Kate; Methuen, Kevin; Smith, Caryn
Subject:	RE: MX08 consultation- accomodation

Hi Lisa,

The Board is in agreement with the 275 for musk-ox tags. If you need more information please let me know.

Best regards,
Jimmy Oleekatalik,
Manager, SBHTA

-----Original Message-----
From: Leclerc, Lisa-Marie <LLeclerc@GOV.NU.CA>
Sent: Monday, April 29, 2019 1:59 PM
To: Jimmy Oleekatalik <taloyoak@krwb.ca>
Cc: England, Kate <KEngland@GOV.NU.CA>; Methuen, Kevin <kmethuen@GOV.NU.CA>; Smith, Caryn <CSmith@GOV.NU.CA>
Subject: MX08 consultation- accomodation

Hi Jimmy,

The Government of Nunavut, Department of Environment, discussed on the possibility to accommodate the recommendation of the HTO in having an increase of the harvesting rate of the muskox population MX08 of more than 6%.

With the comments of the HTO and the community members, we can support an additional increase with a recommendation of 7.5% / 275 animals as this seems reasonable by way of being: aligned with the HTO proposition, community comments, population increase, meeting increased demand for tags, while also reducing risk of meat wastage/wounding animals which is a current problem with the caribou.

Please let me know if the board support this recommendation.

All the best,

Lisa

1

SUBMISSION TO THE

NUNAVUT WILDLIFE MANAGEMENT BOARD

FOR

Information: **Decision: X**

Issue: 2017 Muskox (Ovibos moschatus) distribution and abundance, muskox management unit MX-09, west of the Coppermine River

Background

- The muskoxen of the West Kugluktuk management unit (MX-09) are the westernmost indigenous muskoxen in North America.
- There are 80 years of scientific monitoring data on the MX-09 muskox population, making it the population with the longest monitoring history in Nunavut.
- The upper Rae-Richardson River area West of Kugluktuk group saw its highest estimate in 1988 with a total of 1,805 ± 289 (S.E) muskoxen.
- In 1994, muskox abundance in this area decreased to 540 ± 139 (S.E) animals, where it remained relatively stable based on a subsequent survey conducted in 2007 (estimated 589 ± 121 (S.E)).
- In the 1990s, the decline of muskoxen in this area was partly attributable to the discovery of a lungworm (*Umingmakstrongylus pallikuukensis*) infection and potential increase in predation pressure by Grizzly Bear (*Ursus arctos horribilis*).
- The current TAH for MX-09 of 20 was set in July 1, 2014 under the Muskox Total Allowable Harvest Order, and this annual limit has remained consistent since 1994.
- The Department of Environment (DOE) has engaged with the community of Kugluktuk and respective co-management partners (Nunavut Tunngavik Inc., Hunters and Trappers Organizations, Kitikmeot Regional Wildlife Board). The DOE will continue to work closely with these groups to manage the muskox population of the West of Kugluktuk group (MX-09) for sustainability in order to meet conservation, management, and food security needs of the ecosystem and local community.

Current Status

- The DOE was concerned about the status of the muskox population in the West Kugluktuk group, MX-09, since the last survey was done a decade ago.

- With the scarcity of caribou around Kugluktuk, hunters are seeking alternative sources of meat, such as muskox. Understanding the status of the MX-09 muskox population can support the ongoing management and, therefore, continued harvest of this population.

- A population survey was conducted, based out of the community of Kugluktuk, from August 25 to September 2, 2017 to determine the abundance and distribution of muskox in MX-09. During the survey, 87 adult muskoxen were recorded on transect resulting in an estimated abundance of 539 ± 150 (S.E.) animals in MX-09. The muskoxen population in MX-09 has been mostly stable since 1994.

- The TAH has been 20 since 1994. However, for the last ten years, the current quota has not been filled, and only an average of 15 muskoxen are harvested each year.

Consultations:

- The progress of this research and monitoring effort was communicated during the Kitikmeot Muskox Management Plan Face-to Face meeting and shared with all the Hunters and Trappers Organizations (HTOs) during the Kitikmeot Regional Wildlife Board Annual General Meeting (KRWB AGM) in September 2017 and the KRWB AGM in September 2018.

- On April 2, 2019, the final report and management objectives were discussed with the Kugluktuk HTO board. The HTO recommended maintaining the TAH of 20 on the muskox population in MX-09.

Accommodations:

- From the consultations, change in the report was made to include more local and traditional knowledge, such as
    - Background information on the discovery of the lungworm by Inuit in the 1970s.
    - Explanations from the community include perspectives on recent changes in distribution of muskoxen towards the treeline; thought to be related to avoidance of disease (lungworm) and forest fires.
- The recommendation from the Kugluktuk HTO was consistent with recommendations based on survey estimates made by the Department of Environment.

Recommendation

- *The Department of Environment is recommending to the Nunavut Wildlife Management Board to maintain a TAH of 20 for the Muskox Management Unit MX-09.*

MUSKOX (*Ovibos moschatus*) DISTRIBUTION AND ABUNDANCE, MUSKOX MANAGEMENT UNITS MX-09, WEST OF THE COPPERMINE RIVER, AUGUST 2017.

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Department of Environment
Avatiliqiyikkut
Ministère de l’Environnement

REPORT ON MUSKOX DISTRIBUTION AND ABUNDANCE, MUSKOX MANAGEMENT UNITS, MX-09, AUGUST 2017

Summary

This short document is a summary of the information provided in the report entitled: “Muskox (*Ovibos moschatus*) distribution and abundance, in muskox management units MX09, West of the Coppermine river, August 2017.”

This report is a document that put the research into context, identifies the diverse methodology used, describes the results, as well as provides future monitoring and management recommendations.

The Government of Nunavut has jurisdiction for managing the harvest of the muskox in Nunavut and needs to conduct research and monitoring (population surveys), along with consultations with Hunter and Trapper Organizations (HTOs) and communities, to inform the management process. This report provides scientific information and recommendations to help decision-makers manage muskox.

This summary is based on the information in the full English version of the research report on the muskox of the West of the Coppermine River conducted in August 2017. The original English copy of the report has been provided for reference.

Information

During the last century, muskox on the upper Rae-Richardson River Valley were able to persist on the landscape, while the species was near extirpation in Nunavut. Therefore, the muskox of the West of the Coppermine River, MX-09, are the westernmost indigenous muskoxen in North America.

This herd plays an essential role in the lives of Inuit people and it highly valued from a spiritual, economic, cultural, and harvesting perspective. The community of Kugluktuk is the only community subsisting on this herd.

In 1980, the muskox population in the area was estimated to be 869 animals. Based on relatively comparable systematic population surveys, this population peaked in 1988 to 1,295 animals before it plummeted and remained stable. Based on these 1995 and 2007 survey results, the conclusion made was that the population remained, at best, stable around 540 animals.

Since caribou herds in this region of Nunavut are declining in numbers, and thus becoming harder to hunt, harvesters are seeking alternative sources of meat, such as muskox, to address food security. The conservation and recovery of this small population of muskox is thus a priority for future management.

Objectives

This project aims to address concerns of Inuit, as well as to provide new scientific information for 2017. Therefore, the main objectives of this study of MX-09 are to:

1. Determine the total estimated number of muskox
2. Determine muskox distribution and density; and
3. Determine calf:adult ratio and group size.

Methods

Study Area

The study area is the muskox management unit MX-09, also known as the West of the Coppermine River management unit. The boundaries for this area are to the west and south of the Nunavut boundary with the Northwest Territories and, to the north, the coast line of the Dolphin and Union Straight. Muskox management unit MX-09 is separated to the east from the adjacent muskox management unit MX-11 by the Coppermine River.

Survey area

To maximize the coverage area investigated, anticipated muskox distribution pattern were obtained from past ground surveys, hunter observation, and Inuit Traditional Knowledge. Since it was reported that muskox groups are still found in low numbers and mostly uniformly distributed across MX-09, the whole management unit was surveyed at 16% coverage and 8.5 km spacing between transect lines, with no strata of different effort allocation (Figure 1).

Figure 1: Transect lines flown in August 2017, representing 16% coverage, of the muskox management units MX-09.

Aircraft configuration

A systematic transect line survey was flown with a fixed-wing single engine turbine aircraft, a grand caravan. The transect lines were surveyed at a speed of 160 km/hr and the survey altitude of about 121 meters above ground level (AGL). The strip transects included 800 meters on each side of the aircraft. Observers on both sides of the plane were responsible for continuously searching for, spotting, and counting muskox including the number of calves. Incidental sightings of caribou, grizzly bear, wolverine, and wolf were also recorded.

Results

Distribution

The survey was conducted from the community of Kugluktuk from August 25th to August 30th, 2017. During the survey, 18 groups of muskoxen were seen, both on and off-transect. Larger groups of muskoxen, of 16-19 adult animals, were mainly distributed North of Dismal Lake, and 25 km from the coast South of Stapylton Bay. Most muskoxen sighted were found between Emagyok and Dismal Lake (Figure 2).

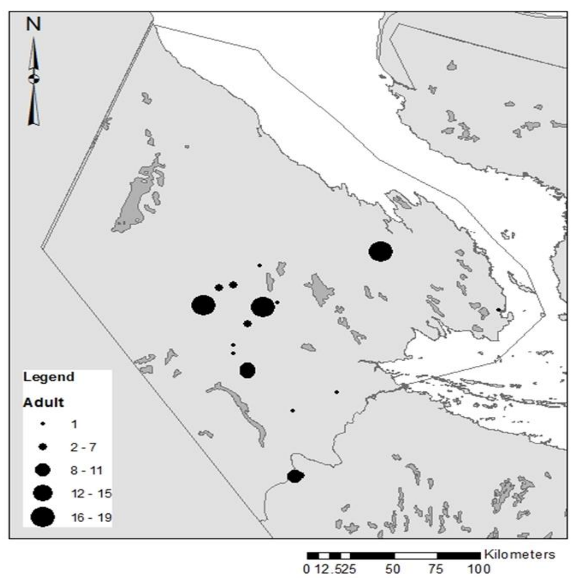

Figure 2: Muskox distribution, on and off transect, in the management unit MX-09 during the survey, where the number of animals per group was classified into group of 0-1, 2-7, 8-11, 12-15, and 16-19 animals.

Group Characteristic and estimate

The majority of groups observed were small groups of 2 to 11 adults. The average number of adults (+1 year and older) per group was 6.21 ± 6.6 (S.D.). During the visual survey 87 adult muskoxen were counted on transect. Overall, the muskox density of the study area was low at 0.010 muskox / km^2. The estimated number of muskox in the management unit MX-09 is 539 ± 150 (S.E.) (Figure3). This shows that this population has remained stable since the early 90s. Thus, the current status estimated through this survey is also supported by the observations of local hunters.

Recommendations

Based on these results, the following recommendations, according to the management plan, should be taken into consideration: the Department of Environment is recommending to the Nunavut Wildlife Management Board to maintain a TAH of 20 for the Muskox Management Units MX-09.

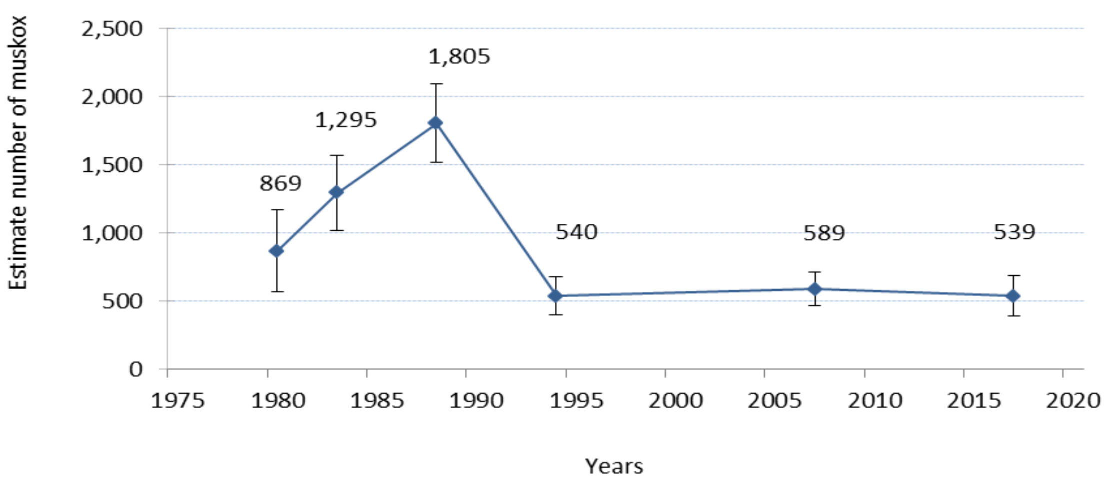

Figure 3: Muskox population estimate for MX-09 over time, estimated from aerial surveys conducted from 1980 through 2017.

MUSKOX (*Ovibos moschatus*) DISTRIBUTION AND ABUNDANCE, MUSKOX MANAGEMENT UNITS MX09, WEST OF THE COPPERMINE RIVER, AUGUST 2017.

Lisa-Marie Leclerc[1]

Version: January 2019

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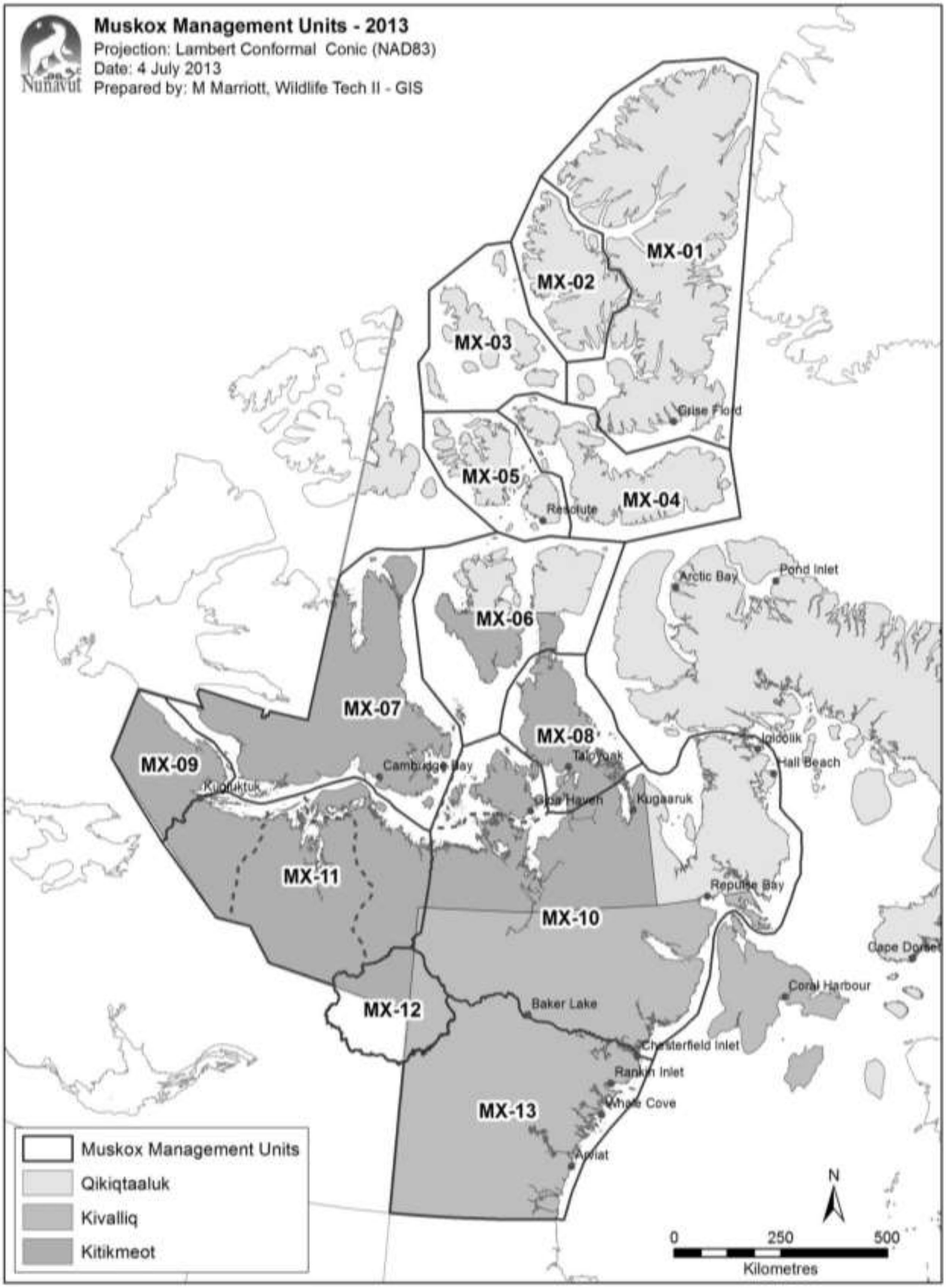
NUNAVUT DEPARTMENT OF ENVIRONMENT

WILDLIFE RESEARCH SECTION

KUGLUKTUK, NU


Muskox Management Units - 2013
Projection: Lambert Conformal Conic (NAD83)
Date: 4 July 2013
Prepared by: M Marriott, Wildlife Tech II - GIS
Nunavut
MX-01
MX-02
MX-03
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MX-09
MX-10
MX-11
MX-12
MX-13
Grise Fiord
Resolute
Arctic Bay
Pond Inlet
Igloolik
Hall Beach
Cambridge Bay
Taloyoak
Gjoa Haven
Kugaaruk
Kugluktuk
Repulse Bay
Cape Dorset
Coral Harbour
Baker Lake
Chesterfield Inlet
Rankin Inlet
Whale Cove
Arviat
Muskox Management Units
Qikiqtaaluk
Kivalliq
Kitikmeot
N
0
250
500
Kilometres

Executive Summary

The muskox in the West Kugluktuk management unit MX-09 are the westernmost indigenous muskoxen in North America. A systematic strip transect survey took place in August 2017 to determine the muskox abundance and distribution in this management unit. A total of 8,591 km^2 were flown, representing 16% coverage of the study area of 53,215 km^2. During the survey, 87 adult muskoxen were recorded on transect resulting in an estimated number of 539 ± 150 (S.E.). The population in MX-09 has been mostly stable since 1994, and the survey results are consistent with local observations. The muskox distribution does not appear to have changed from the observed historical distribution. Muskoxen have taken advantage of the wetter and lower-lying areas in the Rae-Richardson River Valley that is within the proximity of uplands, providing them with suitable forage and a refugee from predators. The calf to adult ratio was 38 calves/100 adults and the average number of group, excluding calf, was small, 6.21 ± 6.6. (S.D.). Muskox density in MX-09 was the lowest density within the Kitikmeot region with 0.010 muskox / km^2 since 2013. The next survey of this area is planned to be completed no later than 2023 in order to review the harvest quota.

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Introduction

During the last century, muskox on the upper Rae-Richardson River Valley were able to persist on the landscape while the species was nearing extirpation (Barr, 1991). This small pocket of muskox was known as the population of the North of Great Bear Lake. This population increased in numbers allowing for a small harvest quota to be established for Kugluktuk (6 tags) and Paulatuk (8 tags) (Urquhart, 1980). The muskox population of the North of Great Bear Lake kept growing, giving rise to the muskox population of the Rae-Richardson River watersheds, which was recently renamed the West Kugluktuk muskox management unit, MX09.

The muskoxen of the West Kugluktuk management unit are the westernmost indigenous muskoxen in North American, and represent the muskox population with the longest monitoring effort representing over 80 years of monitoring (Kelsall *et al*., 1971). Based on comparable systematic population surveys, this population peaked in 1988 before it plummeted and remained stable with around 550 animals between 1994 to 2007 (Gunn, 1995; Dumond, 2007). Even if this population is subject to year-round hunting by the community of Kugluktuk, the quota has been limited and enforced to 20 tags. It is known that harvesters do not fill this limit annually, since there is general local knowledge that these muskoxen are "sick" and found in few numbers (Kugluktuk HTO, pers. comm.). In the 1990s, the discovery of a lungworm parasite (*Umingmakstrongylus pallikuukensis*) was found to be an attributable factor to the decline of the population (Gunn, 1995, Kutz, 2000). Although the effect of this parasite on the muskox population dynamics is not fully understood, this lungworm is known to decrease the respiratory capacity of the individual muskox thus making it more vulnerable when being chased by a predator.

The Rae-Richardson Rivers Valley area constitutes a rich habitat for predators, as it sustains wolf (*Canis lupus arctos)*, wolverine (*Gulo gulo*), and grizzly bear (*Ursus arctos horribilis*). Potential increases in grizzly bear could suggest that this predator is exercising a greater pressure in inhibiting the muskox population growth (Gun, 1995). However, a recent study shows that the grizzly bear's diet contains a large proportion of small tundra herbivores (e.g. ground squirrels). On the other hand, muskox represents an important food source for wolves and wolverines (L'Herault *et al*., 2016). People and predators both depend on muskox and have always co-existed on the landscape. Under Inuit natural laws, all living things should be respected as well as the role they play in the ecosystem. This concept is referred to, by elders and hunters, as *Maligaits* (L'Herault *et al*., 2016).

Since caribou herds in this region of Nunavut are declining in numbers and are becoming harder to harvest, harvesters are seeking alternative sources of meat, such as muskox, to address issues around food security. In addition to the conservation and recovery of this small size population of muskox, the preservation of harvesting rights should be considered a priority for future management and for maintaining food security. This task would be difficult to achieve without re-assessing the muskox population of MX-09, and revisiting the Total Allowable Harvest (TAH) This project aims to provide an update of the muskox population, MX-09 and provide updated TAH recommendations. Consistent with other muskox surveys, the Nunavut wide monitoring approach was used. This scientific information will be provided in balance with Traditional Knowledge to review existing management strategies and promote a sustainable harvest of muskox.

Objectives

This project aims to address the concerns and requests of Inuit hunters, as well as to provide up to date scientific information for management purposes. Therefore, the main objectives of this study are:

1. Determine the estimated number of muskox;
2. Determine muskox distribution and density;
3. Determine calf:adult ratio and group size.

By achieving the objectives of this project, it will be possible to have better information on current muskox abundance and distribution in the muskox management unit MX-09. Information on group structure, calf production, group size and density, are essential to gain insight on the relationship between these variables and population dynamic.

Materials and Methods

Study Area

The study area is the muskox management unit MX-09, also called West Kugluktuk management unit. The boundaries for this area are to the west and south, the Nunavut boundary with the Northwest Territories and, to the north, the coast line of the Dolphin and Union Straight. Muskox management unit MX-09 is separated to the east, from the adjacent muskox management unit MX-11, by the Coppermine River.

This area is part of the Southern Arctic Ecozone, transiting following the latitudinal gradient from the boreal forest around Great Slave Lake to the tundra. In this subdivision, two terrestrial ecoregions are found, the Takijuq Lake Upland and Coronation Hills regions (Environment Canada, 1995). In the south of the subdivision, it includes; the edge of the tree line, eskers, rocky barrens, with lakes going through the landscape to provide a physical uniqueness. The taiga forest is present, but restricted to a locally warm and dry place with scattered stands of spruce. The taiga changes to northward vegetation covers, which are dominated by sedge meadows and shrubs, such as dwarf birch, willow mixed with various herbs, lichens, and mosses. The entire eastern boundary of the study area is characterized by vegetated rock outcrops that are common on the Canadian Shield (Environment Canada, 1995). To the North, the Coronation Hill region prevails. The relief of the lower Coppermine River valley and coast line is characterized by weather-worn plateaus and south facing hill systems. These topographic features along with the climate, influence the biotic processes differently. Plant cover becomes discontinuous to null at higher elevations, on dry exposed sites, and on the low profile sand dunes boarding the coastline north of the Bluenose Lake.

Survey Area

Prior to survey, no reconnaissance survey was undertaken to maximize the coverage area investigated. Instead, anticipated muskox distribution patterns were obtained from past ground surveys, hunter observations, and Inuit Traditional Knowledge/*Inuit Qaujimajatuqangit* (IQ). Since it was reported that muskox groups are still found in low numbers across MX-09, the whole management unit was surveyed at 16% coverage with not strata of different effort allocation (Figure 1).

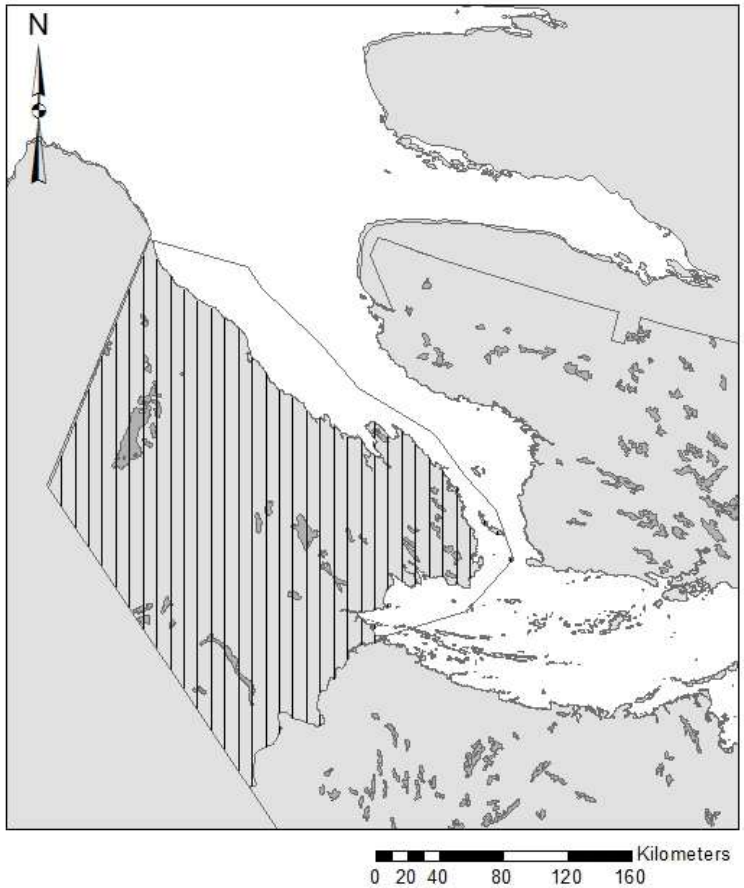

Figure 1: Transect lines of the muskox management units MX-09 representing 16% coverage of the area.

To increase the precision of the survey areas, ESRI'S ArcGIS software with an adapted survey design tool was used to randomly plot the transect lines until desired percentage of coverage was archived. The tool allows the user to determine the precise number of transects and the distance between each transect line required in function of the transect strip width and the total area of the management unit. Orientation of the transect lines within the stratum was determined in function to have the most homogeneous and shorter transect line length under the assumption that muskox groups are randomly and uniformly distributed on the landscape (Figure 1).

Table 1, below, summarizes the total area, the percentage of cover, the total number of kms of transects of different length, the number of lines, the resulting distance between each transect line and the orientation of the transect line. In sum, the management unit, MX-09, of 53,215 km^2 was surveyed with a total of 5,237 km of transect lines, which represented 31 transect lines of different length at a spacing of 8.5 km (Table 1).

Table 1 Characteristic of the study area and the transect lines per stratum in the Management Unit MX-09.

Stratum	Total area (km^2)	Percentages (%)	Total transect lines (km)	Number of lines	Distance between transect line (km)	Orientation
MX-09	53,215	16	5,237	31	8.5	North-South

Aircraft configuration

A systematic transects line survey was flown with a fixed-wing single engine turbine aircraft, a grand caravan. The transect lines were surveyed at a speed of 160 km/hr and the survey altitude of about 121 meters, which was mostly maintained following the relief of the study area using a radar altimeter. The pilot responsibilities were to monitor this air speed and altitude while following the pre-programmed transect on a Geographic positioning system (GPS). The strip transect was 800 meters on each side of the aircraft, for a total transect width of 1.6 kilometers. The pre-determined transect width of 800 meters was set on each wing based on calculation using the formula of Norton-Griffiths (1978) and others (Gunn and Patterson 2000; Howard 2011).

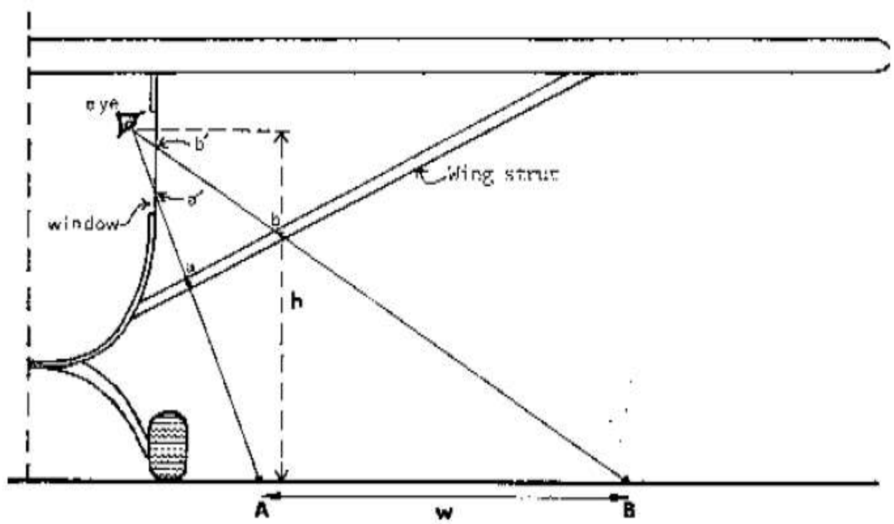

Figure 2: Schematic diagram of aircraft configuration for strip width sampling North-Griffiths (1978). W is marked out on the tarmac, and the two lines of sight a'-a-A and b'-b-B establish, whereas a'- and b' are the window marks.

$$w = W*h/H$$

Where, W= the required strip width; h= the height of the observer's eye from the tarmac; and H= the required flying height.

The entire survey was set up with an observer/recorder crew: two recorders, one left side observer and one right side observer. Each left and right side observers and the recorders were divided into a team. Observers were responsible to continuously search for and count muskox; the number of calves (5-6 months old) were counted when they were conspicuous while on transect. No sex and age classification counts were systematically attempted. The data recorded include the number of muskox and GPS location. Only counts of adults were used in the final population estimate. Even if this survey focused on muskox, additional sightings of other species were also recoded, such as caribou, grizzly bear, wolverine, and wolf.

Analyses

As this survey focused mainly on obtaining an estimated number, only unambiguous classification criteria were used to determine the number of calves and adults. The group was then broken down into adults (female/male) and calves (Howard 2011). The flying height and speed did not allow for accurately distinguishing male from female muskox in a group from horn size. Therefore, the proportion of calves per female cow was not determined, and no information on the recruitment or productivity was generated. The group structure was however described such as calf crop, mean group size, and the number of single lone bull encounter.

To determine the number of muskox in the study area, only adult muskox sightings recorded on transect were analyzed using Jolly's Method 2 for unequal sample sizes (Jolly 1969) using a coefficient limit of 95%. Such methodology is commonly used in calculating the muskox estimate in other management units in Nunavut. The population estimates for fixed-width strip sampling using Jolly's Method 2 for uneven sample sizes (Jolly 1969; summarized in Caughley 1977) are derived from the following equation:

$$\hat{Y} = RZ = Z\frac{\sum_i y_i}{\sum_i z_i}$$

Where $\hat{Y}$ is the estimated number of animals in the population, R is the observed density of animals (sum of animals seen on all transects $\sum_i y_i$ divided by the total area surveyed$\sum_i z_i$), and Z is the total study area. The variance is given by:

$$Var(\hat{Y}) = \frac{N(N-n)}{n}\left(s_y^2 - 2Rs_{zy} + R^2 s_z^2\right)$$

Where N is the total number of transects required to completely cover study area Z, and n is the number of transects sampled in the survey. s_y^2 is the variance in counts, s_z^2 is the variance in areas surveyed on transects, and s_{zy} is the covariance. The estimate $\hat{Y}$ and variance $Var(\hat{Y})$ are calculated for each stratum and summed. The Coefficient of Variation (CV = σ/$\hat{Y}$) was calculated as a measure of precision.

Density, the number of muskox per unit area (muskox/km^2), will be determined using the number of adult muskox seen on transect divided by the total area of the study area. Lakes and stream areas will be not subtracted from the total area calculations used in muskox density (Statistical analysis based on Campbell and Setterington (2001).

The area occupied by muskoxen and the time of the survey within the study area was determined. Thus, the distribution was illustrated by plotting each muskox sighting on transect based on their precise geospatial position captured with GPS. In addition, the number of animals composing each group was highlighted using an increasing size of circles to represent groups of 0-1, 2-7, 8-11, 12-15, and 16-19 animals.

Given the importance of predators, Arctic wolf, wolverine, and grizzly bears, we collected standardized information of predator sightings in the management units using the predator index (Heard, 1992). The predator index reports all predator sighting per species against the total number hours flown, in this case also including the ferry time. It is then possible do have a yearly trend, as the number of predators observed is expressed per 100 hours.

Results

The survey was conducted out of the community of Kugluktuk from August 25th to August 30th, 2017. The management unit was surveyed at 16% coverage, which was surveyed in 51 hours, including on transect and ferry flight from Kugluktuk airport to the start of the transect lines. Low ceiling and fog prohibited the ability to survey continuously from the west side to the east on the management unit. Therefore, some sections of the coastline were left to be completed at a later time, when weather was permitting. The sedentary muskox behavior (Adamczewski *et al.*, 1997) reduces the probability that an individual moves a significant distance within the short survey time frame.

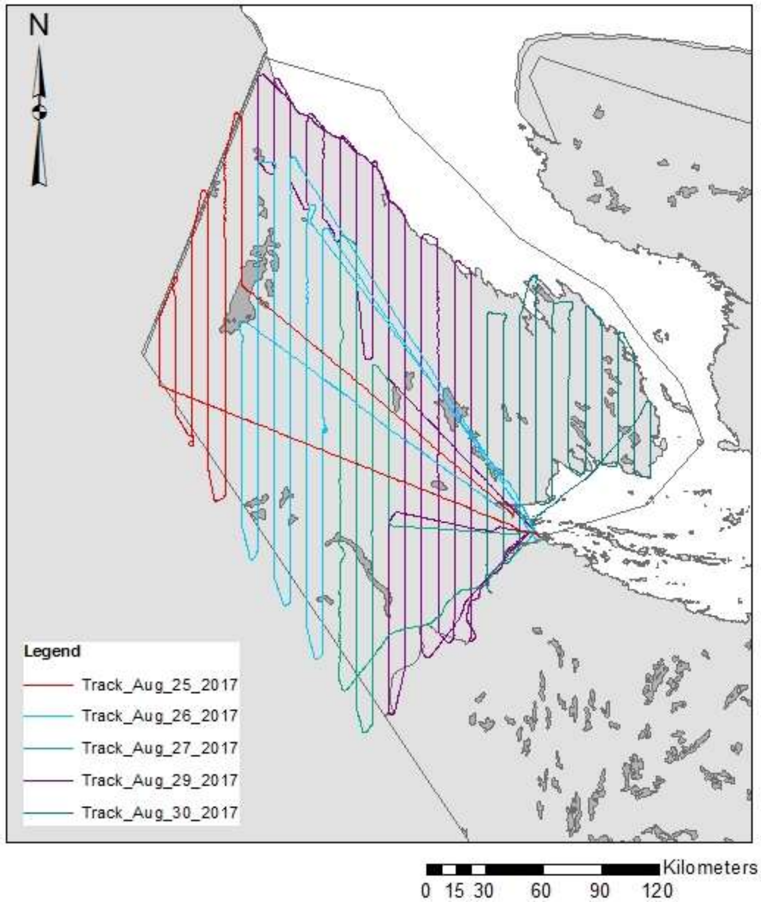

Figure 3: Daily track flown to cover 16% of the muskox management units MX-09 from August 25th to 30th.

Distribution

The adult muskox distribution in the management units is represented in the Figure 5 below. During the survey, 18 groups of muskoxen were seen on and off transect. The large groups of muskoxen, 16-19 adult animals, were distributed mostly north of Dismal Lake, and 25 km from the coast south of Stapylton Bay. Most muskoxen sighted were found between Emagyok Lake and Dismal Lake in the Rae-Richardson River Valley. No muskoxen were seen on the west side of the management unit, or around Bluenose Lake.

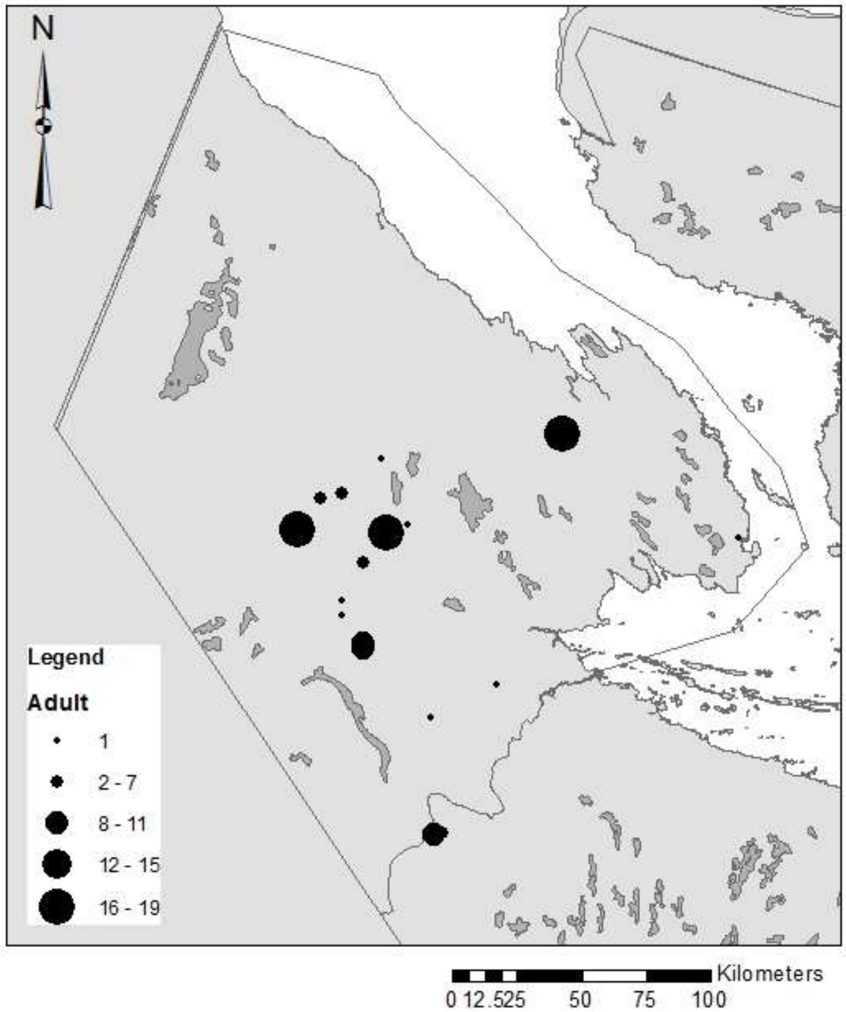

Figure 4: Muskox distribution, on and off transect, in the management unit MX-09 during the survey where the number of animals per group was grouped as 0-1, 2-7, 8-11, 12-15, and 16-19.

Group Characteristic

During the survey, 14 groups of muskoxen were recorded on transect, and seven groups were single muskox, mostly lone bulls. The majority of the groups (58%) were small groups of 2 to 11 adults (Figure 5). The average number of adults (+1 year and older) per group was 6.21 ± 6.6 (S.D.). The highest number of adults counted in one group was 18. Calves were not including in the group size, but in the calf to adult ratio.

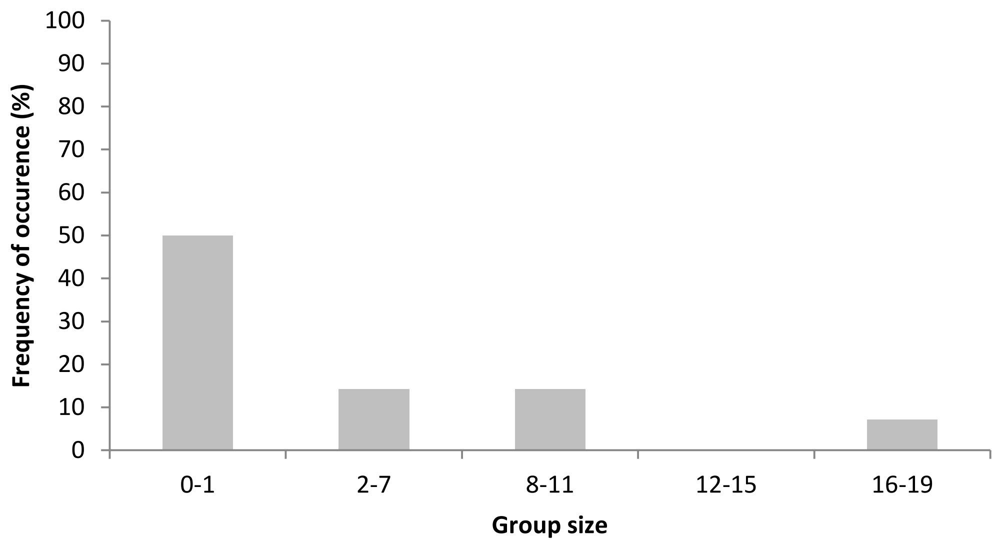

Figure 5: Frequency of occurrence (%) of adult muskox number per group size, grouped as follow 0-1, 2-7, 8-11, 12-15, and 16-19.

The calf to adult ratio was determined for each group of muskox seen on transect. Since the identification was done from a fixed-wing, it was impossible to distinguish with certainty the sex of the adult or the group age based on the horn shape and length. A little more than one third of the groups seen (36%) had calves. For the group that had calves, most of them had at least one calf, but some larger groups had 12 and where distributed mostly in the Rae-Richardson River Valley (Figure 6). Thus, the calf to adult muskox ratio was 38 calves/100 adults.

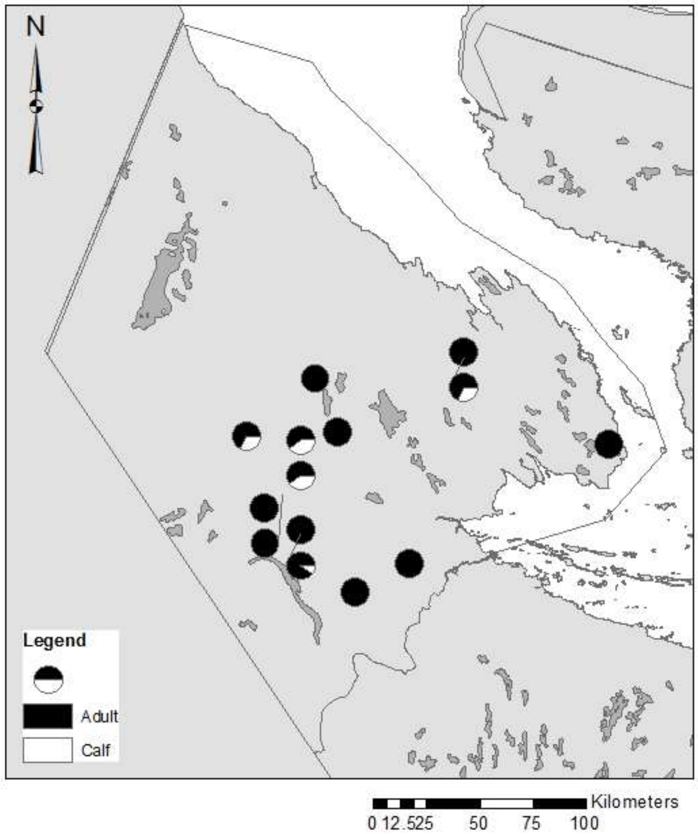

Figure 6: Proportion of calves per adult muskox in each group observed on transect in the Muskox Management Unit MX-09.

Estimate

The percentage of the overall cover of the management unit surveyed with 8,591 km^2 represented 16% of the total study area (53,215 km^2). During the survey, 87 adult muskoxen on transect were recorded. The estimated number of muskox in the management unit MX-09, is 539 ± 150 (S.E.) ($p<0.005$, $t = 1.696$, $N = 132$ and $n = 31$). For this estimate, the total number of transect at 100% coverage was 132 (N) and 31 (n) transect lines were surveyed (Table 2). Overall, the muskox density of the management unit was 0.010 muskox / km^2.

Table 2 Muskox estimate in the Muskox management Unit MX-09

Stratum	Area Survey (km^2)	Total area (km^2)	Muskox on Transect	Estimate	Standard error (S.E.)	95% CL (±)	CV
MX-09	8,591	53,215	87	539	150	255	0.28

* $p<0.005$, $t = 1,696$, $N = 132$ and $n = 21$

Predator sighting (wolf, wolverine, and grizzly bear)

In 2017, during the 51 hours of flying within the management units, 6 wolves, 2 wolverines, and 26 adult grizzly bear sightings were recorded (Figure7). The wolves (blue dots) were found on the southern part of the study area, south of Dismal Lake, meanwhile the wolverines (yellow dots) were along the coast or between Bluenose Lake and Emagyok Lake. Grizzly bears (red squares) were found dispersed in the study area in 24 different locations. Among them, one group was composed of a female and cubs and two other groups were composed of a female and two cubs. Predator sightings, using the predator index, (Heard, 1992) reveled 12 wolves / 100 hours, 4 wolverines / 100 hours, and 51 grizzly bears / 100 hours.

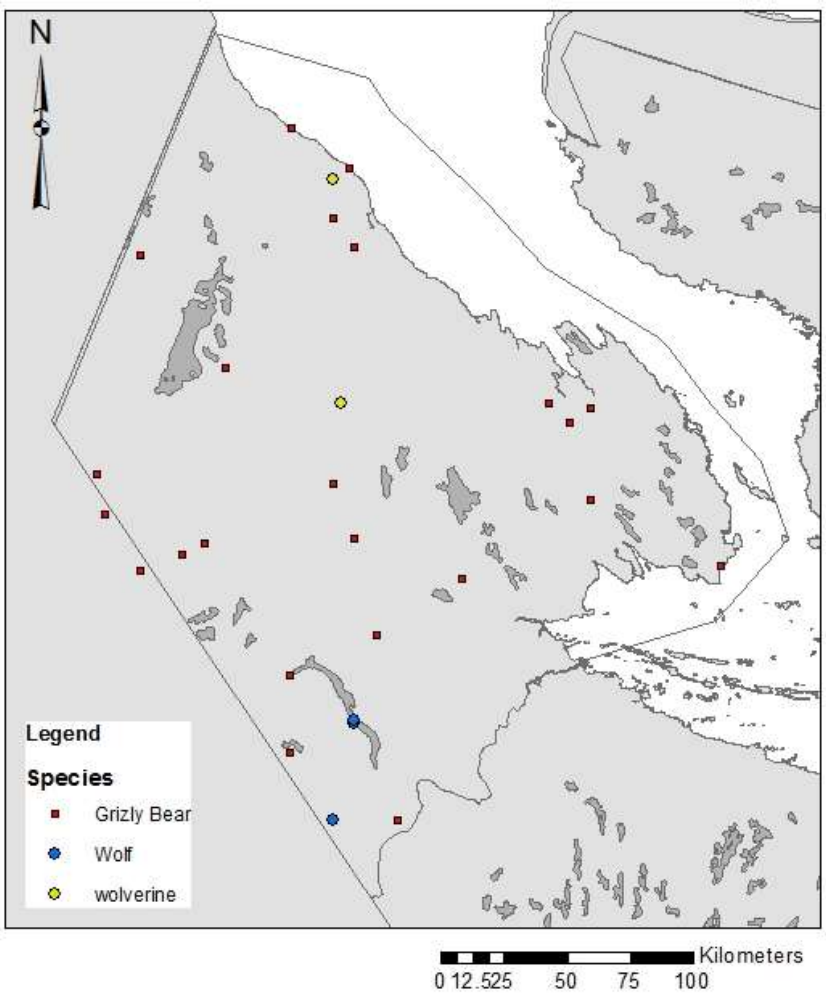

Figure 7: Locations of Wolf, Wolverine, and Grizzly Bear observations in the Muskox Management Unit MX-09.

Discussion

Distribution

Historically muskoxen were abundant in the area of Dismal Lake, and in the 1950s-1960s few muskoxen were seen in the Bluenose Lake area (Kelsall *et al*., 1971). No muskoxen were observed around Bluenose Lake in 2017. In 2007, the majority of the muskox observations on and off transect were north of Emagyok Lake (Dumond, 2007), whereas in 2017 most of the muskoxen were distributed south of the same lake in the Rae-Richardson River Valley, which is typical of muskox suitable summer habitat characterized by a wetter and lower-lying area within the proximity of uplands (Danks and Klein, 2002). Thus, the difference between the 2007 and the 2017 muskox distribution suggests a summer movement away from the coastal plain. Such change in distribution could be explained by the specific time that the survey was completed, June versus late August. Muskox have potentially moved their main distribution slightly to the south and this might be due to a change in the aridity of the soils that influenced the foraging conditions and due to the proximity the upland serves as an escape terrain from predators. The use of summer areas may vary from year to year and within the season.

Group Characteristic

The small group sizes encountered, 6.21 ± 6.6 (S.D.), during the survey is attributable to the timing in which the work was completed. After the peak of the rut, in mid-August, the herds are still small and have not started to merge into the larger wintering herds. They are then easier to count. The small herds are the result of competition within herds to access the rich forage of the Rae-Richardson River Valley. Bulls tend to be solitary, which explains the number of solitary muskox seen during the survey (7 groups of solitary muskox) (Gunn, 1990). During mating season, one strategy suggests that the bulls disperse to ensure less contested breeding opportunities, reducing the cost of combat between adult bulls.

The calf to adult muskox ratio was 38%. This ratio is normally associated with a population that would be increasing, since it has been established that 10.5% of calf to adult ratio is necessary to keep the muskox population stable (Freeman, 1971). Since the calf ratios have been known to vary greatly between years, longer term data is needed to determine a trend (Reynolds, 1998).

Density

The mechanism driving muskox density is not fully understood. Heard (1992) noted that group size is not generally related to muskox density. In this management unit, a vast area to the west of the management unit does not seem to be utilized by muskox that, at low muskox numbers, drive the overall density down- 0.010 muskox / km^2. The 2017 muskox density in the management unit MX-09 is the lowest muskox density recorded in the Kitikmeot Region since intensive survey work started in 2013.

Abundance Estimate

The extent of this area remained relatively the same even after all the muskox management units were re-delineated across Nunavut in 2015. For this management unit, small changes included extending the delineation to reach the Northwest jurisdiction boarder to the west and south. This relative similarlity between the old and new delineation allows the 2017 survey to be compared to the previous population estimates.

During the muskox moratorium, the small number of muskoxen remaining on the upper Rae-Richardson River Valley were able to increase in number on the north part of Great Bear Lake. In 1980, the muskox population in the area was estimated to be 869±279 (S.E.) and the successive survey, done three years later, recorded a continuous increase in the muskox population of the Rae-Richardson Rivers watersheds with an estimate of 1,295 ± 300 (S.E.) animals (Gunn 1995; Fournier and Gunn, 1998). The peak of the muskox population in the area was recorded in 1988, with 1,805 ± 289 (S.E.). From the three consecutive surveys, in 1980, 1983, and 1988, the number of tags increased respectively from 12, 35, to 50. In 1994, muskox abundance in this area plummeted to 540 ± 139 (S.E.) muskoxen and remained relatively stable based on the subsequent survey conducted in 2007 with a population estimate of 589 ± 121 (S.E.) muskoxen (Gunn 1995; Dumond, 2007). The latest estimate of 2017 with 539 ± 150 muskoxen show that this population has remained stable. This current status is supported by the observations of hunters.

Since 1994, the muskox population has remained relatively stable and the number of tags has also remained consistent with 20. Environmental factors such as predators, forage quality and quantity, diseases, and harvesting might have contributed to the stabilization of the muskox population in this management unit. Ongoing and more frequent population monitoring, carried out every 5 years, might allow for early detection of signs of recovery in the herd through indicators of population growth. Information provided in this report should guide future muskox surveys in allocating the survey effort proportionally with the distribution of muskox. This will help to produce a more precise estimate.

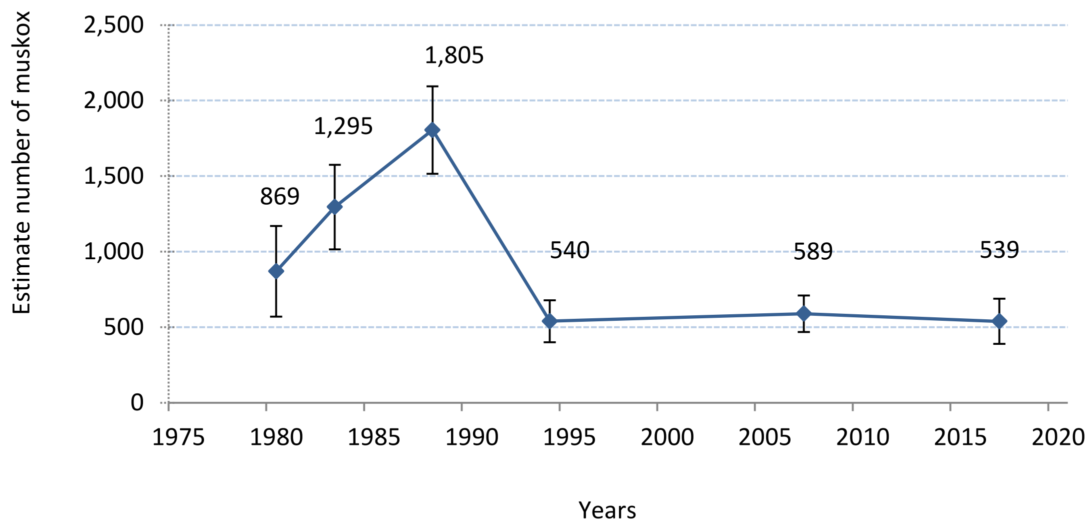

Figure 8: Muskox population estimates for MX-09.

Predator sighting (wolves, wolverine, grizzly bear)

Wolves and wolverines are muskox predators and are found in the study area and pose an additional cause of mortality that might affect the muskox population to a greater extent in the future. Although the number of grizzly bear sightings (51/ 100 hours) is greater than the other two predators (12 wolves / 100 hrs and 4 wolverines/ hours), their impact on influencing the muskox dynamics might be disproportional to their number, since their diet mostly consists of small tundra herbivores (e.i. ground squirrels) (L'Herault *et al*., 2016). However, the grizzly bear has adapted to their tundra environment and have maximized of available food sources. Local community members have observed novel grizzly bear hunting strategies which involve chasing the herd to break the calf-cow pair and then sit there to attract the lost muskox calf, as the muskox calf is attracted by the darker silhouette. The community members are however more concerned about the predation effect on caribou, than the effect of these predators on the muskox.

Acknowledgements

I wish to thank the pilot, Dan Hall, for his dedication and in making the survey possible. A special acknowledgement goes to Darien Evyagotailak for his logistical support and his enthusiastic participation. I am grateful to the Kugluktuk HTO for assistance in providing meaningful insight essential to the planning of this survey and the selection of observers: Aislyn Bolt, Jonathan Niptanatiak, Saveah Ilgok, Albert Anavilok, Amber Adjun, Kevin Ongahak; their involvement needs to be acknowledged as they assisted as observers during the aerial survey. I also want to acknowledge the precious time that Tristan Brewer gave as technical support for the data analysis. This project was funded by the Department of Environment (Government of Nunavut) and the Nunavut Wildlife Research Trust Fund under the Research Permit 2017-13.

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Building Nunavut Together
Nunavu liuqatigiingniq
Bâtir le Nunavut ensemble

Muskox distribution and abundance in Muskox Management Unit, MX09, West of the Coppermine River

Kugluktuk HTO

Lisa-Marie Leclerc
Government of Nunavut
Department of Environment

June, 2019

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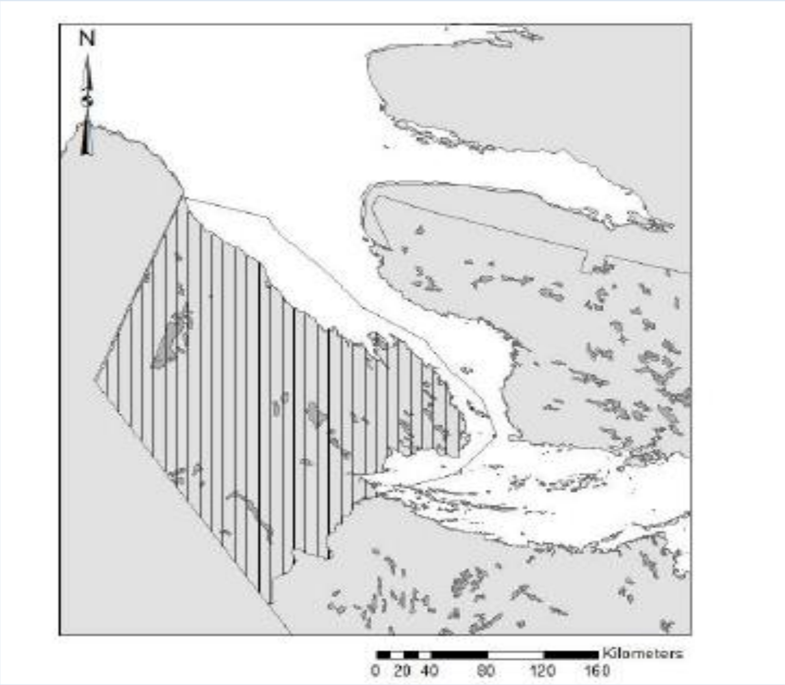
Building Nunavut Together
Nunavuliuqatigiingniq
Bâtir le Nunavut ensemble

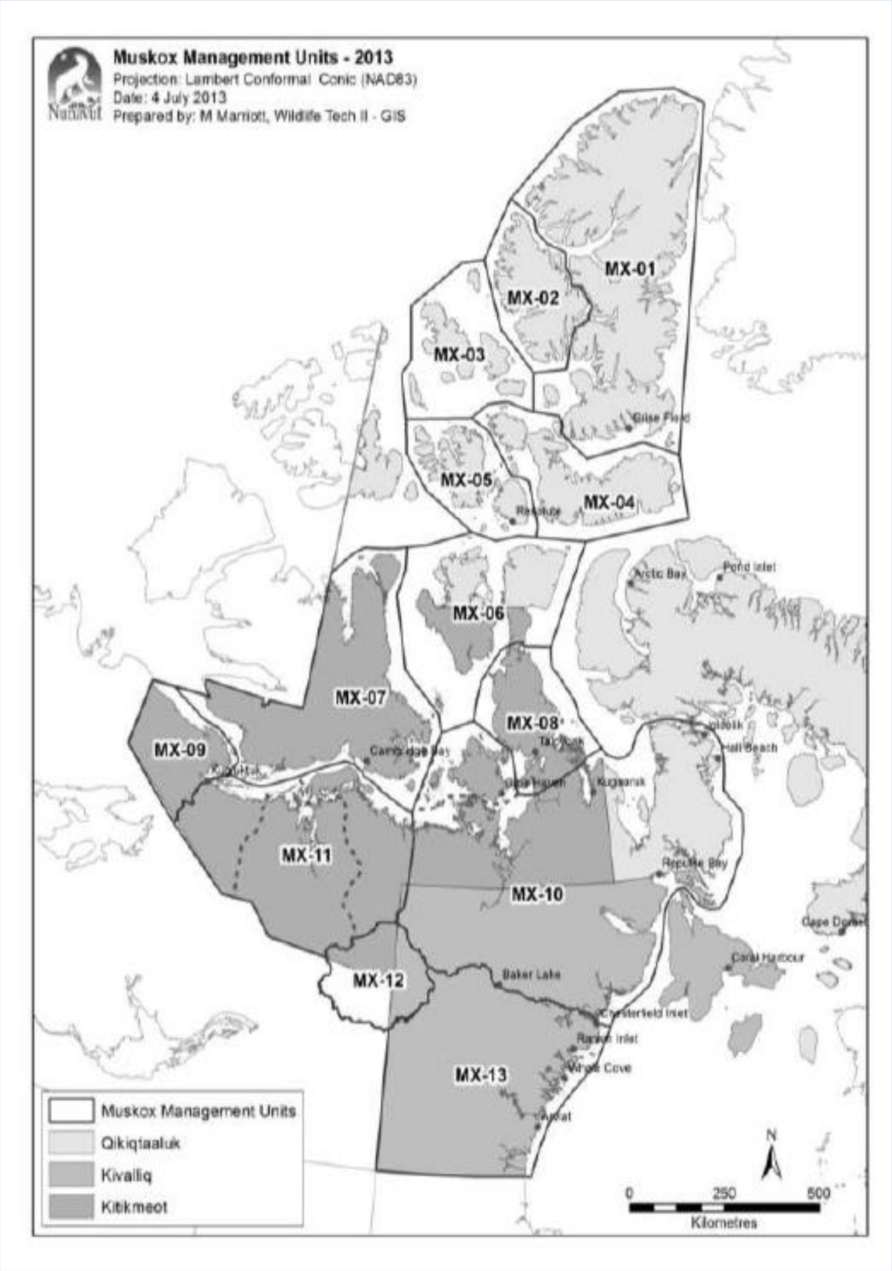
The Government of Nunavut would like to:

GN-DoE would like to inform the Board of the progress in research and monitoring on the Muskox Management Unit MX-09 in 2017, and provide current management recommendations

Survey Area

- MX-09, last estimate of 2007 was 598 muskoxen, with 159 adults on transect.
- Concerns, hunters seem to go harvesting muskox in the area to compensate for the lack of caribou.

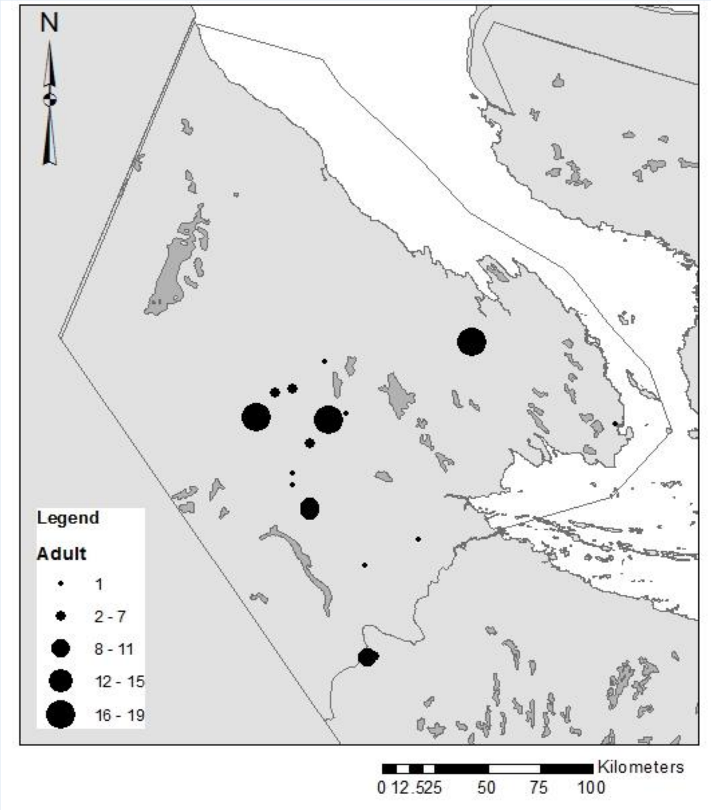




Monitoring

- Survey completed on August 25 to September 02, 2017 (16% coverage)
- 103 adults counted and 87 on transect

- 58% of the groups were small groups, of 2 to 11 adults
- The calf to adult muskox ration was 38 calves/100 adults



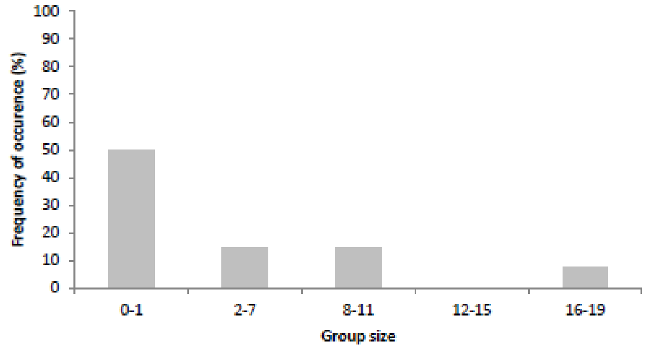
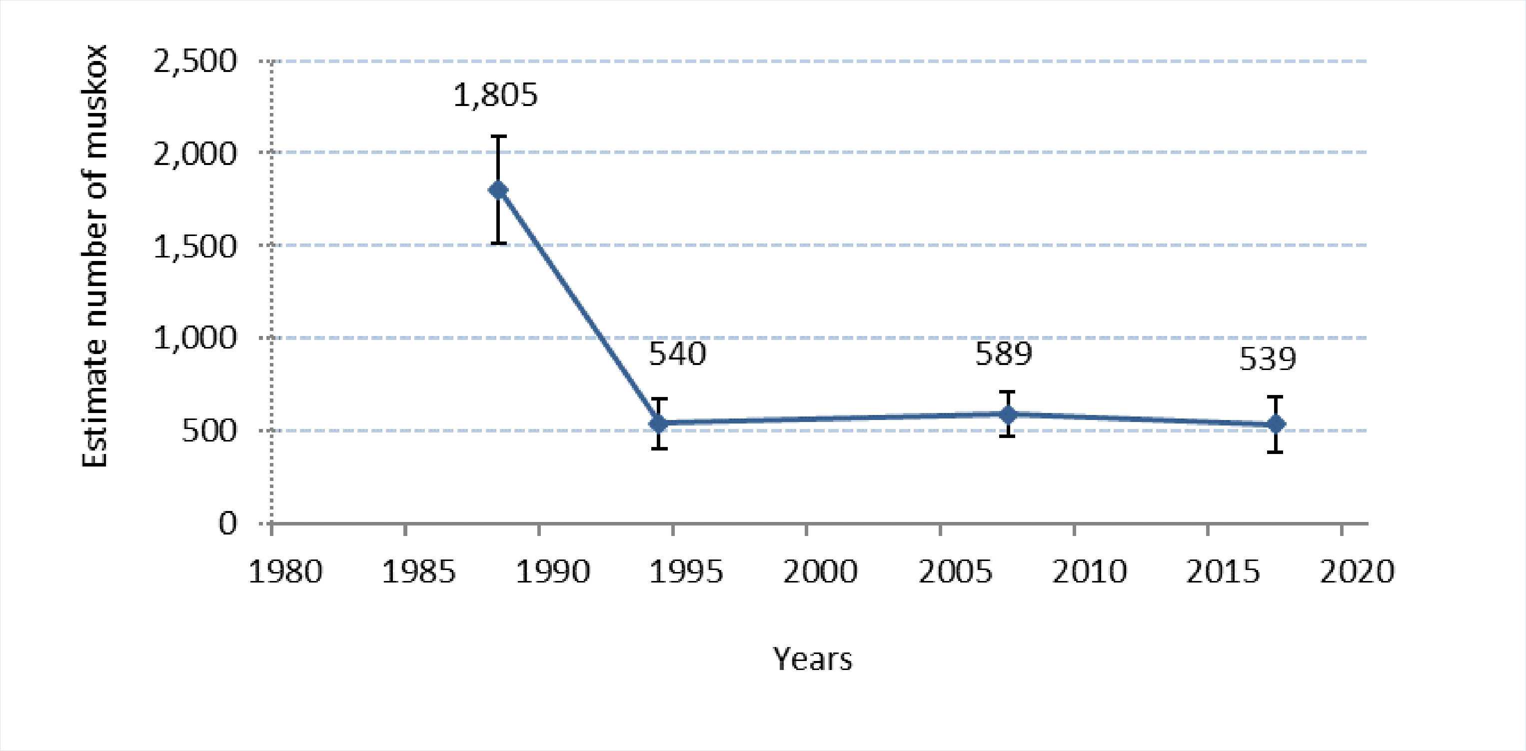


Figure 5: Frequency of occurrence (%) of adult muskox number per group size, grouped as follow 0-1, 2-7, 8-11, 12-15, and 16-19.

MX09, 2017 population estimate

Muskox number seems to be stable, since 1995, with an estimate of 539 ± 150 SE



Predators

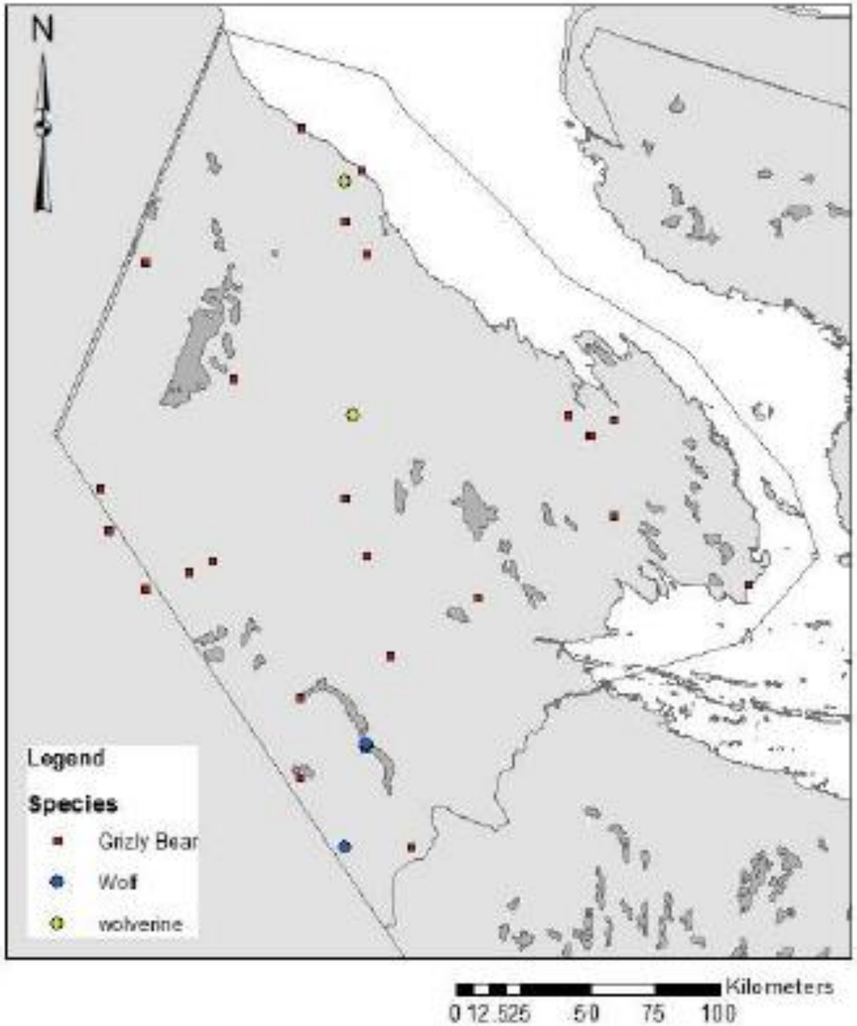


Figure 7: Locations of Wolf, Wolverine, and Grizzly Bear observations in the Muskox Management Unit MX-09.

Managements - Discussion

What is the HTO's management objective?

Are all tags being filled?

What is the community need?

Government of Nunavut recommendations

Based on survey results and community and HTO consultations, the following, current recommendation is made for managing muskoxen in Muskox Management Unit MX-09:

The Department of Environment is recommending to the Nunavut Wildlife Management Board to maintain a TAH of 20 for the Muskox Management Unit MX-09.

HTO Consultations on muskox distribution and abundance, Muskox Management Units MX-09

April 2019

Department of Environment, Government of NunavutIqaluit, Nunavut

Executive Summary

Representatives of the Government of Nunavut, Department of Environment (DOE) conducted a consultation with the Hunters and Trappers Organizations (HTO) of Kugluktuk on April 2nd, 2019. The primary purpose of these consultations was to inform the community members of the results of the 2017 abundance estimate of MX-09 and discuss management recommendations that the Kugluktuk HTO would like to see implemented. The consultation was also a way to receive and collect additional local and traditional knowledge insight to complement the survey report.

The Kugluktuk HTO agrees with the survey result, which show the muskox number in the management unit has remained stable for the past 20 years. The current Total Allowable Harvest (TAH) has remained consistent with 20 tags or a harvest rate of 3.4%. However, only 15 of these 20 tags were used recently, lowering the harvesting rate. Harvesters have not requested an increase in the TAH, therefore, the HTO would like to keep this *status quo*. However the HTO can implement their own management initiatives and reduce the tags given to the members if need be. The DOE support this recommendation, and will offer to work closely with the community. If harvesters see an increase or a decrease in the number of muskox in MX-09, this could trigger the initiation of a new population survey for MX-09. Otherwise, the next muskox population survey for MX-09 should be done in 2023.

This report attempts to summarize the comments made by HTO board members during the consultation on April 2nd, 2019.

Preface

This report represents the Department of Environment's best efforts to accurately capture all of the information that was shared during consultation meetings with the Hunters and Trappers Organizations.

The views expressed herein do not necessarily reflect those of the Department of Environment, Nunavut or Government of Nunavut.

Table of Contents

1.0 Report Purpose and Structure

This report is intended to collate and summarize comments, questions, concerns, and suggestions raised during a consultation held with the Kugluktuk HTO on April 2nd, 2019 about the results of the muskox distribution and abundance survey of the muskox management unit MX-09 and management recommendations. The summary and notes herein only reflect what was shared during the meeting.

2.0 Purpose of Consultations

The primary purpose of the meetings organized and led by DOE was to engage the HTOs in an ongoing dialogue on the survey results of the muskox management unit MX-09 am and solicit feedback on the report, gather additional local knowledge, and discuss future management recommendations. The results from the 2017 population survey were communicated during the meeting. The affected HTO was consulted as the designated representatives of the hunting community under the Nunavut Land Claims Agreement (NLCA).

2.1 Format of Meetings

The meeting was held during the evening and was one hour in length. Meetings were facilitated and lead by the Regional Biologist, who was also the primary presenter. The Regional Wildlife Manager was present as an observer, and the Wildlife Technician as a note taker. The presentation format was informal and HTO Board members were invited to ask questions or raise concerns and recommendations. It was an open dialogue.

3.0 HTO Consultation Summary

The objectives of the meeting were made clear to the HTO and the report was provided to them prior to the meeting. By doing so the HTO Board members was already familiar with the information and could be engage in a more meaningful way. The muskox has an important economic value and become an important alternative source of country food in a time that caribou meat become rarer. Several members HTOs stated the importance of sustaining the muskox to a certain number to assure the continuation of their harvest rights and food security.

3.1.1 Kugluktuk HTO Consultation Summary-2019

Issues: Muskox distribution and abundance, muskox management unit MX-09.West of the Coppermine River, August 2017. The muskox number in this management unit is stable.

Purpose of the Consultations:
A consultation was organized in Kugluktuk on April 2nd, 2019. The primary purpose of the meeting was to engage the HTO in an ongoing dialogue on the muskox survey, review the report, and talk about the future management recommendation. The meeting was anopportunity to inform the audience that the DOE does recommend a TAH of 20 based on the available information, but an increase of the current harvest is not possible at this time.

Date: April 2nd, 2019

Representatives:
DOE: Terry Milton, Lisa-Marie Leclerc and Kevin Methuen, Russell Akeeagok, Allen Niptanatiak

HTO: Bobby Anavilok, Kevin Klengenberg, Jacob Palogongak, Myles Peterson, Alannah, Stanley Carpenter, Jayko Palongayak, Larry Adjun (Chair).

Polar Knowledge Canada: Lynda Orman

Member of MLA: Mila Akeeagok

Summary of the Discussion:
During the presentation, HTO members made comments and asked questions to ensure an understanding of the research methodology and results. The HTO members expressed concerns regarding the time of the year in which the survey was realized. Traditional knowledge says that the muskox herd is harder to find because the number of lone bulls increase in late-summer. The bulls are nice and fat and they are getting ready to fight during the rut. Therefore, it would be recommended to do future surveys outside of the rut.

The HTO members gave additional information on the muskox lungworm. Local Inuit saw muskox with bloody noses way back in the 1970s. However, it took a decade for the Government to start a study investigating this clinical cause of the symptoms. Thus, in 1997, following studies determined the cause of the nose bleeding, which was associated with a parasitic lungworm that lodged itself in the lung host by creating nodules. Once affected, the muskox has difficulty running, as his pulmonary capacity is compromised.

The HTO members were not surprised by the relatively high number of Grizzly Bear sighting during the survey. However, they would like to specify that the predators are not the only one to blame for stabilizing the muskox population. Some muskoxen may have moved away to the tree line, maybe to move away from the area infested by lungworm. Also with the recent forest fire experienced in Yellowknife, the muskox might change distribution to avoid the smoke or burnt areas.

Muskox movements are not well understood. Biologists ear tagged muskox at Napatilik Lake in early 1990s, and a muskox with a tag was seen again in 2017 close to Contwoyto Lake. Muskox when scared can run for four to five miles. There is muskox in the tree line and around Great Bear Lake. It appears that they are moving south towards the border with and into the Northwest Territories.

Since there are muskoxen in the Northwest Territories, some questions were asked about the current monitoring of muskoxen by the Government of the Northwest Territories (GNWT). The HTO board members were very interested to know if the muskox in the Northwest Territories belongs to the same population as the muskox in MX-09. Thus, they would like to have a meeting and work with the GNWT.
Concerning the harvest rate, the tags are currently not all being filled. This year, all the tags were assigned, but only 7 were reported harvested out of the 20. In addition, the last ten years the quota has not been filled, 15 tags used over a maximal number of 20, and there was no reports of harvesters expressing concerns. . The HTO would like maintain the status quo for MX-09 with 20 TAH.. . However, the HTO has the discretion to use their by-law to implement a community-based management action; a small moratorium for 1 or 2 years to help the muskox population increase, since it has remained stable, without growth, for so long.

Recommendation to the GN:
The HTO of Kugluktuk recommended maintaining the *status quo* for MX-09 with 20 TAH. If the harvesters and users report any change in observations indicating an increase or decrease in the population, they would like to have a population survey done before 2023.

4.0 Conclusion- Next Steps

The DOE will finalize the muskox report with the additional comments provided during the meeting and distribute it to the co-management partners. When planning the 2019 muskox survey on the mainland, DOE will consider the comments and suggestions made during the HTO consultation, as to avoid the time of the rut.

Since 2017, population survey results have been discussed at the Kitikmeot Regional Wildlife Board Annual Meeting in 2018 and now with the HTOs and other co-management partners. Key information on the stability of the muskox number in the muskox management unit MX-09 has been communicated. In addition, recommendations to the NWMB would be made to keep the current TAH status as is, according to this position, which is supported by the Kugluktuk HTO. The consultation process for this management recommendation is summarized in this report.

Appendix I

PowerPoint Presentation 2019

Muskox distribution and abundance
Muskox Management Unit, MX09,
West of the Coppermine River

Kugluktuk HTO

Lisa-Marie Leclerc
Government of Nunavut
Department of Environment

April, 2019

Survey Area

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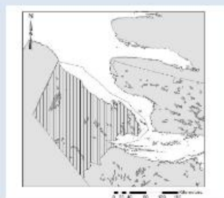

Monitoring

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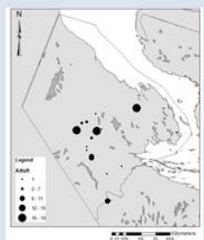
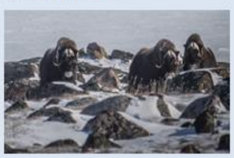
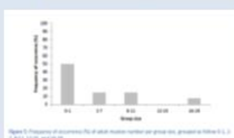
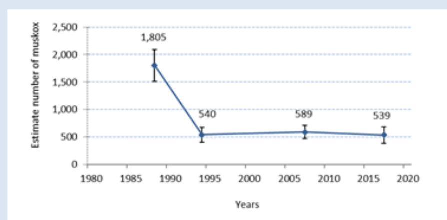




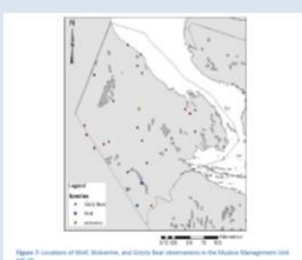


MX09, 2017 New population estimate

Muskox number seems to be stable with an estimate of 539 ± 150 SE



Predators



Managements- Discussion

What is the HTO's management objective?

Are all tags being filled?

What is the community need?

Kugluktuk Angoniatit Association • Hunters' & Trappers' Organization
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NUNAVUT WILDLIFE MANAGEMENT BOARD
3rd Floor Allavik Building
P.O. Box 1379, Iqaluit, NU, X0A 0H0
Phone: (867) 975-7300
Fax: (888) 421-9832
E-Mail: tsataa@nwmb.com

NWMB Regular Meeting 002-2019

Please accept this document, Kugluktuk Angoniatit Association Bluenose East Community Caribou Management Plan for decision/approval.

Kugluktuk Angoniatit Association representatives will be present at the Regular Meeting in Ottawa on June 19, 2019.

Thank you,

Amanda Dumond

Manager

KUGLUKTUK ANGONIATIT ASSOCIATION

BLUENOSE EAST COMMUNITY CARIBOU MANAGEMENT PLAN

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TABLE OF CONTENTS

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EXECUTIVE SUMMARY

This management plan was prepared by Kugluktuk Angoniatit Association, Government of Nunavut and Nunavut Tunngavik Inc.

ACKNOWLEDGMENTS

The Kugluktuk Angoniatit Association would like to thank Cheryl Wray, Nunavut Tunngavik Inc and Lisa-Marie Leclerc, Government of Nunavut, for their assistance in developing this plan.

Kitikmeot Inuit Association had participated and assisted in the early stages of the development of this plan.

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ACRONYMS

ACCWM	Advisory Committee on Cooperation of Wildlife Management
BNECH	Bluenose East Caribou Herd
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
DOE	Department of Environment, Government of Nunavut
ENR	Environment and Natural Resources, Government of the Northwest Territories
GN	Government of Nunavut
GNWT	Government of the Northwest Territories
HTO	Hunters and Trappers Organization
KIA	Kitikmeot Inuit Association
KRWB	Kitikmeot Regional Wildlife Board
NA	Nunavut Agreement
NTI	Nunavut Tunngavik Inc.
NQL	Non-Quota Limitation
RWO	Regional Wildlife Organization
TAH	Total Allowable Harvest
TK	Traditional Knowledge

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CO-MANAGEMENT PARTNERS & ROLES

KUGLUKTUK ANGONIATIT ASSOCIATION the Kugluktuk HTO will be responsible for allocating the TAH; collection of TK; monitoring; regulating the members and fulfilling obligations in accordance with the Nunavut Agreement; reviewing and updating the plan as required.

NUNAVUT TUNNGAVIK INC will be responsible for ensuring all processes adhere to the Nunavut Agreement. NTI will also provide support as needed.

KITIKMEOT REGIONAL WILDLIFE BOARD will provide support to the HTO.

GOVERNMENT OF NUNAVUT, DEPARTMENT OF ENVIRONMENT will be responsible for scientific monitoring; conducting research; providing reports when required; providing information and support as required.

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1. PLAN DEVELOPMENT

The purpose of this plan is for the Kugluktuk Angoniatit Association to manage harvesting at the local level, as per the Nunavut Agreement under Section 5.7.3 "The Powers and functions of HTOs shall include the following: (a) the regulation of harvesting practices and techniques among members, including the use of non-quota limitations; (b) the allocation and enforcement of community basic needs levels and adjusted basic needs levels among members; (c) the assignment to non-members, with or without valuable consideration and considerations, of any portions of community basic needs levels and adjusted basic needs levels; and (d) generally, the management of harvesting among members."

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2. SPECIES INFORMATION

Barren-ground caribou (*Rangifer tarandus groenlandicus)* occupies the Territories of Nunavut and Northwest Territories. This caribou is known to occupy a vast range and can occur at high numbers. Due to the migtation and behavioral differences of each herd, different herds are recognized and managed. Thomas (1969) first introduced the name of the "Bluenose herd" for the caribou that wintered northwest of Great Bear Lake and calved around Bluenose Lake. In mid-1990s, based on distribution data and telemetry surveys done between 1966 and 1993, there was some evidence that three herds of caribou could be distinguished within the range of the "Bluenose herd" (Nagy *et al.*, 2005). The name Bluenose-East herd was attributed to the barren-ground caribou subpopulation in which the females show a strong annual spatial affiliation to the calving ground east of Bluenose Lake (ACCWM, 2014; Nagy *et al.,* 2011).

The numbers of Barren-ground caribou population is known to follow a 60-year cycle. Because of the length of this cycle, traditional knowledge provides critical information on the long-term population trend that is not possible from the available recent aerial surveys. For example, Government biologists started to monitor the Bluenose East caribou in 2000 where the herd estimate totaled 120,000 caribou. The peak in population was recorded at 122,697 animals in 2010 before a decline was detected in 2013, when the herd was estimated to number 68,295 caribou. In 2015, the population was estimated to number 38,592 animals (Boulanger *et al.*, 2016).

The rapid decline in the Bluenose-East herd size triggered a conservation concern, and an urgency to develop management actions among the users. Nine communities: Wrigley, Norman Wells, Tulit'a, Deline, Whati, Gameti, Bechoko, Paulatuk in the Northwest Territories and Kugluktuk in Nunavut are depending on this herd as a reliable source of food (ACCWM, 2014). However, caribou represent more than food security. People of the north and the caribou have developed a deep relationship over thousands of years, where caribou are at the root of the Inuit culture, normative values, and the foundation of social relationship in the community. Caribou is an essential part of the richness of Inuit culture.

2.1. Caribou Health

Disease, parasites and other pathogens, are known to affect the survival, fecundity of the individual host, which might lead to an impact caribou at the population level. Inuit needs to have access to healthy animal to maintain their cultural well-being and dependence on healthy country foods (Carlsson *et al.,* 2016; Jenkins *et al.*, 2015). Therefore, establishing a health baseline and monitoring program are important to understand the affect of pathogens in population dynamism and to secure food safety for northern communities.

Diseases pose a moderate threat to the Bluenose-East herd through effects on body conditions, pregnancy rate, and survival. The Bluenose-East samples collected during community-based monitoring programs and community hunts from 2004 to 2014 were used to test against the most predominant pathogens known to affect caribou. The Bluenose-East caribou have a

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seroprevalence for Alphaherpesvirus (Herp), Pestivirus (Pesti), and Parainfluenzavirus type 3 (PI3), *Brucella suis biovar* 4 (Bru) and *Toxoplama gondii* (Toxo). They have no seroprevalence for *Neospora caninum* (Neo), West Nile Virus (WNV), and Bovine respiratory syntical virus (BRSV) (Table 1) (Carlsson *et al.*, in press.; Kutz *et al.*, 2001).

Table 1: Seroprevalence of screened pathogens in adult Bluenose-East caribou.

Pathogens	Female Sample seroprevalence (%)	Male Sample seroprevalence (%)
Herp	56	46
Pesti	35	33
PI3	31	13
Neo	--	--
Bru	2	0
Toxo	0	14
WNV	--	--
BRSV	--	--

Bluenose-East herd was found to be positive for *Brucella suis biovar* 4 and *Toxoplama gondii* and these pathogens are known to be zoonotic to human. The *Brucella* bacterium, which causes Brucellosis, is currently affecting a very low percentage of individual from this herd. Hunters can recognise an infected caribou by observing swollen joints or limping behavior. The prevalence of antibodies to *T. gondii* indicate that caribou meat may contain viable *T. gondii* (Kutz *et al.*, 2001). In both cases, traditional food preparation techniques should include cooking the meat very well and handling of wild game should be done with additional precautions.

Continuing this Bluenose-East health surveillance program will help to detect risk for wildlife population and the northern communities. However, health has become more than qualifying wildlife in the absence of disease and the apparent normality of their behavior (Boorse, 1977). The definition of a healthy caribou herd could be enlarged to encompass the notion of population sustainability and resilience, habitat quality, and the presence of stressors (Macbeth and Kutz. in press.). This lead to revisit our current approach in understanding the Bluenose-East herd health in a more holistic approach.

2.2 Migration, Seasonal Range, Habitat Use

Barren-ground caribou is known for their long-scale terrestrial migration and their predictable use of different geographic areas to meet their seasonal requirements. Geographic locations that facilitate caribou travel, shallow or hard snow and frozen water bodies, are favored during their migration. These successful migration routes are then learned by younger caribou that follow experienced adult animals and these paths become traditional routes (Nicholson *et al.*, 2016). Through the year, the seasonal ranges have been divided by biologists into eight periods: calving/post calving, early summer, mid-summer, late summer, fall/rut, fall/post rut, winter, spring migration and pre-calving (Nagy *et al.*, 2005). Driven by environmental conditions (temperature, precipitation, snowpack, environmental productivity) or presence of predators, caribou can use

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their habitat differently in response to these factors. For example, a factor affecting negatively the productivity of new vegetation can cause a range shift in spring (Nicholson *et al.*, 2016).

Satellite tracking data obtained for the female Bluenose-East from 1996 to 2004 were analysed to define their eight specific seasonal ranges (Table 2) (Nagy *et al.,* 2005). The calving ground of the Bluenose-East caribou has encompassed from the east of Bluenose Lake to the community of Kugluktuk. When the herd is abundant, Kugluktukmiut recall the presence of female caribou in the community. During the early summer, the female and their calves moved closer to the shore of the Dolphin and Union Strait, before starting to move south spreading from the coast to the north side of Great Bear Lake in mid-summer. They will aggregate at this location from early August to October (late summer). At the time of the fall/rut, the distribution of the female caribou covers the north and east side of the Great Bear Lake, the Mctavish Arm, reaching up to the Dehcho Region. The fall/post rutting is the period were the female caribou seems to aggregate between the south side of Great Bear Lake and Dehcho Region and will be also wintering at this location. The winter range of the Bluenose-East caribou is known to generally overlap with the adjacent Bathurst caribou herd. Finally, at the time of spring and pre-calving, the caribou begin a northward migration back to the calving ground location and come relatively close to Kugluktuk. However, current biological understanding of the Bluenose-East caribou herd's habitat use is limited, as it relies mostly on a small number of adult female caribou that have been collared.

Table 2: Bluenose-East Seasonal classification time frame based on Nagy et al., (2005).

Seasonal ranges	Period
Calving/ post-calving	June 1 to 25
Early Summer	June 26 to July 15
Mid Summer	July 16 to August 7
Late Summer	August 8 to October 7
Fall/rutting	October 8 to 31
Fall/ post-rut	November 1 to 31
Winter	December 1 to March 31
Spring, spring migration, pre-calving	April 1 to May 31

Determining the extent of the Bluenose-East seasonal ranges is important to guide the conservation of the species by identifying important habitat. Future special management or protected areas should show a degree of flexibility to accommodate behavioral response to unsuitable environmental conditions that might result in a distribution shift within the herd's range (Nicholson *et al.*, 2016). Such flexibility could be achieved through adaptive-management approach, where the best short-term management recommendations are revisited frequently to respond to changes in the system.

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3. THREATS

Many definitions of a threat exist, but according to the one used by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), threats are defined as the proximate activities or process that directly and negatively affect each population. Predator interactions (problematic native species), hunting pressure, climate change and severe weather, habitat changes, parasites and diseases, and energy production and mining constitute potential direct threats. Threats can also be organized and evaluated based on the IUCN-CMP (World Conservation Union-Conservation Measures Partnership) unified threats classification system (Master *et al.*, 2009). This classification is yet to be completed for the Bluenose-East herd and such an exercise could be undertaken by communities.

3.1 Human Disturbance

Resource exploration and development, recreational activities can affect directly caribou behavior and impact caribou negatively. Indirect effect from these human activities can also cause changes in the access, quality and quantity of forage or fragment the habitat, which might make a particular location unsuitable for the caribou and cause a range shift or displacement (Nicholson *et al.*, 2016). When the herd is at low numbers, they are less resilient to human disturbance and this can impair the recovery of the herd.

Within the Bluenose-East caribou range, there are proposed exploration and mining projects. In the Northwest Territories, the Mackenzie Valley is rich in shale oil and extensive exploration of the area is taken place. Proposed project such as the Mackenzie Gas Project (MGP) natural gas pipeline and the Mackenzie Valley Highway extension will interact with the Bluenose-East caribou (ACCWM, 2014). The Northwest Territories and Nunavut have also a rich mineral potential for diamond and other valuable minerals that overlap with the range. Both exploration and mining projects can impact the Bluenose-East caribou depending on their location and severity. Cumulative impacts should also be considered.

3.2 Predators

Wolf (*Canis lupus arctos*), Grizzly Bear (*Ursus arctos*), Wolverine (*Gulo gulo*) and Golden Eagle (*Aquila chrysaetos*) are known predators. Caribou are prey to wolves, grizzly bears, and wolverines, where wolves had the greatest proportion of caribou in their diet (90%) (L'Herault *et al.*, 2016). Even though, wolf is the main predator of barren-ground caribou, the extent in which wolves influence the decline and recovery of caribou herd is unknown. The predator-prey relationship suggests a regulatory mechanism where wolf pup recruitment decrease at low caribou availability (Klaczek *et al.,* 2016). Due to a delay in the predator population response to a caribou decline, the effect of predation might become proportionately greater at that time (ACCWM, 2014). This could explain why hunters and community members have great concerns about wolf numbers and are very proactive in creating predator management programs to reduce predation pressure.

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Up to this day, biologists are still questioning the effectiveness of wolf control programs. Previous lethal wolf control programs, such as the Finlayson and Aishihik areas in the Yukon, have shown to be an effective short-term solution to increasing ungulate population where benefits lasted under 10 years. However, the program is intensive and as soon as the program stops, the wolves can recover rapidly, (Hayes, 2010).

According to Traditional Knowledge, the number of grizzly bears within the Bluenose-East caribou range has increased considerably, with numerous sightings of this predator in the calving and post-calving range (Kugluktuk HTO, pers. comm.). Grizzly bear usually targets young caribou, particularly newborn calves, but are also found to kill adults. Grizzly bear has developed different methods to kill caribou: charging caribou group, chasing moving bands of caribou, exploiting caribou at traditional river crossing, scenting calves (Reynolds & Garner, 1987). Although observations of Grizzly bear killing caribou have been documented, the grizzly bear-caribou interrelationship is not well understood (Skoog 1968; Murie 1981).

Golden eagle predates on small ungulates, such as sika deer (*Cervus nippon*) and Dall's sheep (*Ovis dalli*) (Kerly, 2013; Nette *et al.*, 1984). In Finland, Golden eagle is known to contribute to the mortality on semi-domesticated reindeer (*Rangifer tarandus fennicus*) calves (Nybakk *et al.*, 1999). Golden eagle nests on the south facing cliffs of the Rae Richardson river valley, which bifurcate the Bluenose-East calving ground. This implies the possibility of golden eagle to predate on newly born Bluenose-East caribou calves contributing to a percentage of the mortality. This paucity might happen in the event that the usual preys, ground squirrels and smaller mammals, become scarce forcing them to attack alternative species (Nette *et al.*, 1984; Nybakk *et al.*, 1999). Current work is in process to determine golden eagle-caribou interrelationship, and the results of this study should become available to further inform predator pressure on the Bluenose-East caribou.

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4. HARVEST LEVELS & PRACTICES

4.1 Communities that Harvest Bluenose East Caribou in Nunavut

Kugluktuk is the only community in Nunavut that harvest caribou from the Bluenose East herd. There are other communities that harvest from this herd in the NWT.

4.2 Use of the Population and History of Harvest Management

The Bluenose East Caribou Herd (BNE) have always been an important staple in the Inuit diet/lifestyle. Caribou were harvested at different times of the year for different uses. Caribou was used for food, clothing, shelter, tools. Inuit harvested only what was needed. There was never wastage of the animal.

Today, harvesters use machines and rifles to hunt caribou. It is much faster and easier to find the animals.

Season:

- *During migration, leave the leaders along, as harvesting/disturbing them may alter migration.*
- *January to March – mostly females*
- *April to June – bulls*
- *July to August – mix but little harvest*
- *September to October – bulls*
- *November to December – young bulls and females*

In 2007, the Kugluktuk HTO had made a motion to stop all sport hunting and commercial hunting of all caribou herds in the Kugluktuk area. This was also supported by the local outfitter at the time.

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5. MANAGEMENT/IMPLEMENTATION/MONITORING

5.1 Management Goals

The tools in the ICCMP includes:

1) Setting a limit on KHTO member harvest which is controlled by the KHTO;
2) Mandatory BNECH harvest reporting to the KHTO by members;
3) Establishing a 'No Caribou Hunting Zone' to reduce BNECH harvest in an area that has easy access by trails and all-terrain vehicles;
4) The establishment of an KHTO controlled enforcement system regarding BNECH harvest rates and zones, mandatory reporting, and harvest practices;
5) Creation of a program and looking for partners to create a predator management program to reduce predation pressure on the BNECH;
6) Continuing and improving education of KHTO members about caribou, respectful harvest practices, and alternate species to harvest; and
7) Increased effort to increase the fair quota to the KHTO regarding muskox in the Kugluktuk harvest area to relieve harvest pressure on the BNECH.

5.2 Plan Implementation

The KHTO Approved Integrated Community Caribou Management Plan.

<u>Setting a limit on KHTO member harvest which is controlled by the KHTO</u>

The KHTO estimates that from May 2015 to May 2016 that about 190 BNECH were harvested in this one-year period. The KHTO estimates the seasonal breakdown of the annual BNECH harvest was about: 20 in the summer; 20 in the fall; 100 in winter, and 50 in April. Of the 100 BNECH harvested in winter, these were harvested at Napaktolik, which is about 200Km south- east of Kugluktuk where it appeared that a large herd of caribou wintered in the rocky hills in the area. There was discussion about whether these were the BNECH, but it was generally believed to be this herd from the KHTO.

Even if the KHTO harvest was underestimated by 75%, the total harvest is less than the 340 TAH. There have been years when the harvest has been much higher and it is related to the BNECH population being higher, or the BNECH was close to town for a period of time.

The reason for the reduced harvest in this May 2015-May 2016 period are many, and include:

a. many Inuit do not have the resources, or skills to harvest caribou;
b. the BNECH population is on a decline and the opportunity to find and harvest BNECH is reduced as a result (a natural feedback loop);
c. there are no winter roads, or airplanes used to hunt caribou around Kugluktuk, so

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unskilled hunters, and those without resources to travel far from town cannot harvest BNECH.

Thus, the KHTO is willing to enforce its own limit of 340 caribou harvested in 2016-17 using mechanisms the KHTO already has in place. The KHTO will develop its own methods for distributing the right to KHTO members to harvest the 340 animals from the BNECH. There was not enough time offered by the NWMB to more fully develop the details of this KHTO enforced plan, but the KHTO is confident that it can do it.

The HTO made a motion to allow the harvesters to hold on to tags for two weeks prior to resolving them back to the HTO. The HTO has also made a motion to not allow harvesting for a one-month period from June 1-July 1st. The Wildlife Act states that no edible pieces of meat can be wasted and is thus an infraction of the Wildlife Act. Caliber Act is a .223 and larger for big game.

5.3 Monitoring and Reporting

In addition to mandatory reporting, the KHTO and the GN are working together to submit biological samples to further manage and monitor the health of the herd. As part of a KHTO enforced limit on its members of 340 BNECH to be harvested, the KHTO will implement a system of monitoring the harvest of BNECH. This will provide feedback as to whether the ICCMP has been effective in achieving its goal. If harvest results are over the KHTO enforced limit, the KHTO can use adaptive management to adjust the ICCMP to meet the limit. As part of this harvest reporting, there will also be feedback sought from hunters on the health and population of the BNECH to be used as a mechanism to assess the state of the BNECH. For example, the number of calves, the number of pregnant females and other relevant information as we have successfully done to document the increased population of muskox on the mainland east of Kugluktuk which resulted in an increased TAH for this species. The KHTO is confident it has the mechanisms available to enforce reporting of the BNECH harvest.

KRWB and KHTO are working to implement a traditional knowledge program with Trailmark to record observations, harvesting, climate change into a database.

5.4 No Hunting Zone

1) <u>Establishing a 'No Caribou Hunting Zone' to reduce BNECH harvest in an area that has easy access by trails.</u>

The BNECH often comes relatively close to Kugluktuk during the spring and fall migration. Access to the south-west of Kugluktuk for a distance of about 5-10 miles is facilitated by the lack of river or stream crossings and the development of trails. This allows for rapid access of hunters with limited resources or skills to a relatively small area near Kugluktuk that the BNECH sometimes passes

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through. A lot of BNECH harvesting can happen if the BNECH passes through this area.

The KHTO implemented an Article 5.7.3 non-quota limitation at its Annual General Meeting on June 12, 2017 on harvesting that prohibits caribou harvesting in this area, which is shown in Figure 1 and Figure 2. This area is about 300 square kilometers of the most easily accessible hunting areas from the Hamlet of Kugluktuk. There are clear land marks in this area that can used to establish this no hunting zone for caribou that include major rivers and cliffs. The establishment of this zone will result in significant reduction in caribou harvest in years and seasons when the BNECH migrates close to town through this area. Further, many hunters are not adequately resourced or trained to harvest caribou respectfully, and too many hunters in this area can pose a human and hunter safety issue. This no hunting zone was put in place based on IQ (include the names within the text). Include dates when this area is effectively closed to harvesting.

Figure 1. The KHTO "No Caribou Hunting Zone" outlined in red. This zone is bounded by the Kugluk (Coppermine) and Kuungnahik (Richardson) River, the arctic ocean, and a set of well-known cliffs in the Hatongaat area to the southwest and the Gurling Point Cliffs to the northeast.

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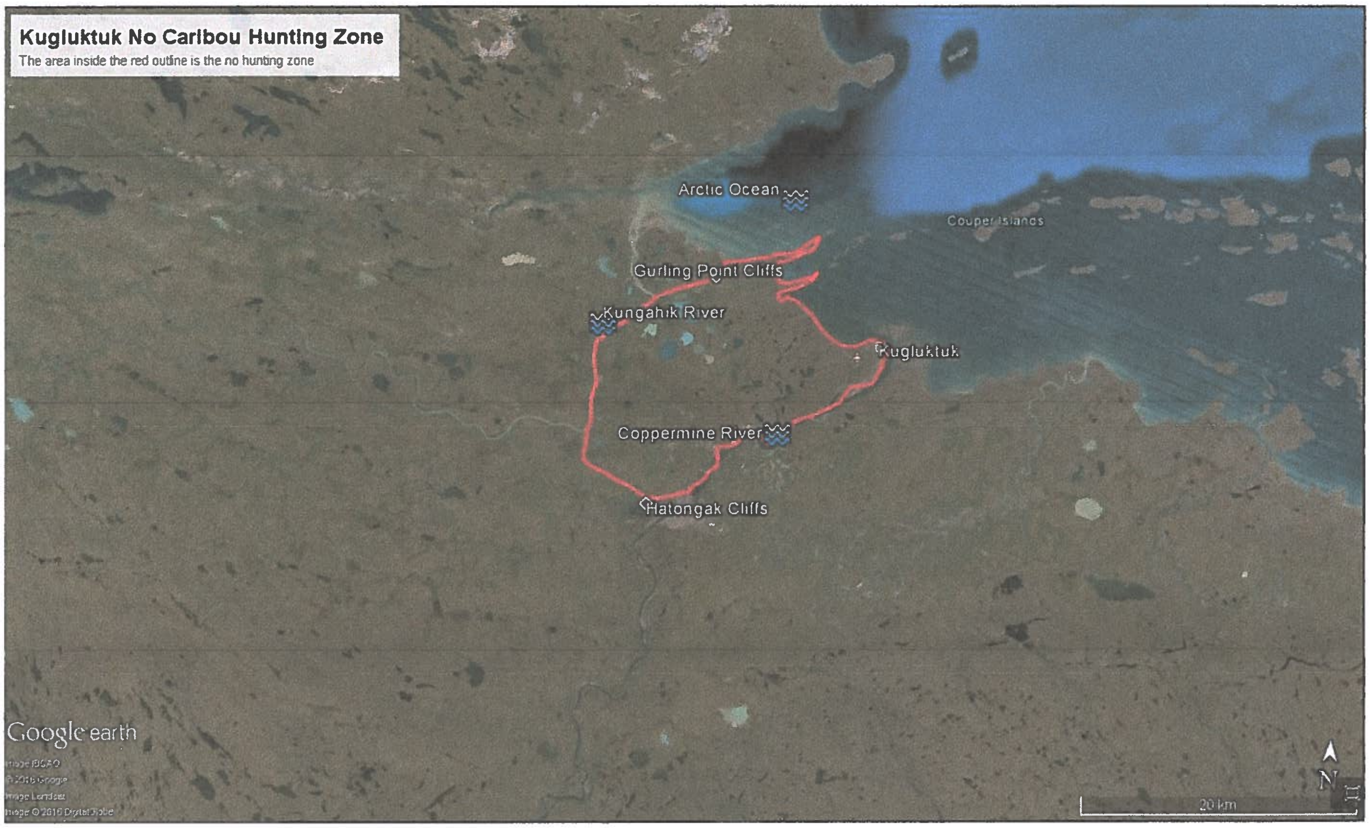
Figure 2. The same Proposed KHTO "No Caribou Hunting Zone" outlined in red, but in a regional setting.



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SITUATION: POPULATION IS HIGH (120,000 +)

OBJECTIVE: MAINTAIN HEALTHY POPULATION

POSSIBLE TOOLS

- Education about sustainable harvest
- Predator Monitoring
- Harvest Monitoring
- Traditional Knowledge collection
- No-Hunting Zone Implemented
- Sample collection – optional

SITUATION: POPULATION IS INTERMEDIATE & DECREASING (60,000 +)

OBJECTIVE: PROMOTE HERD RECOVERY

POSSIBLE TOOLS

- Increase monitoring
- Limit harvest
- Predator Management
- Mandatory Reporting
- Mandatory Sample collection
- Traditional knowledge collection
- Education about sustainable harvest
- Hold Regular Meetings with co-management partners, governments, organizations, community
- Calving Ground/Habitat Protection
- No Hunting Zone Implemented
- No sports and commercial harvests
- Encourage mainly bull harvest
- Encourage other species harvests
- Encourage aerial/population/cow-calf ratio; calf survival rate; adult composition surveys every year

SITUATION: POPULATION IS LOW (20,000 -)

OBJECTIVE: PROMOTE HERD RECOVERY

POSSIBLE TOOLS

- Smaller/No Harvest
- Bull Harvest Only
- Establish a Season
- Mandatory Reporting
- Increase monitoring
- Predator Management
- Mandatory Sample collection
- Traditional Knowledge collection
- Education about sustainable harvest
- Calving Ground/Habitat Protection
- No Hunting Zone Implemented
- No sports and commercial harvests
- Hold Regular Meetings with co-management partners, governments, organizations, community
- Encourage other species harvests
- Encourage aerial/population/cow-calf ratio; calf survival rate; adult composition surveys every year
- Increase Monitoring

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6. ENFORCEMENT

1) <u>The establishment of an KHTO controlled enforcement system regarding BNECH harvest rates and zones, mandatory reporting, and harvest practices.</u>

The KHTO believes that it has the respect of the community, and the capacity to enforce compliance to its proposed ICCMP. There was not enough time afforded by the NWMB to put into place formal enforcement mechanisms as part of this submission, but it will not be hard to complete. Enforcement mechanisms include limiting future opportunities related to: BNECH harvest opportunities, access to KHTO subsidized goods; KHTO sponsored community hunts, and KHTO partnerships with government and industry on various wildlife and environment activities. Loss of these privileges is a loss of harvesting opportunity and a loss of economic potential to members who do not follow the rules, in addition to the moral shame involved in breaking locally enforced rules and values.

When the KHTO has made rules, or voiced opinions in the past they have been respected. It makes sense that rules made more locally are better adhered to and respected that rules enforced by authorities that are seen to be further away, or not related to the community.

As an example, the KHTO passed a resolution many years ago that there should be no more cabins built on the Coppermine River north of Bloody Falls, because there was concern that too many cabins would disturb wildlife, including caribou that use the area. This part of the river is part of the border with the 'No caribou hunting zone' proposed above. Even though the KHTO had no legal authority to enforce this resolution (because it is not a landowner), the community, by and large, has respected this KHTO resolution and few or no new cabins have been built in this area on the Coppermine River. This is an example of how both Inuit and non- Inuit in Kugluktuk respect the desires of the KHTO.

Further, local enforcement of an ICCMP will be more effective as there is a stronger moral obligation of KHTO and Kugluktuk community members to follow the rules. If one has to account to their grandparent, parent, uncle, aunt or friend for why they broke the rules, this is a much stronger reason to comply than to worry about a government rule that may appear to be distant and unreasonable. There are new provisions for cross bow hunting.

GN can enforce the interim of 340 and the HTO will enforce the sex selective NQL by imposing the no hunting zone during calving season.

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7. MOVING FORWARD

1) Creation of a program and looking for partners to create a predator management program to reduce predation pressure on the BNECH.

For years, the KHTO has expressed to the GN-DOE the observations of the high number of predators, such as wolves and grizzly bears that are present in the range of the BNECH. Traditionally, Inuit have harvested wolves and grizzly bear in this area as part of day-to-day life on the land. Now that most Inuit spend the majority of their time in established communities, there are fewer Inuit on the land and less opportunity to harvest these animals.

Inuit have strong hunting skills in general, and there is a long history as wolf hunters. This combined with extensive traditional knowledge about wolves and grizzly bear give Inuit the ability to be very effective managers. For example, Inuit know where many of the denning areas are of wolves in the BNECH range in Nunavut.

Inuit continue harvesting wolves and grizzly bear to the present. Unfortunately, the price of fur has declined drastically over the last many years and is very low compared to the cost of hunting. The GN has proposed a program to assist the KHTO with regards to the predator control. In addition, the KIA has funding to assist the KHTO to further look into predator management. The KHTO is continuing to work with the GN and KIA for funding to assist with predator management to ensure the health and viability of the BNE Caribou Herd.

Actual development of a predator management plan. Bring hunters together to develop a plan. Wolves are known predators of caribou. It is generally thought that a wolf eats about 25 caribou per year. A properly designed wolf management program that used the traditional skills of Inuit could be a significant help to managing the BNECH, and also conserve Inuit hunting skills. Take for example if there was an incentive in place to motivate Inuit hunters to spend more effort hunting wolves that, on the margin, resulted in an extra 30 wolves being harvested every year. These extra 30 wolves would represent 750 caribou that are not eaten by wolves, and available to assist with population recovery. It would also more than offset the annual harvest by KHTO members.

There is also traditional knowledge that the grizzly bear population has increased considerably in the West Kitikmeot Region of Nunavut and is expanding north and east. It is known that there is a relatively high number of grizzly bears in the calving and post-calving range of the BNECH. Grizzly bears are known to be effective caribou predators. The GN has removed the quota on grizzly bear for Inuit and it is expected the harvest rate of grizzly bears in the area around Kugluktuk will increase as a result. Increased rates of harvest are already occurring.

The Kitikmeot Inuit Association has already endorsed predator management measures and may be willing to assist with securing funds for such a program. In the Northwest Territories (NWT), hunters can get several hundred more dollars as an incentive to kill wolves that is above the price of the fur, if the wolf is killed in a time of year when the fur is valuable. The Government of Nunavut, in geographic areas where there is a conservation concern with caribou, should mirror

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the GNWT programs to incentivize the management of wolves. The incentive should be offered year-round so that hunting at the dens for pups can occur.

The KHTO would be willing to implement programs to remove wolf pups in the summer, which significantly reduces the food requirements of wolf packs. This along with a properly designed incentive system for harvesting wolves would use the impressive wolf hunting skills of Inuit to manage the herds. Further, unlike other aboriginal groups in the NWT, Inuit have no traditional beliefs against hunting or handling wolves. Wolf fur is used in everyday winter clothing by Kitikmeot Inuit. The increase of grizzly bear tags will assist with this. The KHTO is advocating for 10 grizzly bear tags for sport hunts. Studies are being conducted this summer on Golden Eagles (raptors) and their impacts on caribou calves.

The Department of Environment implemented a Wolf Pilot sample collection in the Kitikmeot Region. The goal of this project is to collect data about wolves and increase the number of wolves harvested.

2) Continuing and improving education of KHTO members about caribou, respectful harvest practices, and alternate species to harvest

The KHTO has an established caribou education week based in Kugluktuk. This week includes activities such as harvest practices, respectful harvesting, and harvesting alternate animals. There are many other sources of country food in the Kugluktuk area including muskox, moose, arctic char, seal, and geese to name a few. This education week will continue along with every day transfer of knowledge from Inuit to younger generations and include the information and skills that is part of the ICCMP. Education will be completed in two parts: educate what it is in this plan (i.e. hunting zone and no harvest restrictions in terms of dates, the status of the herd and the respectable harvest practices of caribou (parts to utilize, types of firearms)

3) Increased effort to increase the fair quota to the KHTO regarding muskox in the Kugluktuk harvest area to relieve harvest pressure on BNECH.

A new muskox management zone designated by the GN is MX-11. It occurs on the mainland from the east side of the Coppermine River all the way past Bathurst Inlet to the west side of Ellice River. The KHTO for years noted that the muskox population on the east side of the Coppermine River has been increasing and lobbied the GN to re-evaluate the TAH. In 2013 the GN did a survey of the western 25% of MX-11 which is closest to Kugluktuk. The GN estimated that there was a muskox population of 6746 +/- 1851 in this most western portion of MX-11. (GN – DOE Kitikmeot Muskox Harvest Management Plan 207-18). The Total Allowable Harvest for MX-11 is 225.

In September 2017, the KRWB allocated these tags as follows: Cambridge Bay HTO – 25; Omingmaktok HTO – 40; Burnside HTO – 40 and Kugluktuk HTO – 120.

In November 2017, the KHTO allocated their 120 tags as follows: 60 – beneficiaries; 10 – non-beneficiaries; 30 – country food program; 20 – sports hunts.

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Kugluktuk Angoniatit Association

"Hunters and Trappers Organizations are established for the purpose of protecting wildlife in Nunavut Communities, and to promote the health and culture of our communities by regulating, managing, developing and enforcing specific sections of the Nunavut Agreement for the benefit of all Inuit for years to come." Policies and Procedures for HTOs in Nunavut: Volume One Governance, Nunavut Inuit Wildlife Secretariat.

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SUBMISSION TO THE

NUNAVUT WILDLIFE MANAGEMENT BOARD (NWMB)

Regular Meeting No. RM 002- 2019

FOR

Information: ☐ **Decision:** ☒

Issue: ***Amendment of the Total Allowable Harvest (TAH) for Baffin Island Caribou (BIC), 2019***

Background:

Since 2014, there was at first a TAH of 0 caribou, which was later changed to a TAH of 250 male-only caribou for Baffin Island. The QWB and HTOs have debated this TAH since it was implemented in 2015.

Inuit Qaujimajatuqangit (IQ) teaches that the social behaviour and welfare of caribou is affected when only one sex of caribou is harvested for several years. A balance between the sexes of caribou is needed for every aspect of their complex seasonal and annual lives during their long-term population cycles. It is not just a question of having enough males to mate with females during breeding. The age, size and condition of males can affect calf survival and their growth to become healthy and productive adult females and males. Strong males can break snow and sometimes ice that covers vegetation in winter so females and their calves may access winter forage. Even if science cannot corroborate it, the complex role of males is understood through IQ, and well known among reindeer herders in Eurasia.

The prohibition of Inuit from harvesting female caribou has also undermined Inuit culture values and knowledge regarding the hunting and use of female caribou.

At the 2017 QWB AGM, HTO representatives discussed options for restructuring the harvesting of BIC, passing a resolution for an increase in the total TAH and an allocation for harvesting females. In 2018, the QWB requested that the NWMB increase the TAH to 280, with 35 of them being females. The NWMB asked the QWB to wait for information to be provided by GN biologists about recruitment surveys conducted since 2014.

During a community tour of Qikiqtaaluk communities in January 2019, two biologists from the Government of Nunavut's Department of Environment (DoE) provided information to the Hunters and Trappers Organizations (HTOs) indicating that information from calf-cow ratios showed positive signs that the caribou population on Baffin Island is probably increasing. These conclusions corroborate information from Inuit who travel on the land throughout the year. Hunters are reporting increased caribou distributions and abundances in several areas. Perhaps most notably and consistent with IQ, caribou are returning to the winter hunting area of Cape Dorset, which was first abandoned by caribou in winter 1987-88, 30 years ago.

DoE has indicated that they will not conduct another survey of Baffin Island before 2025.

In lieu of a new survey, the QWB proposes to use the results of 2014 DoE survey to revise the current TAH. In 2014, DoE was 95% confident that there were between 3,462 and 6,250 caribou in the Baffin Island population. Subsequently, the TAH was set at 5.4% of the mean estimate of

4,652. Given the early signs of population recovery as expected based on IQ and supported by DoE recruitment surveys, the QWB recommends that the TAH could be revised to 278 (i.e., 5% of 5,500, which is about half way between the mean estimate and the upper limit of the 2014 confidence-interval limit).

Female caribou have been protected from harvesting for 5 years. We propose that from the 278 TAH, hunters should be allowed to harvest up to 45 females per year on Baffin Island. This could enable the production of up to 2 caribou winter parkas per year in each of 9 communities, assuming that it takes 2-3 caribou skins per parka. These 45 tags should be for either female or male caribou, as hunters may not get all 45 females each year because of accessibility issues.

The NWMB should recognize that this recommendation from the QWB Executive is a very modest request to improve the male-only harvest of caribou on Baffin Island. It does not fully reflect how caribou should be harvested according to IQ.

Consultation:

The QWB, the HTOs and local Inuit have all raised this issue on numerous occasions for years, not only at the QWB AGM in November 2017. The HTOs and QWB participated in rescheduled community consultations by DoE in January 2019.

Recommendation:

The QWB recommends that the TAH for harvesting of caribou on Baffin Island beginning in July 2019 should be set at 278 per year, with up to 45 of those being females. The 45 tags for females should also be available for the harvesting of males.

Prepared by:

Michael Ferguson, Qikiqtaaluk Wildlife Board, 613-407-1197

Date:

May 14, 2019

Kitikmeot Regional Wildlife Board
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Ikaluktutiak
Gjoa Haven
Uqsuqtuuq
Kugaaruk
Kugaaruk
Kugluktuk
Kugluktuk
Taloyoak
Taloyoak

May 22, 2019

Nunavut Wildlife Management Board
P.O. Box 1379
Iqaluit, NU
Attn: Denis Ndeloh, Terrestrial and Avian Species Biologist

Dear Mr. Ndeloh,

Re: Kitikmeot Regional Wildlife Board Support for EHTA Request for Additional Grizzly Bear Sport Hunts Tags

In response to our conference call on May 21st, 2019, KRWB attempted to followed up with Mr. Drikus Gissing to see if the Government of Nunavut had any concerns regarding the EHTA request for five (5) additional grizzly bear tags. Drikus was out on duty travel at the time and we did not get his response. Further, he was to return from duty travel Monday, May 27th, 2019. After the NWMB deadline to receive briefing notes for their June 2019 meeting.

I'd also like to mention the rationale for EHTA's request for additional tags are needed. EHTA has reduced caribou sport hunts on the Dolphin and Union herd after conservation concerns were raised and that EHTA will stop the sport hunts on the herd after the fall of 2019. This will take away income for our local hunters.

We hereby submit this request for five (5) additional grizzly bear tags for the Kitikmeot region and ask NWMB that GN's comments or concerns be included once they are available. Once again, Mr. Gissing is out on duty travel at the time of our request for their input on this request.

If you have any questions, please do not hesitate to contact me or our staff, Ema Qaggutaq at (867) 769-1007 or via email at krwb@niws.ca

Yours truly,

James Panioyak,
Chairperson

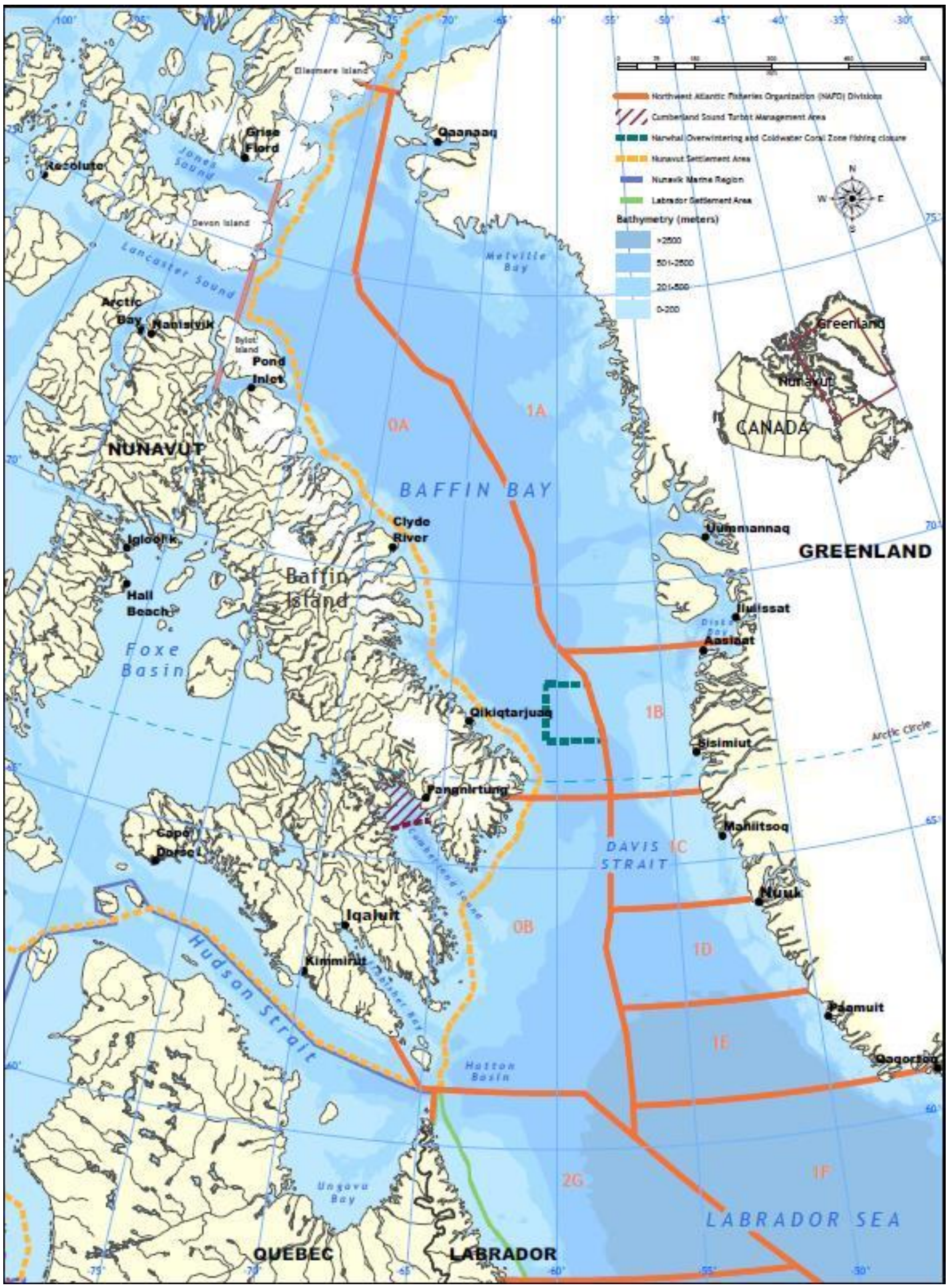
cc. Drikus Gissing, GN
Bert Dean, NTI Wildlife
Robert Greenley, Chair of EHTA

SUBMISSION TO
THE NUNAVUT WILDLIFE MANAGEMENT BOARD

Information: **Decision: X**

Issue: Approval of the 2019 Integrated Fishery Management Plan for Greenland Halibut (Turbot)

Map: NAFO Management Areas



Background:

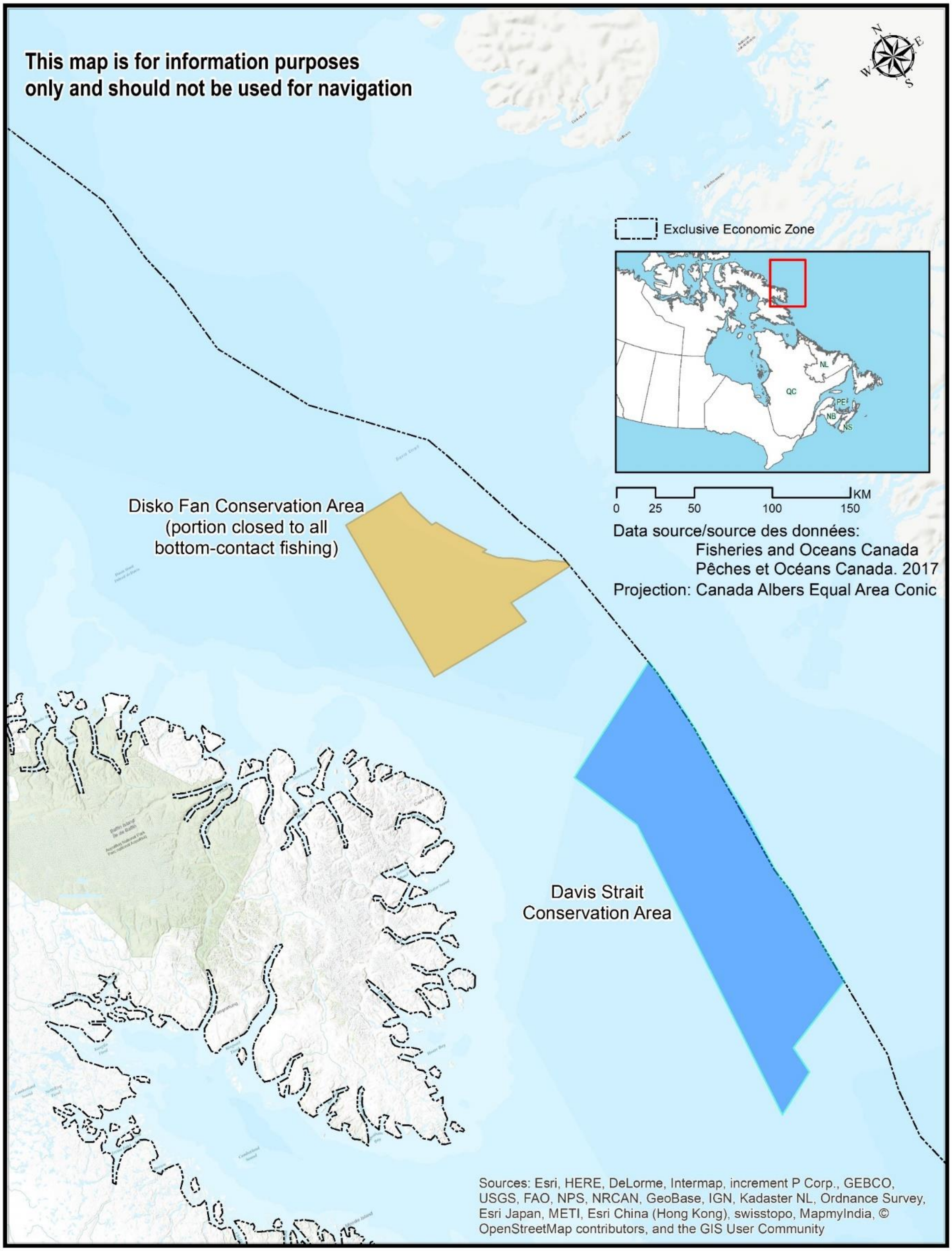
The 2013 Integrated Fishery Management Plan (IFMP) for Greenland Halibut (Turbot) in Northwest Atlantic Fisheries Organization (NAFO) Subarea 0 has been updated and revised for 2019. The IFMP provides a clear and concise summary of the Greenland Halibut fishery characteristics, including the history, location, gear, participants, management issues, decision making processes and biology of Greenland halibut (*Reinhardtius hippoglossoides*). The IFMP describes the existing previously approved management measures, current functioning, rules and realities of the entire fishery in NAFO Subarea 0 (Divisions 0A and 0B). The IFMP does not include the Cumberland Sound Turbot Management Area fishery. A separate IFMP will be developed for that fishery.

Information pertaining to the Nunavut Settlement Area (NSA) and adjacent waters has already been approved through decision making processes between the Board and the Minister. It is important to note that although the IFMP contains some new information, it does not include any proposed changes to the management regime that would affect any allocation holder, harvester or stakeholder in the fishery in or adjacent to the NSA. A summary of changes to the draft IFMP is included in Tab 2.

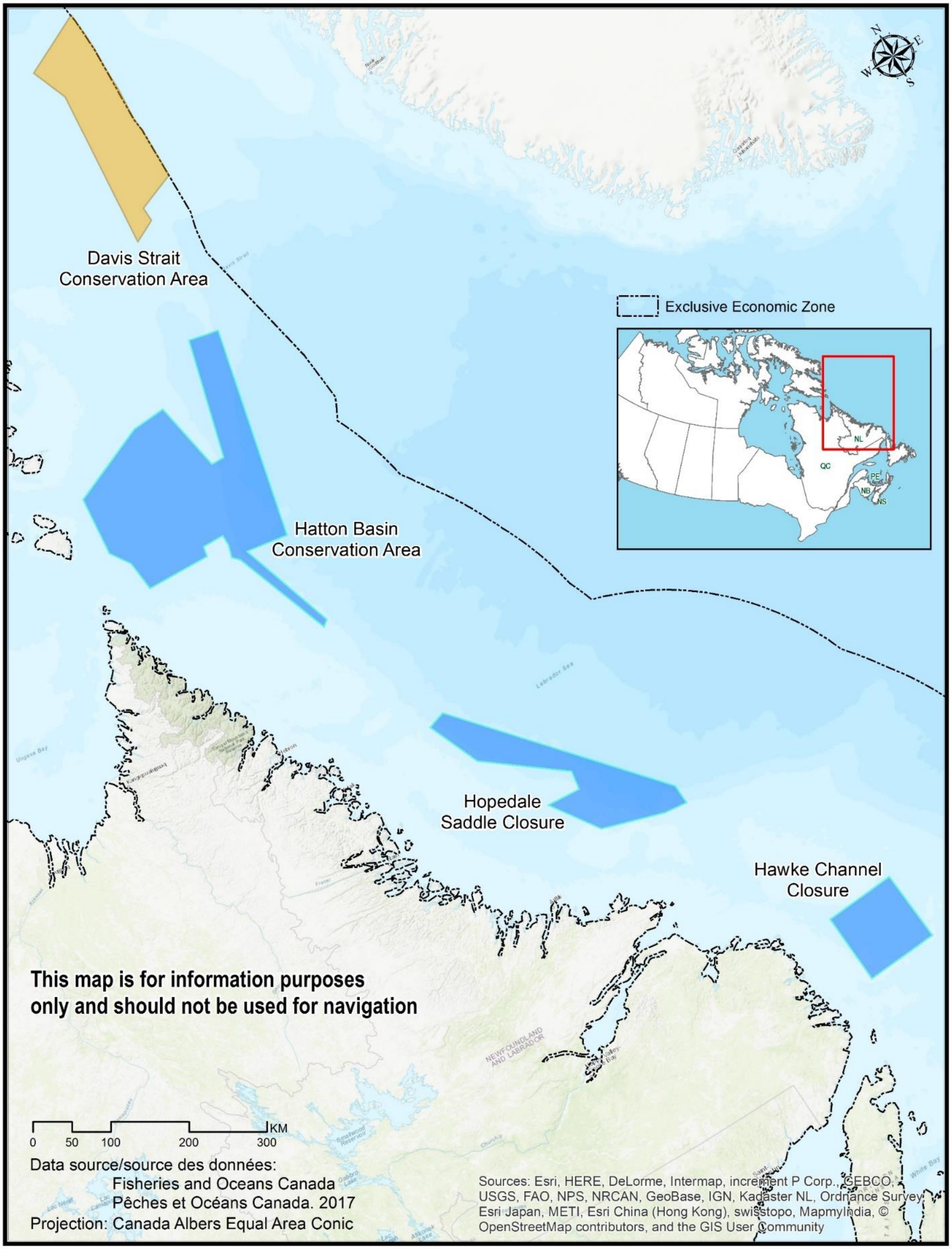
Of note, a new addition to the 2019 IFMP is a description of the new marine refuges created within Subarea 0. The refuges were implemented in 2018 after significant consultation and collaboration with fishery stakeholders, and were provided previously to the Board in June and September of 2017.

Maps of the new conservation areas are included below.

Map: Disko Fan & Davis Strait Conservation Areas



Map: Davis Strait & Hatton Basin Conservation Areas



Consultation:

DFO Central & Arctic Region has provided the opportunity for stakeholders of the Greenland Halibut fishery to review and comment on the draft IFMPs at past meetings of the Eastern Arctic Groundfish Stakeholder Advisory Committee (EAGSAC). The current draft was discussed at the 2019 EAGSAC meeting held on February 19th-20th, 2019 and distributed to EAGSAC members and other stakeholders for review and comment on March 25, 2019. A summary of consultations and stakeholders can be found in Tab 3.

Recommendation:

Given that the updated 2019 IFMP:

- summarizes the current management regime of this fishery and reflects decisions already made, including those resulting from processes between the Board and the Minister;
- does not have any implications to any existing previously approved process / measure in any area of the fishery, whether within or adjacent to the NSA;
- does not propose or imply any new management measures; and
- has undergone a full consultative process with all affected stakeholders, with several opportunities and avenues to submit feedback.

It is recommended that the NWMB approve the revised 2019 IFMP as an evergreen document to replace the 2013 IFMP.

Prepared by:

DFO Resource Management, Central and Arctic Region.

Date:

May 15, 2019

Attachments (3):

Tab 1: 2019 IFMP GHL 2019 Summary Document (Translated)

Tab 2: Summary of 2019 GHL IFMP Changes (Translated)

Tab 3: Consultation Summary (Translated)

Fisheries and Oceans Canada | Pêches et Océans Canada
Fisheries Management | Gestion des pêches

Integrated Fishery Management Plan Summary

Greenland Halibut

(Reinhardtius hippoglossoides)

Northwest Atlantic Fisheries Organization Subarea 0

Effective 2019

Canada

Forward

The purpose of this Integrated Fishery Management Plan (IFMP) summary is to provide a brief overview of the information found in the full IFMP. This document also serves to communicate the basic information on the fishery and its management to Fisheries and Oceans Canada (DFO) staff, legislated co-management boards and other stakeholders. This IFMP provides a common understanding of the basic "rules" for the sustainable management of the fisheries resource.

This IFMP is not a legally binding instrument which can form the basis of a legal challenge. The IFMP can be modified at any time and does not fetter the Minister's discretionary powers set out in the *Fisheries Act*. The Minister can, for reasons of conservation or for any other valid reasons, modify any provision of the IFMP in accordance with the powers granted pursuant to the *Fisheries Act*.

Where DFO is responsible for implementing obligations under land claims agreements, the IFMP will be implemented in a manner consistent with these obligations. In the event that an IFMP is inconsistent with obligations under land claims agreements, the provisions of the land claims agreements will prevail to the extent of the inconsistency.

1. Overview of the Fishery

The Greenland Halibut fishery addressed by this Integrated Fisheries Management Plan (IFMP) occurs in the Northwest Atlantic Fisheries Organization (NAFO) Subarea 0 (Figure 1). Subarea 0 is divided into a northern region, Division 0A (Baffin Bay) which extends from 78°10'N to 66°15'N, and a southern region, Division 0B (Davis Strait) which extends from 66°15'N to 60°12'N.

The Division 0A fishery is an enterprise allocation type fishery with quota reserved exclusively for Nunavut interests, as approved by the Minister. The Division 0B quota is currently shared between Special Allocations, Enterprise Allocations and a competitive allocation. Participants include interests from Nunavut, Nunavik, Labrador, Newfoundland and Nova Scotia.

The Division 0A fishery operates on the calendar year. The fishing season is dictated by the presence of sea ice but typically begins in June and ends in November. Both mobile (single and twin bottom otter trawl configurations) and fixed (longline or gillnet) gear vessels are used and vessels are typically greater than 28m (92') in length due to the harsh environment and location of this fishery. All vessels used in the offshore are outfitted with factory freezer capabilities. The average number of vessels operating in Division 0A between 2014 and 2018 was 10. During this time ~59% of the Division 0A quota was taken by mobile gear and ~41% by fixed gear. Lack of infrastructure (i.e. port facilities and processing plants) in the North presents landing constraints. As a result, catches are offloaded predominately in Greenland ports. In some years a limited amount of fishing has occurred under the 100t exploratory inshore quota.

The Division 0B fishery operates on the calendar year. In the offshore, both mobile (single and twin bottom otter trawl configurations) and fixed (longline or gillnet) gear vessels are used and all have factory freezer capabilities. The fishing season is dependent on ice conditions and usually starts in May and finishes at the end of November. The exception is the Fixed Gear Competitive fishery (quota = 900t) which historically has opened within the first or second week of June and ends when the quota is reached. On average between 2014 and 2018, there were 18 vessels fishing in Division 0B each year. During this time ~56% of the Division 0B quota was taken by mobile gear and ~44% by fixed gear. Interest exists in further development of an inshore summer fishery in the Division 0B portion of Cumberland Sound.

1.6. Governance

Canada and Denmark (on behalf of Greenland) request the NAFO Scientific Council to conduct the stock assessment for the Subarea 0 and Division 1A (offshore) and Divisions 1B-F stock area, including recommendations on Total Allowable Catch (TACs) for Division 0A and 1A (offshore) and 1B in the north and Divisions 0B and 1C-F in the south. Canada retains management authority for stocks in Subarea 0, while Greenland retains management authority in Subarea 1.

Canada's *Fisheries Act*, and the *Fishery (General) Regulations* and the *Atlantic Fishery Regulations*, as well as the *Oceans Act* and the *Species at Risk Act (SARA)* are the main pieces of federal legislation under which the Subarea 0 Greenland Halibut fishery is managed. The powers granted pursuant to these Acts and Regulations permit the Minister to specify licence conditions related to vessel type, gear, species and catch limits, incidental catch, fishing restrictions, information reporting, vessel monitoring system, *SARA* listed species etc.

The Subarea 0 Greenland Halibut fishery is managed consistent with the *Nunavut Agreement* (*NA*) and the *Nunavik Inuit Land Claims Agreement* (*NILCA*). While Government retains ultimate responsibility for wildlife management within and outside respective settlement areas, the Agreements, among other things, set out the harvesting rights of the beneficiaries to the respective Agreements, provide for the establishment of wildlife management structures, set out the role of those structures and cooperative management processes, and contain provisions related to defined waters outside of the settlement areas.

DFO has developed a National Sustainable Fisheries Framework to promote an ecosystem-based approach to fisheries management. This policy framework applies to the Subarea 0 Greenland Halibut fishery.

This IFMP applies to the Subarea 0 Greenland Halibut fishery in waters both inside and outside the Nunavut Settlement Area (NSA). In addition to working with co-management organizations, the management of the Subarea 0 Greenland Halibut fishery is done in collaboration with fishery participants and other stakeholders. Fishery review meetings with co-management organizations and stakeholders are held to review current management measures, discuss management issues, and provide management recommendations. In accordance with the terms of the *NA*, applicable management recommendations are provided for NWMB decision and/or advice. Stakeholder and NWMB decision/recommendations, as approved by the Minister, are incorporated into the IFMP for final approval by the Minister (or designate).

2. Stock Assessment, Science, and Traditional Knowledge

Greenland Halibut of the Northwest Atlantic are highly migratory. The Northwest Atlantic population extends south from Baffin Bay to the waters off the continental slope of Labrador and outer Grand Banks east of Newfoundland, east into Greenland waters and Denmark Strait.

The Baffin Bay-Davis Strait Greenland Halibut stock is thought to originate primarily in the deep-water (800-2000m) spawning grounds in Davis Strait near the submarine ridge between Baffin Island and Greenland. Once spawning occurs, eggs and then larvae drift for up to four months before they metamorphose into the bottom-dwelling life stage. Eggs and larvae originating in the Davis Strait spawning grounds are thought to drift with the currents along the coast of West Greenland and then westwards, until larvae settle on the Greenland and Baffin Island shelves. These relatively shallow waters (<400m) in Baffin Bay and Davis Strait are considered nursery areas where fish are thought to spend the first few years of their lives. Larger fish are found at greater depths and it is believed that the fish migrate off the banks into deeper waters, i.e. eastward into the fjords of Northwest Greenland and south and westward into Baffin Bay and Davis Strait.

Inuit and fisher Traditional Ecological Knowledge (TEK) is an important component of fisheries management and is used with scientific knowledge for effective fisheries decision-making. While Inuit did not traditionally fish Greenland Halibut, Inuit fishers as well as other users have knowledge of the resource. For example, Inuit have experience in the Cumberland Sound inshore fishery which can contribute to understanding in areas such as climate change, sea ice patterns, and fish movements. TEK can contribute to an understanding of long-term changes in environments that ultimately affect the management of Greenland Halibut in Subarea 0.

Biomass and abundance indices, length frequency distribution and catch-per-unit-effort are currently the key metrics used in stock assessments and subsequent recommendations from the NAFO Scientific Council on TACs.

NAFO Scientific Council recommended TACs are set on the basis of available stock biomass and abundance indices and catch size structure. In general, the lack of an appropriate assessment model and precise estimates of Greenland Halibut age and growth makes predicting the impact of fishing effort on future stock recruitment difficult.

Precautionary Approach

A precautionary approach to the management of the fishery, consistent with the basic tenets set out in DFO's *Fishery Decision-Making Framework Incorporating the Precautionary Approach* is applied. Priority is given to monitoring the stock and establishing a data time series to support management decisions. Monitoring stock indices and quantifying scientific uncertainty is done following specific criteria, and peer reviewed through the NAFO Scientific Council process.

3. Economic, Social and Cultural Importance of the Fishery

The Subarea 0 Greenland Halibut fishery adds significant economic value to Northern communities. The landed value average for Nunavut Enterprises from 2011-2017 was around $90 million per year. The fishery is also considered to be the most lucrative Atlantic groundfish fishery with the largest Greenland Halibut TAC in domestic waters.

In Division 0A, during 2011–2017, average Greenland Halibut landings were 7,252t generating an average landed value of $47 million. In Division 0B, during 2011–2017, average Greenland Halibut landings were 7,041t generating an average landed value of $43 million.

Several useful economic indicators are tracked to focus on the trends in recent years. Trends in these variables explain in part the current economic viability of the Greenland Halibut fishery. Exchange rates and ever increasing costs of production have significantly squeezed the profit margin in recent years.

Eco-certification of a fishery from one of the international certification bodies, which is being driven by retailers and the food service sector, has gained significant momentum and become much more main stream. Meeting these increasing buyer preferences imposes additional costs on harvesters.

4. Management Issues

4.1. Fisheries Issues

Scientific Knowledge - The multi-species surveys are the main basis for Greenland Halibut stock assessment and TAC recommendations. These surveys also provide data on species, benthic habitats and oceanographic conditions. Specific studies on Greenland Halibut are required to delineate stocks and understand reproduction, age determination, recruitment and migration. Surveys and research need to continue to support management decisions and resource conservation.

Implementation of a precautionary approach - There are a number of scientific data limitations which preclude the use of standard biomass and harvest metrics to determine reference points and stock status for the Subarea 0 Greenland Halibut stock. Work is planned to explore the use of proxies for calculating reference points and defining harvest decision rules.

Size distribution of catch - Fish size composition of catches varies depending on the gear type and Division. Currently there is a mix of both fixed gear and mobile gear used to prosecute the fishery, with trawls catching primarily small, immature fish, whereas gillnets are catching larger fish with a mix of immature and mature status. Scientific assessments continue to show the stock is healthy with stable or increasing trends in biological indices, suggesting the level of exploitation and harvesting approach have been effective to date. DFO will continue to closely monitor biological indices and the size distribution of the catch, and will take action as needed to ensure sustainability of the resource.

Mitigation of impacts on sensitive benthic areas - Bottom contact fishing gear is used in the Greenland Halibut fishery and these gears are known to impact benthic habitat, communities, and species. Further implementation of DFO’s Policy for Managing the Impacts of Fishing on Sensitive Benthic Areas in the Subarea 0 Greenland Halibut fishery may be required.

Bycatch management - Improvements are needed in bycatch management, including reporting on both retained and released bycatch species as well as clear and consistent information in all Subarea 0 Greenland Halibut fishery management documents. Effective solutions to specific bycatch issues need to be developed in collaboration with harvesters.

Reporting - Issues exist with the accuracy of information reported to DFO including discard amounts, bycatch amounts, landings, etc. Timeliness of reporting is also an issue in some cases. This information is used to monitor quotas and effectiveness of management measures. It is also essential for demonstrating sustainable harvesting and fish harvested are legal, reported and regulated. Concerted efforts are required by all licence holders to provide timely, accurate and complete information as outlined in licence conditions. DFO will continue to work with industry and, where applicable, international counterparts to improve reporting in the Greenland Halibut fishery.

Fishery monitoring - Monitoring is carried out by harvesters, third party At-sea Observers designated by DFO, and DFO staff. A variety of tools and best practices are used to meet fishery monitoring requirements. New approaches and technologies need to be considered and tested. In collaboration with fishery participants, DFO will assess the risks and management requirements of the fishery, review the efficiency of the current fishery monitoring and reporting program, and make changes as required to support sustainable harvesting practices.

Fishery modernization - DFO continues to implement a number of changes aimed at modernizing fisheries management to ensure Canada's fisheries are sustainable, prosperous and competitive for years to come.

Compliance - Conservation and Protection (C&P) is developing a risk-based enforcement plan to better identify the most significant compliance risks/issues in this fishery. C&P continues to work with industry representatives as well as vessel captains to address compliance issues.

Performance review - Progress on achieving the short term objectives and effective implementation of management measures identified in the Plan will be reviewed annually. Recommendations to improve management of the fishery will be developed to meet the long term objectives of maintaining a sustainable fishery.

4.2. Depleted Species Concerns

Subarea 0 contains several depleted species which have either been listed under *SARA*, assessed by Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and awaiting *SARA* listing, or are under a DFO moratorium. These species are of conservation concern for a number of reasons. Also to be noted is the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) of which Canada is a member.

There are also species which do not fall under any of the above formal listing processes but for which concerns exist. For example, sharks and skates typically grow slowly, mature late, and produce few offspring making them susceptible to overexploitation, thus a precautionary approach to management and conservation of these species is warranted.

4.3. Oceans and Habitat Considerations

DFO has developed criteria for the identification of Ecologically and Biologically Significant Areas (EBSAs) in Canada's oceans. EBSAs do not have legal status, but rather are to be considered as areas requiring risk adverse management during planning and decision making processes.

The federal government remains committed to protecting 10% by 2020. The 2017 and 2020 targets are collectively referred to as Canada's marine conservation targets. Through collaboration with industry and stakeholders, within NAFO Subarea 0 the Hatton Basin, Davis Strait, and Disko Fan Conservation Areas are closed to bottom contact fishing under the *Fisheries Act.* These Areas contribute to Canada's marine conservation targets.

4.4. Gear Impacts

Size and age composition of Greenland Halibut catches in the Greenland Halibut fisheries in Subareas 0 and 1 can vary depending on gear type. Bycatch species and rates may vary between gear types and management areas. In the Division 0A fishery the most commonly caught bycatch species includes Greenland Shark, Thorny Skate, Arctic Skate and Roughhead Grenadier. In the Division 0B the most commonly caught species includes Greenland Shark, Thorny Skate, several grenadiers, redfish, and Northern Wolffish.

There are a number of species of marine mammals (primarily seals and whales) found in Subarea 0 that have the potential to interact with fishing gear. Gear interactions with gillnet and trawl entanglements or entrapments can result in serious injury and/or mortality to marine mammals. Several different groups of marine birds have been reported as bycatch, including Northern fulmars (*Fulmarus glacialis*), gulls (unknown species) and phalaropes (unknown species). While fishing with longlines is limited some does occur within the foraging range of several colonies of northern fulmar. Fishing with gillnets also overlaps with the known Northern fulmar foraging ranges of some of the southern colonies in Nunavut.

Different gear types also have different benthic habitat impacts. Management of fishing gears has been developed in the Policy for Managing the Impacts of Fishing on Sensitive Benthic Areas (http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/fish-ren-peche/sff-cpd/benthi-back-fiche-eng.htm).

Abandoned, lost or otherwise discarded fishing gear (ALDFG, or "ghost gear") is a form of marine pollution that can be fatal to fish, marine mammals and other marine life, and poses a navigation hazard. As of 2019 mandatory reporting requirements for lost gear, as well as reporting the retrieval of gear previously reported lost, has been implemented in commercial fisheries.

4.5. International Issues

Canada has various international commitments, agreements and obligations regarding commercial marine fisheries and has developed domestic policies and tools (e.g. Sustainable

Fisheries Framework) to support them. These will be implemented in the Subarea 0 Greenland Halibut fishery in a phased and progressive manner over a number of years based on priorities established by DFO in consultation with the fishing industry and other stakeholders.

Also to be noted, a substantial portion of Greenland Halibut caught in this fishery is offloaded in foreign ports (i.e. Greenland). Canada is working with Greenland officials to establish protocols for sharing and exchange of landing information.

5. Objectives

Objectives for the Greenland Halibut fishery are a key component of the IFMP. Long term objectives guide the management of the fishery and may be categorized as stock conservation, ecosystem, shared stewardship, compliance, and social, cultural and economic objectives. Each long term objective is supported by one or more short term objectives to address existing management issues in the fishery. The objectives listed in Table 1 were developed in consultation with industry, co-management and Inuit organizations, and other stakeholders.

Table 1: Long and short term objectives for the Subarea 0 Greenland Halibut fishery

Long-term Objective	Short-term Objective
Stock Conservation	
Conserve the Greenland Halibut stock through sustainable use and effective fishery management.	• Improve knowledge of Greenland Halibut biology through the continuation of growth, maturity, genetics and migration studies. • Secure funding for annual multi-species surveys to monitor Greenland Halibut abundance and biomass. • Monitor size distribution of catch. • Promote fishing practices that maximize quality of the catch thereby minimizing discards.
Take a precautionary approach to fishery decisions for the Greenland Halibut stock	• Given uncertainties related to the Greenland Halibut stock, take a precautionary approach to setting TACs. • Develop a Harvest Strategy, containing Harvest Control Rules, for this fishery.
Ecosystem	
Conserve sensitive benthic areas through effective fishery management.	• Promote fishing practices that avoid or mitigate impacts on sensitive benthic habitats. • Determine priority areas within Baffin Bay and Davis Strait for future Ecological Risk Assessments.
Conserve bycatch species through effective fishery management.	• Promote fishing practices that avoid or mitigate impact on bycatch species. • Explore population based bycatch limits for vulnerable bycatch species (e.g., *SARA* and COSEWIC listed species, elasmobranchs). • For Northern Wolffish and Spotted Wolffish adhere to pertinent licence conditions. Also, implement fishery management related recommendations found in the Recovery Plan and Action Plan. • Reduce harm to Greenland Shark by promoting awareness of safe release techniques.

	• Improve data collection methods that facilitate improved assessment of seabird bycatch rates and possible impacts.
Shared Stewardship	
Promote collaboration, participatory decision making, and shared responsibility with resource users, co-management organizations and other interested parties.	• Conduct Greenland Halibut fishery meetings with stakeholders on a regular basis. • Work towards specific, measurable, achievable, realistic and time-sensitive (SMART) objectives and commensurate indicators and targets with which to measure progress. • Transition shared responsibility, accountability and decision making to licence holders within the constraints of the *Fisheries Act* and land claim agreements.
Promote collaborative science and management initiatives with Greenland.	
Support effective fishery management through reliable, timely and accessible fishery information.	• Obtain and evaluate information on total catch, effort, and other ecosystem components. • Improve the timeliness and accuracy of discard and landings reporting in the fishery to account for total catch. • Improve bycatch reporting in order to account for total catch. • Improve reporting of Species At Risk in order to account for total catch. • Establish standards and the infrastructure within DFO to support electronic logbooks and encourage their use. • Review monitoring program to identify gaps in monitoring and the associated risks.
Social, Cultural and Economic	
Promote a competitive and prosperous fishing industry that is able to maximize value from fisheries resources and generate economic growth, while ensuring stocks remain healthy and abundant for future generations.	• Support stability in allocation and effective management (subject to the 4th bullet). • Work with stakeholders to improve management of the Division 0B competitive fixed gear fishery including the possibility of moving to a share based regime. • Support increased market access initiatives such as eco-certification. • Continue to take into account relevant land claim agreements and Government of Canada strategies and policies when making access and allocation decisions.
Compliance	
Support effective fishery management through a comprehensive compliance program.	• Conduct a risk assessment of compliance issues. • Develop and implement compliance strategies to address identified compliance risks in this fishery. • Conduct targeted at-sea fishery inspections/patrols. • Conduct targeted aerial surveillance flights. • Collaborate with Newfoundland and Labrador Region for operational planning to support compliance measures. • Strengthen the collection and reporting on intelligence in the fishery. • Conduct an enforcement driven compliance assessment. • Develop and implement a risk-based enforcement plan (including enhanced stakeholder engagement on compliance issues in this fishery to support compliance planning and effectiveness).

6. Access and Allocation

There are two elements that frame the sharing of adjacent marine resources: access (i.e. licences and validations for participation in the fishery) and allocation (i.e. distribution of quota). The Minister can, for reasons of conservation or for any other valid reasons, modify access, allocations and sharing arrangements as outlined in this IFMP in accordance with the powers granted pursuant to the *Fisheries Act*.

Access

There has been no increase in non-Nunavut access to the fishery since 2002. The Government of Canada is supportive of the development of Nunavut's fisheries and recognizes the importance of the commercial fishery to the economy of Nunavut.

Allocations

When making decisions regarding allocation of fisheries resources, primary consideration is given to conservation. Other important considerations include relevant land claim agreements, adjacency, historical dependence and economic viability. With respect to the Greenland Halibut Subarea 0 fishery and land claim agreements, relevant provisions of the *NA* and *NILCA* apply.

Allocations and the NA

With the exception of the 100t inshore allocation in Division 0A, the fishery occurs in the waters of Baffin Bay and Davis Strait (in Division 0A and 0B), which are adjacent to the NSA. Inside the NSA, the NWMB is the main instrument of wildlife management and the main regulator of access to wildlife, including fish.

Access to Nunavut's share of the resource in Divisions 0A and 0B is determined in cooperation with the NWMB who provides decisions and recommendations to the Minister for decision with respect to allocations to Nunavut interests. To make these decisions and recommendations, the NWMB follows its *Allocation Policy for Commercial Marine Fisheries*.

Allocations and the NILCA

Within the Nunavik Marine Region (NMR), the Nunavik Marine Region Wildlife Board (NMRWB) is the main instrument for the management of fish and other wildlife. Where required the Minister seeks the advice of the NMWMB on the allocation of the Division 0B Greenland Halibut TAC to Nunavik Inuit.

7. Management Measures

Management measures outline the controls or rules adopted for the fishery, including stock conservation and ecosystem management measures. These measures are based on the *Fisheries Act* and *SARA* and the regulations made under these acts. Also, non-quota limitations may be established under the *NA* on harvesting activities in the NSA. Variation Orders outline fishing season, management areas and conservation area closures. In addition to the provisions set out in the *Fishery (General) Regulations* and *Atlantic Fishery Regulations, 1985*, specific management measures are outlined in annual licences. Conservation Harvest Plans for each fleet reiterate key management measures found in licences and the IFMP, as well as any industry proposed Codes of Conduct for responsible fishing. *SARA* requirements are included as licence conditions that list species and specific mitigation measures. Habitat protection measures (including closures or partial closures) are also listed in licences. Table 2 provides an overview of management measures currently in place in the NAFO Subarea 0 Greenland Halibut fishery and is appended to this summary.

Quota reconciliation is applied to the Subarea 0 Greenland Halibut fishery and helps to achieve conservation objectives for the resource, ensures that overruns by one fleet/licence holder does not impact others, and provides industry with increased responsibility in meeting conservation objectives.

The Subarea 0 Greenland Halibut fishery is not currently eligible for the carry forward of quota, however Subarea 0 stakeholders continue to support the introduction of Carry Forward provisions in this fishery.

8. Shared Stewardship Arrangements

The Greenland Halibut fishery has a long history of shared stewardship arrangements. Internationally, Canada and Denmark (on behalf of Greenland) ask the NAFO Scientific Council to conduct the Greenland Halibut stock assessment and provide TAC recommendations. As well DFO and the Greenland Department of Fisheries, Hunting and Agriculture are signatories to a Memorandum of Understanding on Issues Related to Satellite Based Vessel Monitoring System (VMS). DFO and the GINR support collaborative research projects and the implementation of the multi-species survey. Research undertaken in collaboration with the Government of Nunavut and its research vessel Nuliajuk supports the development of inshore fisheries.

Through a Memorandum of Understanding with Transport Canada, there is a commitment ensuring safety considerations are outlined in every fisheries management plan.

9. Compliance Plan

The Conservation and Protection (C&P) Program promotes compliance with legislation, regulations and management measures implemented to achieve the conservation and sustainable use of Canada’s aquatic resources, and the protection of species at risk, fish habitat and oceans.

The program is delivered through a balanced regulatory management and enforcement approach including the following:
- promotion of compliance through education and shared stewardship;
- monitoring, control and surveillance activities;
- management of major cases/special investigations in relation to complex compliance issues; and
- strengthening the collection and reporting on intelligence in the fishery.

Designated At-sea Observers are deployed to perform duties best described as "Observe, Record and Report." Duties are related to monitoring of fishing activities, examination and measurement of fishing gear, collection of biological samples, recording of scientific data, monitoring the landing of fish, and verification of the weight and species of fish caught and retained.

All vessels engaged in the NAFO Subarea 0 Greenland Halibut fishery are required to carry a DFO approved satellite tracking device. This VMS is used to monitor fleet activity particularly in and around closed areas and international boundaries as well as deploy surveillance resources. When a vessel is fishing in the NSA, the NWMB requires that vessels carry two (2) VMS units onboard.

With respect to monitoring capacities, the focus is on targeted air surveillance and at-sea patrols in the NAFO Subarea 0 Greenland Halibut fishery. Patrol coverage using government or chartered aircraft with a Fishery Officer onboard is used to identify concentrations and distribution of fishing vessels. In particular, air patrols are necessary to monitor closed and/or conservation areas and the boundary between Canada and Greenland for illegal fishing.

Fishery Officers will focus on targeted compliance and enforcement of the Greenland Halibut commercial fishery by developing and implementing a Risk-based Enforcement Plan and action plan. Fishery Officers conduct investigations in response to reported violations on compliance issues such as fishing in closure areas, licence conditions, regulations, international boundary complaints and other elements of the fishery. Where warranted appropriate enforcement action is taken.

10. Performance Review

This IFMP was developed through a consultative process including resource users, co-management organizations, and other interested parties. DFO will continue to consult and liaise with these groups on an annual basis and as circumstances require, both through formal advisory processes as well as informal ad hoc or issue-related basis between advisory processes.

The stock will continue to be assessed through the NAFO Scientific Council and monitoring of the fishery will be accomplished using several tools including quota reports, daily hails, logbooks, VMS, Dockside Monitoring Programs, At-sea Observers, air surveillance and at-sea patrols.

Figure 1. Northwest Atlantic Fisheries Organization Subareas and Divisions Relevant to the Greenland Halibut fishery

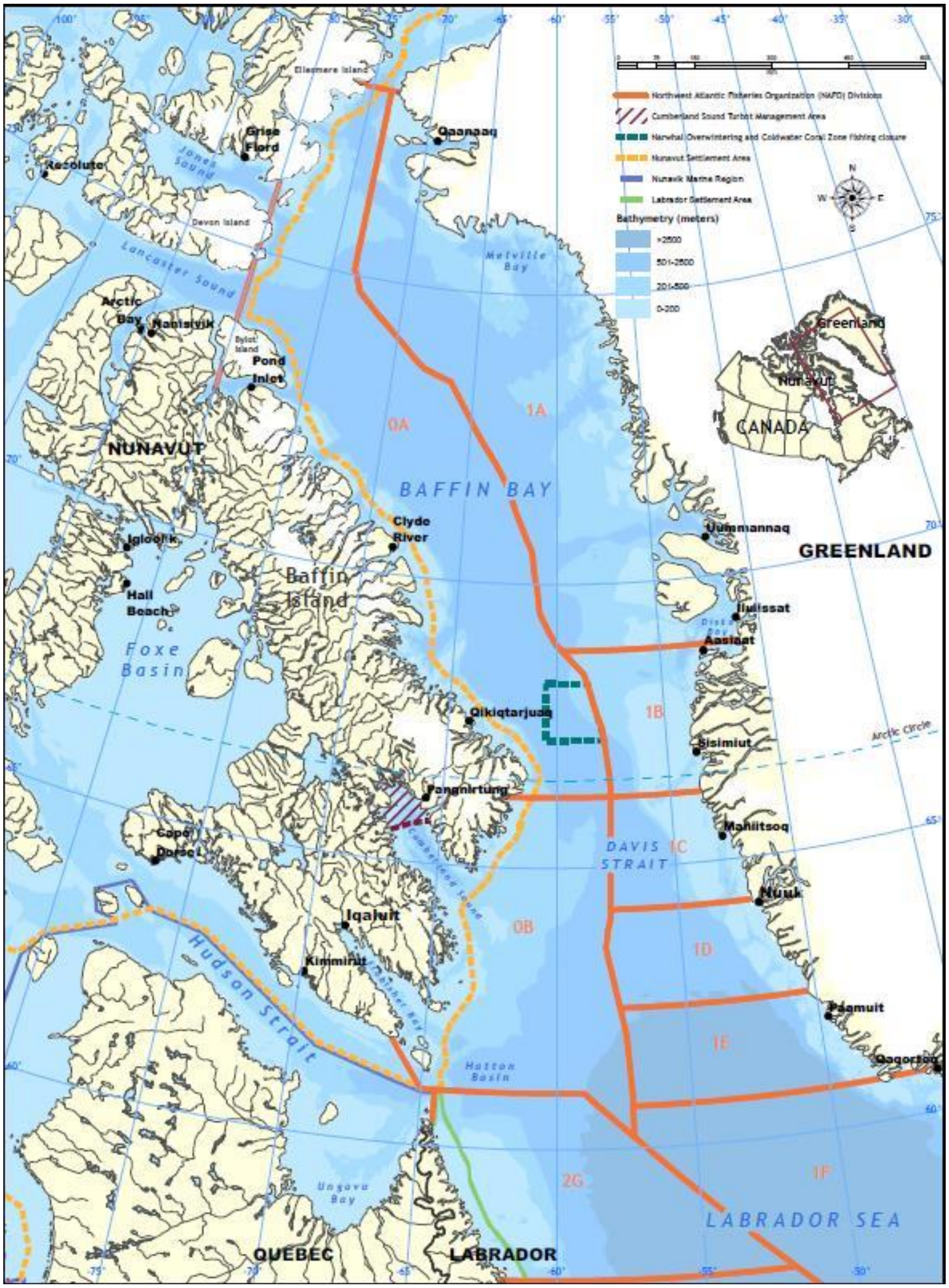


Table 2 - Overview of current management measures in the Subarea 0 Greenland Halibut fishery

Management Measure	Description
Total Allowable Catch (TAC)	• The Minister determines the Canadian TAC for the Greenland Halibut stock.
Licences	• Required when fishing Greenland Halibut.
Vessels	• Specified by fishing licence.
Species, area and catch limitations	• Species, quantity and area permitted to fish are specified in a schedule attached to licence. • Conversion factors for various product forms have been defined by DFO. • Quota reconciliation is applied to all overruns.
Fishing Season	• For Enterprise Allocation and Special Allocation holders, January 1 - December 30 (subject to identified closure provisions). • For Division 0B fixed gear competitive participants, to be determined annually.
Notification of closure	• Via broadcasting, electronic means, or Fishery Officer.
Fishing gear	• Trawl (mobile) • Longline (fixed) • Gillnet (Fixed) ○ Gillnets require a valid tag securely attached to the headrope of each net. • Gear size specifications can be found in Conditions of Licence • Every reasonable effort made to retrieve lost nets. • Fishing gear is not to be left unattended in water for more than 72 consecutive hours.

Management Measure	Description
Fishing restrictions	• No fishing in the NSA or Nunavik Marine Region unless granted permission by respective wildlife board. • No fishing with otter trawls >19.8m in waters <12 nautical miles from Atlantic seacoast. • For fixed gear between May 1 and Dec.31, 20% At-sea Observer coverage is required. • No fishing in Division 0B with gillnets south of 63°10’N from October 1 to December 31. • No fishing with longline in Division 0B south of 63°10’N from October 1 to December 31 except where water depth is >1372m. • Disko Fan Conservation Area*, Davis Strait Conservation Area, and Hatton Basin Conservation Area closed to all Greenland Halibut fishing. • Division 0A closed to fixed gear as of November 11 – December 31 and closed to all gear January 1 – May 31 of each year. Close date may be extended depending on ice conditions.
Bycatch/incidental catch and discards	• Groundfish are to be retained (unless specified otherwise in Conditions of Licence). • Any other fish other than groundfish are to be released and, where alive, in a manner causing the least harm. • Catch of each bycatch species for each trip is not to exceed a specified percentage of the weight of Greenland Halibut caught. • Procedures for Monitoring and Control of Small Fish Catches and Incidental Catches may be applied in this fishery.
Treatment of species listed under the *Species At Risk Act*	• Species at Risk identified in Condition of Licence are to be released and, where alive, in a manner causing the least harm. • Information on interactions with these species is to be recorded in logbook.

Management Measure	Description
Fish Harvester Reporting requirements	• Pre-departure report (hail out) to an At-sea Observer company. • Daily At-sea Reports (daily hails). • Logbook completed daily and provided to DFO by the end of each trip. • Proper labelling of product forms. • End of trip report (hail in) to a Dockside Monitoring Company in Canada. • Lost Fishing Gear Form. • Retrieved Gear Form • Marine Mammal Interaction Form. • Greenland Offloading Notification Form.
Vessel monitoring system (VMS)	• Required to have an approved and operational VMS. • Within the NSA, vessels are to have two VMS transponders onboard that operate on the iridium satellite system.
At-sea Observers	• 100% At-sea Observer required in Division 0A for both mobile and fixed gears. • 100% At-sea Observer required for mobile gear in Division 0B throughout the year and for fixed gear between January 1 and April 30. • Where required, the operator is not to depart for fishing until an At-sea Observer is onboard.
Fish landing procedures	• Offloading in Canady may only be carried out in the presence of a dockside observer. • Offloading in a Greenland can only occur in a port that is authorized under the control of the European Union Border Inspection Post (i.e. Nuuk or Sisimiut). o the offload is to be monitored and documentation related to the offloading completed and submitted to DFO as set out in licence conditions.

Note: For complete information refer to the *Fisheries Act*, *Species at Risk Act*, *Fishery (General) Regulations* and *Atlantic Fishery Regulations, 1985*, as well as specific licences, Notices to Fishers, and Conservation Harvest Plans. Measures may vary based on fleet. In the event of discrepancies between the above table and licence conditions, licence conditions will prevail.

2019 Greenland Halibut IFMP Update Changes

Section	Amended Text/Summary of Changes	Justification for Change
1.3 Historical Development of the Fishery, 1.3.1 Division 0B	In 2017, the Division 0B TAC be increased to 7,575t for the 2017 and 2018 fishing seasons. Subsequent TAC increases in 0B have been implemented by the Minister and can be found at the following website: http://www.dfo-mpo.gc.ca/decisions/index-eng.htm.	Recent and future decisions will be available at the link provided. This will eliminate the requirement to update this section annually.
1.3 Historical Development of the Fishery, 1.3.1 Division 0B	Quota and catch information can be found at the following website: http://www.dfo-mpo.gc.ca/stats/commercial/yrlist-eng.htm.	Quota and catch information will be available online. To ensure up-to-date information is available the link has been provided and tables removed from IFMP. This will eliminate the requirement to update this information annually.
1.3 Historical Development of the Fishery, 1.3.2 Division 0A	The quota for the offshore was 6,400t from 2008-2013, increased to 7,900t in 2014, and increased to 8,575t for the 2017 and 2018 fishing seasons. Subsequent TAC increases in 0A have been implemented by the Minister and can be found at the following website: http://www.dfo-mpo.gc.ca/decisions/index-eng.htm.	Recent and future decisions are/will be available at the link provided. This will eliminate the requirement to update this section annually.
1.3 Historical Development of the Fishery, 1.3.2 Division 0A	Quota and catch information can be found at the following website: http://www.dfo-mpo.gc.ca/stats/commercial/yrlist-eng.htm .	Quota and catch information will be available online. To ensure up-to-date information is available the link has been provided and tables removed from IFMP. This will eliminate the requirement to update this information annually.
1.4. Participants, 1.4.1. Division 0A	Allocation information is publicly available and is provided upon request. Inquiries can be sent to the following email: info@dfo-mpo.gc.ca.	Allocation information is available on request. To ensure up-to-date information is available the email address has been provided and tables removed from IFMP. This will eliminate the requirement to update this information annually and also addresses potential privacy issues.
1.4. Participants, 1.4.2. Division 0B	Allocation information is publicly available and is provided upon request. Inquiries can be sent to the following email: info@dfo-mpo.gc.ca.	Allocation information is available on request. To ensure up-to-date information is available the email address has been provided and tables removed from IFMP. This will eliminate the requirement to update this information annually and also addresses potential privacy issues.
1.5. Fishery Characteristics	Vessel and Catch information in 0A and 0B updated.	Updated information of interest to participants and stakeholders.
2.4. Stock Assessment	Current stock assessment information for Greenland Halibut in NAFO Subarea 0 + Division 1A (offshore), and Divisions 1B-F can be found on the NAFO website at the following link: www.nafo.int/Science/Science-Advice/Stock-advice .	Stock Assessment appendix has been removed and the link to the NAFO Scientific Committee website provided. This will eliminate the requirement to update this information in future versions and ensure most up-to-date information is readily available.
3. Economic, Social and Cultural Importance of the Fishery	Entire section updated to reflect current information on the economic value of the fishery, included recent increases to TAC. Appendix 4 also updated.	Updated information of interest to participants and stakeholders.
4.1. Fisheries Issues, Bycatch Management	Greenland Halibut may also be caught as bycatch in other marine fisheries. In Baffin Bay and Davis Strait, the only other offshore commercial marine fishery is the Northern and Striped Shrimp bottom otter trawl fishery. In Division 0A (i.e. Shrimp management unit 1), total weight of Greenland Halibut incidentally caught has averaged 5.73mt/year from 2005-2014 with 95% of the catch between 5-38 cm based on At-sea Observer data with 100% coverage (Siferd 2010, Walkusz pers. com.). In Division 0B (i.e. the Davis Strait management units), total weight of Greenland Halibut incidentally caught has averaged 7.05 mt/year from 2005-2014 with 95% of the catch between 5-44 cm based on At-sea Observer data with 100% coverage (Siferd 2010, W. Walkusz pers. com.).	Moved from Section 2.4. Stock Assessment. More appropriate to be in this section.

4.2. Depleted Species Concerns	White Sharks (Northwest Atlantic population) have been listed as Endangered under SARA. Although Atlantic Canadian waters comprise a portion of a larger geographic area with high White Shark density in summer months, there have been no recorded observations of White Shark in Arctic or Sub-Arctic waters.	Information added to ensure completeness. Table also reorganized to be clearer to reader. No changes to information.
4.3.2 Canada's Marine and Coastal Areas Conservation Mandate	In October 2017, the Government of Canada announced it had reached its first milestone of protecting 5% of Canada's marine and coastal areas. The federal government remains committed to protecting 10% by 2020. The 2020 target is both a domestic target (Canada's Biodiversity Target 1) and an international target as reflected in the Convention on Biological Diversity's Aichi Target 11 and the United Nations General Assembly's 2030 Agenda for Sustainable Development under Goal 14. The 2017 and 2020 targets are collectively referred to as Canada's marine conservation targets. More information on the background and drivers for Canada's marine conservation targets is available at http://www.dfo-mpo.gc.ca/oceans/conservation/index-eng.html. To meet this target, Canada is establishing Marine Protected Areas (MPAs) and "other effective area-based conservation measures" ("Other Measures"), in consultation with industry, non-governmental organizations, and other interested parties. An overview of these tools, including a description of the role of fisheries management measures that qualify as Other Measures is available http://www.dfo-mpo.gc.ca/oceans/mpa-zpm-aoi-si-eng.html. Within NAFO Subarea 0 the Hatton Basin, Davis Strait, and Disko Fan Conservation Areas are closed to bottom contact fishing under the Fisheries Act. These Areas contribute to Canada's marine conservation targets. Overviews of these Conservation Areas and their conservation objectives are available http://www.dfo-mpo.gc.ca/oceans/oeabcm-amcepz/refuges/index-eng.html	New section added to reflect GoC Marine Conservation Mandate and establishment of the Hatton Basin, Davis Strait and Disko Fan Conservation Areas.
4.4.6. Abandoned, Lost or Otherwise Discarded Fishing Gear	Abandoned, lost or otherwise discarded fishing gear (ALDFG, or "ghost gear") is a form of marine pollution that can be fatal to fish, marine mammals and other marine life, poses a navigation hazard, and also breaks down into other forms of pollution such as microplastics. As part of our G7 Presidency, Canada championed the Charlevoix Blueprint for Healthy Oceans, Seas, and Resilient Coastal Communities, which includes a commitment to strengthen our domestic and international activities to address marine litter. As of 2019 mandatory reporting requirements for lost gear, as well as reporting the retrieval of gear previously reported lost, has been implemented in commercial fisheries to accurately quantify ALDFG in Canada and allow for the development of priority areas for retrieval projects. By becoming a leader in addressing ALDFG, Canada is strengthening its commitment to improve the health of marine ecosystems, protect marine animals from harm, and safeguard human health and livelihoods.	New section added to reflect GoC international commitments to address marine pollution.
5. Objectives	Table 2 updated to clarify wording and also remove objectives that have been met.	Ensure objectives are clear and up-to-date.
6. Access and Allocation	See IFMP	Section updated to clarify the access & allocation process in the fishery. Some information removed since it is included in detail in Appendix 1. (below)
8. Shared Stewardship Arrangements	TC safety-at-sea considerations and measures are available through TC Marine Transportation website at http://www.tc.gc.ca/en/services/marine.html.	To ensure up-to-date information is available to fishery participants, the appendix referencing this information has been removed and this link provided. This will eliminate the requirement to update this information in future versions.
Appendix 1: Key Provisions of the *NA* and the *NILCA*	See IFMP	Appendix has been updated to include key provisions from both the *NA* and the *NILCA.*
Appendix 6: ToR for EAGSAC		Updated ToR approved by EAGSAC in 2019.

GHL IFMP Consultation

Year	Stakeholder(s)	Mechanism
2016-17	EAGSAC	Presentation of proposed revisions and draft IFMP at January 18-19, 2017 EAGSAC meeting
2017-18	EAGSAC	Presentation of proposed revisions and draft IFMP at January 23-24, 2018 EAGSAC meeting
2018-19	EAGSAC	Presentation of updated proposed revisions at February 19-20, 2019 EAGSAC meeting. Distribution of final draft to EAGSAC membership for comment (March 26, 2019). Comments received on/before April 5, 2019.

Current EAGSAC Membership

Interest Type	Member Organization / Interest Group
Co-management Organizations	Nunavik Marine Region Wildlife Board (NMRWB)
	Nunavut Inuit Wildlife Secretariat
	Nunavut Wildlife Management Board (NWMB)
Rights Holders	Nunavut Tunngavik Incorporated
	Makivik Corporation
Coastal Communities	Qikiqtaaluk Wildlife Board
Commercial Fishery Associations	Atlantic Groundfish Council
	Northern Coalition
	Nunavut Fisheries Association
Commercial Fishers/Fisheries	Andrew Daley
	Arctic Fishery Alliance
	Baffin Fisheries Coalition
	Brian McGrath
	Clearwater Seafoods Ltd.
	Craig Clarke
	Cumberland Sound/Pangnirtung Fisheries
	Dominion Trading
	Ecosound Fisheries
	Fish, Food and Allied Workers Union
	Harbour Grace Shrimp Company Ltd.
	Innu Nation
	Jamie Genge
	Heather Starkes
	Labrador Fishermen's Union Shrimp Co
	Mersey Seafoods Ltd.
	Newfoundland Industrial Development Corp / Icewater
	Niqitaq Fisheries
	Nordic Fishing Co (MV Osprey)
	Nunatsiavut Government
	Nunatsiavut Group of Companies
	Ocean Choice International LP
	Qikiqtaaluk Corporation
	Rodney Burton
	Torngat Fish Producers Co-operative
	Ueushuk Fisheries

Environmental Organizations	Ecology Action Centre
	Oceans North Canada
	World Wildlife Fund
Other Government Organizations	Nunavut
	Newfoundland/Labrador
	Quebec
	Environment and Climate Change Canada
	Transport Canada

<u>**SUBMISSION TO THE**</u>

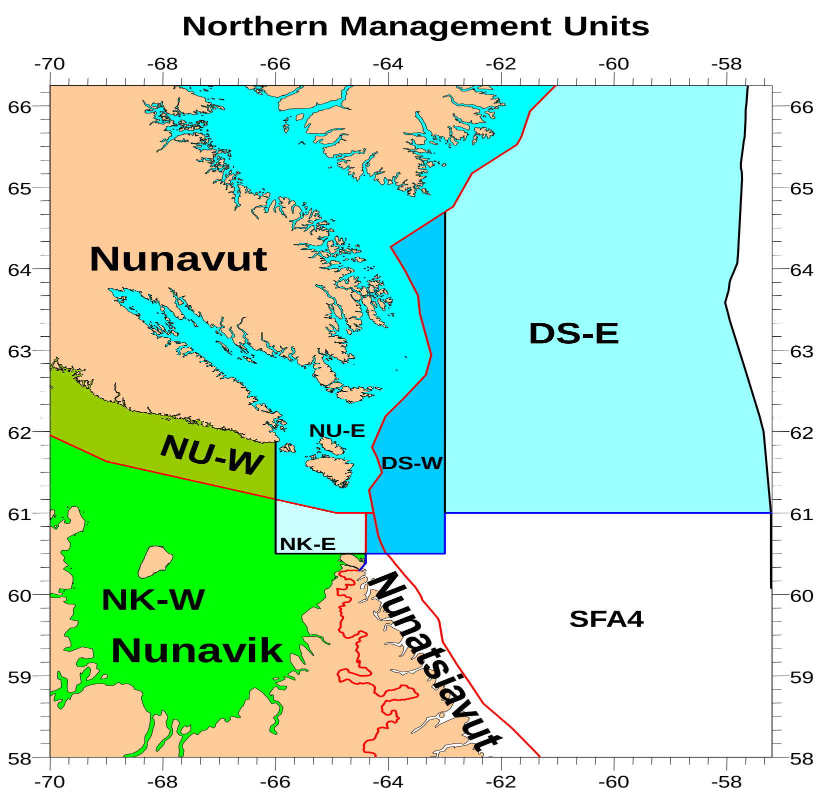
<u>**NUNAVUT WILDLIFE MANAGEMENT BOARD AND NUNAVIK MARINE REGION WILDLIFE BOARD**</u>

<u>**FOR**</u>

Information: **Decision:** X **Recommendation:** X

Issue: 1) Modifying Management Measures for Nunavut (NU) and Nunavik (NK) Allocations in NU/NK East (NU/NKE) and Davis Strait West (DSW); 2) Removing the Bycatch Designation for Borealis in NU/NKE

<u>**Map:**</u>
Blue areas – Eastern Assessment Zone
Green areas – Western Assessment Zone



<u>Background</u>

Two shrimp species (*Pandalus montagui* and *Pandalus borealis*) occur in the Northern shrimp fishery that takes place in the Davis Strait and eastern Hudson Strait which includes parts of the Nunavut Settlement Area (NSA) and the Nunavik Marine Region (NMR). Total Allowable Catch (TAC) for each species is set for two distinct science assessment zones (Eastern and Western), then distributed into management units as per defined sharing arrangements.

This request to the Boards pertains to the management line separating the Nunavut / Nunavik East (NU/NKE), and Davis Strait West (DSW) management units in the Eastern Assessment Zone (EAZ), which functions to delineate the Nunavut Settlement Area and the Nunavik Marine Region waters and the offshore area. Nunavut and Nunavik have allocations in each of these management units, as determined through various decision / recommendation processes between the respective wildlife boards and the Minister. The offshore fleet has allocations in DSW. Davis Strait East is not implicated in this request.

As each management unit is assigned its own quota and allocations, catches must be attributed accurately and accordingly, as per conditions of licence. Licence holders must therefore indicate exactly how much shrimp was caught specifically in NU/NKE, and also in DSW against a specific allocation. Currently, accurate reporting of these allocations according to management units is only possible by beginning and ending a tow in one management unit without crossing into the other.

Given the presence of shrimp at the boundary line and increased focus on ensuring that accurate reporting is being achieved in Canadian fisheries, the Department entered into discussions with Nunavut and Nunavik industry on a way forward, which resulted in the current proposal to allow enterprises that fish Nunavut and Nunavik allocations (through direct allocations and via transfers from other suballocation holders) on both sides of the line to cross over the line in a tow to maximize fishing efficiency operations.

From a Science perspective, the stock assessment for *P. borealis* and *P. montagui* is done at the spatial scale of the EAZ, not the management unit. Without an in-depth analysis of the distribution of the resource and fishing efforts (locations of tows), it is virtually impossible to determine the impact of shifting the fishing efforts between the management units that are proposed to be merged exclusively for the three entities. It appears, however, that the management line dividing the NU/NKE and DSW units is located in the middle of the shrimp aggregation located around Resolution Island. It would be reasonable to assume that currently harvests from NU/NKE and DSW are from the same pool of shrimp. Science expects that the removal of the management line between NU/NKE and DSW for the three entities would have limited overall impact on the resource in the EAZ at this time.

The Department is seeking concurrence from the Boards to allow their combined NU/NKE and DSW allocations to be harvested anywhere in these management units. The process for establishing these Nunavut and Nunavik allocations – by decision within the settlement areas, and by advice for DSW will remain the same, however harvesting and reporting will be based on the larger geographical area of the two management units. In essence and specifically for these allocations, the Department proposes removing the boundary line and approving that each entity will have one single suballocation per species that can be fished anywhere in NU/NKE and DSW, instead of distinct allocations that must be caught in each management unit. This addresses the Condition of Licence requirement for accurate reporting and allows for more streamlined operations without presenting a conservation concern. Offshore allocations will continue to be restricted to Davis Strait.

In order for this change to be possible, the bycatch designation for borealis shrimp in NU/NKE made by the Nunavut Wildlife Management Board and the Nunavik Marine

Region Wildlife Board in 2012 letters dated October 2 and 12 respectively, and accepted by the Minister would need to be modified to be consistent with the directed fishery designation for borealis in DSW. The bycatch designation was in place to align with the previous management regime prior to the 2013 boundary change, in which the SFA 3 (now the Western Assessment Zone) borealis allocation was considered to be a bycatch fishery. There is no bycatch designation for either species in the WAZ.

Montagui is currently a bycatch fishery for the offshore fleet in Davis Strait, and a directed fishery within the settlement areas. The Department will seek recommendations from the Boards and the Northern Shrimp Advisory Committee on the bycatch designation of montagui in Davis Strait for the 2020/21 fishery.

Consultations

The Department had a conference call with Nunavut and Nunavik industry that harvests the NU and NK allocations (Baffin Fisheries Coalition, the Nunavut Fisheries Association, Qikiqtaaluk Corporation, and Makivik Corporation / Newfound Resources Ltd) on the requirement for accurate reporting on Monday, April 1. Industry agrees that the proposed way forward allows accurate reporting of catches against Nunavut and Nunavik allocations while not impeding operations, and notes the absence of any conservation concern.

Summary of Request

The Department requests the Boards to agree that:

1) Harvesters fishing NU and NK allocations can harvest their NU/NKE and DSW allocations anywhere in that combined area; and
2) the bycatch designation for borealis will be removed in NU/NKE.

Next Steps

Should the Boards agree with this approach, the Department will amend the Condition of Licence to reflect that entities fishing Nunavut and Nunavik allocations in both NU/NKE and DSW are permitted to catch these allocations anywhere in the combined NU/NKE and DSW geographical area.

Prepared by: Ecosystems and Fisheries Management, Fisheries and Oceans Canada

Date: May, 2019

May 14, 2019

Daniel Shewchuk
Chairperson
Nunavut Wildlife Management Board
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X0A 0H0

Robert Moshenko
A/Chairperson
Nunavik Marine Region Wildlife Board
P.O. Box 433
Inukjuak, QC
J0M 1M0

Dear Messrs. Shewchuk and Moshenko:

Re: Fishing Nunavut and Nunavik Allocations in Davis Strait West (DSW) and Nunavut/Nunavik East (NU/NKE)

The following letter outlines the support of the Nunavut and Nunavik shrimp industry for the proposal being brought forward by Fisheries and Oceans Canada (DFO) on the fishing of Nunavut and Nunavik allocations within Davis Strait West (DSW) and Nunavut/Nunavik East (NU/NKE).

The Eastern Assessment Zone (EAZ) provides the basis for science assessments and is divided into units (Davis Strait East (DSE), Davis Strait West (DSW) and Nunavut/Nunavik East (NU/NKE)) for management purposes. The line between DSW and NU/NKE marks the boundary between the offshore and the Nunavut and Nunavik settlement areas. Only Nunavut and Nunavik industry sub-allocation holders have access to allocations in NU/NKE and these companies also fish Nunavut and Nunavik's allocations in DSW. Each management unit has quotas associated with it, and catches must be accurately recorded in that unit against those allocations. Despite having allocations in both DSW and NU/NKE, crossing over the line in a single tow results in estimating the origin of catches which according to DFO is insufficient given the Condition of Licence requirement for accurate reporting of catches.

From a Science perspective, the stock assessment for *P. borealis* and *P. montagui* is done at the spatial scale of the EAZ, not the individual management unit. It appears that the management line dividing the NU/NKE and DSW units is located in the middle of the shrimp aggregation located around Resolution Island. As such, it would be reasonable to assume that current harvests from NU/NKE and DSW are from the same pool of shrimp. DFO Science has indicated that the removal of the management line between NU/NKE and DSW for the three Nunavut/Nunavik industry entities active in this fishery would have limited overall impact on the resource in the EAZ at this time.

Based on the above and DFO's conformation that there is no conservation concern, it is proposed that the NU/NKE and DSW management units be amalgamated into one for allocations and catch reporting purposes, specifically and exclusively for Nunavut and Nunavik allocations. In order for this to occur, the bycatch designation for *P. borealis* in NU/NKE would also need to be removed.

This change means that the Nunavut and Nunavik industry's total sub-allocations from DSW and NU/NKE could be fished in either of these two management units. Each of the respective companies would have a single allocation, based on the sum of their sub-allocations for both areas as determined through various processes between their respective Management Board and the Minister.

In summary, the Nunavut and Nunavik shrimp industry members support the proposal to amalgamate the NU/NKE and DSW management unit allocations and the removal of the P. borealis bycatch designation in NU/NKE. These changes will only impact the industry members in Nunavut and Nunavik, simplifying the catch reporting process.

Thank you in advance for the Boards' consideration of the Nunavut and Nunavik industry's recommendations on this issue. Given the minimal impact of the above proposal, we request a quick turnaround in the recommendation process, such that implementation can proceed for the 2019 fishing season in these areas.

Regards,

Jerry Ell	Olayuk Akesuk	Charlie Watt Sr.
Chairperson	Chairperson	President
Baffin Fisheries	Qikiqtaaluk Corporation	Makivik Corporation

cc: Honourable Jonathan Wilkinson, Minister of Fisheries and Oceans, Government of Canada
Mr. Lootie Toomasie, Chairperson, Arctic Fishery Alliance
Mr. Peter Kilabuk, Chairperson, Cumberland Sound Fisheries
Mr. Sakiasie Sowdlooapik, Chairperson, Pangnirtung Fisheries

This change means that the Nunavut and Nunavik industry's total sub-allocations from DSW and NU/NKE could be fished in either of these two management units. Each of the respective companies would have a single allocation, based on the sum of their sub-allocations for both areas as determined through various processes between their respective Management Board and the Minister.

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This change means that the Nunavut and Nunavik industry's total sub-allocations from DSW and NU/NKE could be fished in either of these two management units. Each of the respective companies would have a single allocation, based on the sum of their sub-allocations for both areas as determined through various processes between their respective Management Board and the Minister.

In summary, the Nunavut and Nunavik shrimp industry members support the proposal to amalgamate the NU/NKE and DSW management unit allocations and the removal of the P. borealis bycatch designation in NU/NKE. These changes will only impact the industry members in Nunavut and Nunavik, simplifying the catch reporting process.

Thank you in advance for the Boards' consideration of the Nunavut and Nunavik industry's recommendations on this issue. Given the minimal impact of the above proposal, we request a quick turnaround in the recommendation process, such that implementation can proceed for the 2019 fishing season in these areas.

Regards,

Jerry Ell
Chairperson
Baffin Fisheries

Olayuk Akesuk
Chairperson
Qikiqtaaluk Corporation

Charlie Watt Sr.
President
Makivik Corporation

cc: Honourable Jonathan Wilkinson, Minister of Fisheries and Oceans, Government of Canada
Mr. Lootie Toomasie, Chairperson, Arctic Fishery Alliance
Mr. Peter Kilabuk, Chairperson, Cumberland Sound Fisheries
Mr. Sakiasie Sowdlooapik, Chairperson, Pangnirtung Fisheries

ᕿᑭᖅᑖᓗᖕᒥ ᐃᖃᓗᓕᕆᔩᑦ
BAFFIN FISHERIES

ᒪᑭᕝᕕᒃ
Société Makivik
Makivik Corporation

ᕿᑭᖅᑖᓗᒃ ᑯᐊᐳᕇᓴᓐ
ᓇᒻᒥᓂᖁᑎᖏᓪᓗ
QIKIQTAALUK CORPORATION
& Group of Companies

ᒪᐃ 14, 2019

ᑕᓂᐅᓪ ᓅᑦᓴᒃ
ᐃᒃᓯᕙᐅᑕᖑᑦ
ᓄᓇᕗᑦ ᐅᒪᔪᓕᕆᔾᔪᐊᒃᑯᑦ ᑲᑎᒪᔨᖏᑦ
ᑎᑎᖅᑲᒃᑯᕕᖓ 1379
ᐃᖃᓗᐃᑦ, ᓄᓇᕗᑦ
X0A 0H0

ᐅᕿᐳᑦ ᒧᓴᐃᓐᑯ
ᐃᒃᓯᕙᐅᑕᐅᑕᑲᐃᓐᓇᖅᑐᖅ
ᓄᓇᕕᖕᒥ ᑕᓇᐅᕐᒥᐅᑕᑦ ᐅᒪᔪᓕᕆᓂᖏᓐᓄᑦ ᑲᑎᒪᔨᖏᑦ
ᑎᑎᖅᑲᒃᑯᕕᖓ 433
ᐃᓄᒃᔪᐊᖅ, ᓄᓇᕕᒃ
J0M 1M0

ᑐᕌᖅᑕᐅᔫᒃ ᑐᓴᖅᑎᑦᑎᔩᒃ : ᓅᑦᓴᒃ ᐊᒻᒪ ᒧᓴᐃᓐᑯ:

ᐱᔾᔪᑎᖓ : ᐃᖃᓗᓕᕆᓂᖅ ᓄᓇᕘᕐᒥ ᐊᒻᒪ ᓄᓇᕕᕐᒥ ᑐᓂᔾᔪᓯᐊᒃᓴᖏᓐᓂᑦ ᑰᑕᖏᓐᓂᑦ ᕿᑭᖅᑖᓗᑉ ᐃᑭᕋᓴᖕᒐᑕ ᐱᖓᓐᓇᖓᓂᑦ (DSW) ᐊᒻᒪ ᓄᓇᕗᑦ/ᓄᓇᕕᐅᑉ ᑲᓇᖕᓇᖓᓂ (NU/NKE)

ᐅᑯᐊ ᑎᑎᖅᑲᐃᑦ ᐊᑎᖏᓐᓂᑦ ᓇᓗᓇᐃᖅᓯᕗᑦ ᐃᑲᔪᖅᑐᐃᓂᖏᓐᓂᑦ ᓄᓇᕗᒻᒥ ᓄᓇᕕᖕᒥᓗ ᑭᖑᒃᐸᓕᐊᖕᓂᕐᒧᑦ ᑎᒥᕐᔪᖏᓐᓂᑦ ᑐᒃᓯᕋᐅᑎᓕᐊᓇᔭᒧᑦ ᓯᕗᒧᐊᒃᑎᑕᐅᔪᒥᑦ ᑲᓇᑕᐅᑉ ᐃᒪᕐᒥᐅᑕᓕᕆᔨᖏᓐᓄᑦ ᐃᖃᓗᓕᐅᕐᓂᕆᔭᖏᓐᓂᑦ ᓄᓇᕗᒻᒥ ᓄᓇᕕᖕᒥᓗ ᑐᓂᔾᔪᐊᕆᔭᖏᑕ ᑰᑕᖏᑕ ᐃᓗᖏᓐᓂᑦ ᕿᑭᖅᑕᓘᑦ ᐃᑭᕋᓴᖕᒐᑕ ᐱᖓᓐᓇᖓᓂᑦ ᐊᒻᒪ ᓄᓇᕗᑦ/ᓄᓇᕕᐅᑉ ᑲᓇᖕᓇᖓᓂᑦ.

ᑲᓇᖕᓇᖕᓂ ᖃᐅᔨᓴᖅᑕᐅᓯᒪᔪᒥ ᐊᕙᑎᖓᓂᑦ ᑐᓂᓯᕗᑦ ᑐᓐᖓᕕᒋᔭᐅᔪᒥᑦ ᖃᐅᔨᓴᕈᑎᒋᕙᒃᑕᖏᓐᓄᑦ ᐊᒻᒪᓗ ᐊᕕᒃᑐᖅᑕᐅᓯᒪᕗᑦ ᐊᔾᔨᒌᖏᑦᑐᓂᑦ (ᕿᑭᖅᑖᓗᑉ ᐃᑭᕋᓴᖕᒐᑕ ᑲᓇᖕᓇᖅᐸᓯᖕᒐᓂᑦ, ᕿᑭᖅᑖᓗᑉ ᐃᑭᕋᓴᖕᒐᑕ ᐱᖓᓐᓇᖅᐸᓯᖕᒐᓂᑦ ᐊᒻᒪᓗ ᓄᓇᕗᑦ/ᓄᓇᕕᐅᑉ ᑲᓇᖕᓇᖕᒐᓂᑦ) ᐊᐅᓚᑦᑎᓂᖏᑦ ᐱᔾᔪᑎᒋᓪᓗᒋᑦ. ᓇᓗᓇᐃᒃᑯᑕᐃᑦ ᐊᑯᓂᖏᓐᓂᑦ ᕿᑭᖅᑖᓗᑉ ᐃᑭᕋᓴᖕᒐᑕ ᐱᖓᓐᓇᖅᐸᓯᖕᒐᓂᑦ ᐊᒻᒪᓗ ᓄᓇᕗᑦ/ᓄᓇᕕᐅᑉ ᑲᓇᖕᓇᖕᒐᓂᑦ ᓇᓗᓇᐃᖅᓯᕗᑦ ᑭᓪᓕᕆᔭᖏᓐᓂᑦ ᐃᒪᕕᖕᒥ ᐊᑯᓐᓂᕆᔭᖏᓐᓂ ᐊᒻᒪ ᓄᓇᕗᑦ ᓄᓇᕕᐅᑉ ᐊᖏᕈᑎᖏᑦ ᑭᓪᓕᖏᓐᓄᑦ ᐊᕙᑎᕆᔭᖏᓐᓂᑦ. ᑭᓯᐊᓂ ᓄᓇᕘᒥᐅᑦ ᓄᓇᕕᖕᒥᐅᓪᓗ ᐱᓕᕆᔪᖏᓐᓄᑦ ᑐᓂᔾᔪᐊᒃᓴᒃᑲᓐᓂᕆᔭᐅᔪᑦ ᑎᒍᒥᐊᖅᑎᖏᑦ ᐃᖃᓗᓕᒍᓐᓇᖅᐳᑦ ᑐᓂᔾᔪᐊᒃᓴᖏᓐᓂᑦ ᓄᓇᕗᑦ ᐊᒻᒪᓗ ᓄᓇᕕᐅᑉ ᑲᓇᖕᓇᖅᐸᓯᖕᒐᓂᑦ ᐊᒻᒪ ᑳᑯᐊ ᑲᒪᓂᐅᔪᑦ ᐃᖃᓗᓕᖅᑲᑦᑕᕐᒥᔪᑦᑕᐅᖅ ᓄᓇᕗᑦ ᐊᒻᒪ ᓄᓇᕕᐅᑉ ᑐᓂᔾᔪᐊᒃᓴᖏᓐᓂᑦ ᕿᑭᖅᑖᓗᑉ ᐃᑭᕋᓴᖕᒐᑕ ᐱᖓᓐᓇᖓᓂᑦ. ᐊᑐᓂᑦ ᐊᐅᓚᑎᔨᐅᔪᑦ (ᐊᕕᒃᑕᐅᓯᒪᔪᓂᑦ) ᑰᑕᖅᐳᑦ ᐊᑐᓂᑦ ᐊᕙᑎᓕᐊᕆᓯᒪᔭᓂᑦ, ᐃᖃᓗᒃᑕᐅᔪᑦ ᑕᒪᖅᓯᒪᖏᑦᑎᐊᕐᓗᑎᒃ ᑎᑎᕋᖅᑕᐅᕙᒃᐳᑦ ᐊᑐᓂᑦ ᐊᕙᑎᓕᐊᕆᓯᒪᔭᓂᑦ ᑰᑕᓕᐊᕆᓯᒪᔭᐅᔪᓂᑦ. ᑐᓂᔾᔪᐊᖅᓯᒪᒐᓗᐊᖅᑎᓪᓗᒋᑦ ᑕᒪᕐᒥᒃ ᕿᑭᖅᑖᓗᑉ ᐃᑭᕋᓴᖕᒐᑕ ᐱᖓᓐᓇᖓᓂᑦ ᐊᒻᒪ ᓄᓇᕗᑦ/ᓄᓇᕕᐅᑉ ᑲᓇᖕᓇᖓᓂᑦ, ᐊᑭᖏᑦ ᐅᖓᑖᓄᑦ ᐊᑯᓪᓕᓂᓪᓕᖅᓯᒪᑎᓪᓗᒋᑦ ᓴᖅᑭᑦᑎᓯᒪᖕᒪᑕ ᓇᓚᐅᑦᑖᖅᓯᒪᔪᒥᒃ ᓇᑭᓐᖑᖅᓯᒪᓂᖏᓐᓂᒃ ᐃᖃᓗᒃᑕᐅᔪᓂᑦ, ᒪᓕᒃᑐᒋᑦ ᑲᓇᑕᐅᑉ ᐃᖏᕐᕋᔪᓕᓴᒃᑯᑦ ᓈᒻᒪᖏᓐᓂᕈᐃᓯᒪᖕᒪᑕ ᑕᒡᓗᒋᑦ ᒪᓕᒋᐊᖃᓪᓚᕆᒃᑕᐅᓯᒪᔪᑦ ᓚᐃᓴᒥᒃ ᑕᒪᖏᑦᑎᐊᖅᑐᒥᒃ ᐅᓂᒃᑳᓯᐅᖅᑳᓇᒍᓪᓗᒋᑦ ᐃᖃᓗᒃᑕᐅᔪᓂᑦ.

ᖃᐅᔨᓴᕐᓂᐅᕙᒃᑐᑦ ᑕᒡᓗᒋᑦ, ᑲᑎᖓᔪᑦ ᐃᖃᓗᐃᑦ ᖃᐅᔨᓴᖅᑕᐅᓯᒪᔪᑦ ᐅᑭᐅᖅᑕᖅᑐᒥᑦ ᑭᖑᒃᐸᖏᑦ ᐊᒻᒪ ᑐᐊᑦᑐᑯᓗᒃ ᑭᖑᒃᐸᖏᑦ ᑲᑎᖓᓚᖅᑎᑕᐅᓯᒪᓪᓗᑎᒃ ᑲᑎᑕᐅᕙᖕᒪᑕ ᑲᓇᖅᐸᓯᖕᒪᑕ ᐊᕙᑎᖏᓐᓂᑦ, ᐊᑐᓂᑦ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐊᑐᕐᓂᖅᑲᔪᓂᐅᖏᑦᑐᖅ. ᑕᒃᑯᐅᔾᔮᕐᐳᑦ, ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᑭᒡᓕᖏᑦ ᐊᕕᒃᑕᐅᕙᓂᖏᑦ ᓄᓇᕗᑦ/ᓄᓇᕕᒃ ᑲᓇᖅᐸᓯᖕᒐᓂᑦ ᐊᒻᒪ ᕿᑭᖅᑖᓗᑉ ᐃᑭᕋᓴᖏᓐᓂᑦ ᐃᓂᓕᐅᖅᑕᐅᕙᖕᒪᑕ ᖃᑎᖑᒍᑦ ᑭᖑᒃᐸᐃᑦ ᑲᑎᑕᐅᓯᒪᓂᖏᑎᒍᑦ ᐃᓂᓕᐅᖅᑕᐅᓚᐅᖅᖢᑎᒃ ᐊᑯᓂᖑᓪᓚᑎᒍᑦ ᑐᔫᑦ. ᑕᐃᒪᐃᓐᓂᖑᓄᑦ ᐱᓗᐊᖅᑎᓯᒪᕙᔪᓐᖏᓪᓗᑦ ᐅᓗᒥᐅᔭᖅ ᐃᖃᓗᒃᑲᐅᑦ ᓄᓇᕗᑦ/ᓄᓇᕕᒃ ᑲᓇᖅᐸᓯᖕᒐᓂᑦ ᐊᒻᒪ ᕿᑭᖅᑖᓗᑉ ᐃᑭᕋᓴᖕᒐᑕ ᐱᖓᓐᓇᖓᓂᑦ ᑳᑯᓇᖕᖑᑦᓴᐃᓐᓇ ᑭᖑᒃᐸᑕᖅᑕᖅᑲᐅᒐᔭᖅᐳᑦ. ᑲᓇᑕᐅᑉ ᐃᒪᕐᒥᐅᑕᓕᕆᔨᖏᑦ ᖃᐅᔨᓴᖅᑎᖏᑦ ᓇᓗᓇᐃᖅᓯᓯᒪᕗᑦ ᓅᑕᐅᓗᐊᖅᐸᑦ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᑭᓪᓚᖓ ᐊᑯᓂᖏᓐᓂᑦ ᓄᓇᕗᑦ/ᓄᓇᕕᒃ ᑲᓇᖅᐸᓯᖕᒐᓂᑦ ᐊᒻᒪ ᕿᑭᖅᑖᓗᑉ ᐃᑭᕋᓴᖕᒐᑕ ᐱᖓᓐᓇᖓᓂᑦ ᐱᖓᓱᓂᑦ ᓄᓇᕘᒥ/ᓄᓇᕕᖕᒥ ᐱᓕᕆᔾᔪᑎ ᑎᒥᕐᔪᖏᓐᓂᑦ ᐊᐅᓚᓂᖅᐸᒃᑐᓂᑦ ᐃᖃᓗᓕᐅᕐᓂᕐᒧᑦ ᐊᒃᑐᖅᓯᓂᖃᓗᐊᖅᓱᖓᓕᑦ ᐃᑲᔫᑎᒃᓴᖏᓐᓂᑦ ᑲᓇᖅᐸᓯᐅᑉ ᖃᐅᔨᓴᖅᑕᐅᓯᒪᔫᑉ ᐊᕙᑎᖏᓐᓂᑦ ᒫᓇᐅᔪᒃᑯᑦ.

ᑐᓐᖓᕕᒋᓪᓗᒋᑦ ᖁᑯᓂ ᐅᖃᐅᓯᐅᔪᑦ ᐊᒻᒪ ᑲᓇᑕᐅᑉ ᐃᒪᕐᒥᐅᑕᓕᕆᔨᒃᑯᑦ ᒪᓕᒃᓯᒪᖁᔨᖏᑦ, ᐱᐅᖅᓱᐊᕆᐊᖃᕐᓂᖓᓄᑦ ᐃᓱᒪᒋᐅᑎᐅᓐᖏᑉᐸᑕ, ᑑᒃᓯᕋᐅᑎᓕᐊᕆᔭᐅᕗᖅ ᓄᓇᕗᑦ/ᓄᓇᕗᒃ ᑲᓇᖕᓇᖕᓂᑦ ᐊᒻᒪ ᕿᑭᖅᑖᓗᑉ ᐃᑭᕋᓴᖕᒐᑕ ᐱᖓᓴᖕᒐᓂᑦ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐊᕕᒃᑐᖅᓯᒪᔪᑦ ᑲᑎᖓᓚᖅᑎᑕᐅᖁᔨᔪᖓ ᐊᑕᐅᓯᐅᓕᕐᒧᑦ ᑐᓂᔾᔪᐊᒃᓴᓄᑦ ᑰᑕᓄᑦ ᐊᒻᒪ ᐃᖃᓗᒃᑕᐅᔪᑦ ᐅᓂᒃᑳᓯᐅᖅᑎᐅᔪᖓ ᐱᔾᔪᑎᒋᔭᖏᓐᓄᑦ, ᓇᓗᓇᐃᒃᑲᓂᕐᓗᒍ ᐊᒻᒪ ᑳᑯᓄᖓᑐᐊᖅ ᐊᑐᕐᓗᑎᒃ ᓄᓇᕗᑦ ᐊᒻᒪ ᓄᓇᕕᐅᑉ ᑐᓂᔾᔪᐊᒃᓴᓇᔭᖓᓄᑦ. ᑕᒪᓇ ᐊᑐᓕᖅᑎᑕᐅᓕᖁᓪᓗᒍ, ᐃᖃᓗᒃᑕᓇᓱᖓᓇᑎᒃ ᐃᖃᓗᒃᑕᐅᔪᑦ ᑎᑎᕋᖅᑕᐅᕙᓂᖏᑦ, ᐅᑭᐅᖅᑕᖅᑐᒥ ᑭᖑᒃᐸᐃᑦ ᓄᓇᕗᑦ/ᓄᓇᕕᒃ ᑲᓇᖅᐸᓯᖕᒐᓂᑦ ᐱᖅᑕᐅᒥᐊᖅᓂᐊᕐᒥᔪᑦ.

ᑕᒪᓐᓇ ᐊᓯᔾᔨᓂᖅ ᑐᑭᖃᖅᐳᖅ ᓄᓇᕘᒥ ᐊᒻᒪ ᓄᓇᕕᖕᒥ ᐃᖅᑲᓗᒐᓱᖕᓂᕐᒧᑦ ᐱᓕᕆᕕᖕᒥᑕ ᑲᑎᑦᑐᒥᑦ ᑐᓂᔾᔪᓯᐊᒃᑲᓐᓂᖅᑕᐅᕙᖕᓂᖕᒥᑦ ᐃᖅᑲᓗᒃᑕᐅᓚᔭᖅᐳᑦ ᓇᓕᐊᖕᓂᑐᐃᓐᓇᖅ ᑖᒃᑯᓇᓂ ᐊᐅᓪᓚᑦᑎᓂᕐᒧᑦ ᐊᕕᒃᑐᖅᑕᐅᓯᒪᔪᖕᒥᓐᓂᑦ. ᐊᑐᓂ ᑲᒻᐸᓂᐅᔪᑦ ᐊᑕᐅᓯᕐᒥᒃ ᑐᓂᔾᔪᓯᐊᖅᑲᓕᖁᔭᖅᐳᑦ, ᑐᓐᖓᕕᒋᓗᒋᑦ ᖃᔅᓯᐅᓂᓇᔪᖕᒥᑦ ᑖᒃᑯᓇᓂ ᐊᕕᒃᑐᖅᑕᐅᒃᑲᓐᓂᖅᓯᒪᔪᓂᑦ ᑐᓂᔾᔪᓯᐊᒃᓴᓂᑦ ᑕᒪᕐᒥᒃ ᐊᕙᑎᐅᔪᓂᑦ ᐊᖅᑯᑎᒋᓗᒋᑦ ᐊᔾᔨᒌᖕᒋᑦᑐᑦ ᐱᓕᕆᔾᔪᓯᐅᔪᑦ ᐊᑯᓐᓂᖕᒋᓐᓂᑦ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᑲᑎᒪᔨᐅᔪᑦᑦ ᐊᒻᒪᓗ ᒥᓂᔅᑕᖕᒐᑦ.

ᓇᐃᓪᑎᕐᓗᒍ, ᓄᓇᕘᒥ ᐊᒻᒪ ᓄᓇᕕᖕᒥ ᑭᖑᒃᐸᒐᓱᖕᓂᖕᒥᑕ ᐱᓕᕆᔨᖕᒥᓐᓄᑦ ᐃᓚᒋᔭᐅᔪᑦ ᐃᑲᔪᖅᑐᐃᕗᑦ ᑐᒃᓯᕋᐅᑎᓕᐊᕆᔭᒥ ᑲᑎᙵᓕᖅᑎᑦᓯᖁᐃᓂᕐᒨᖓᔪᑦ ᓄᓇᕗᑦ/ᓄᓇᕕᒃ ᑲᓇᖕᓇᖅᐸᓯᖓᓂᑦ ᐊᒻᒪ ᖁᑭᖅᑖᓗᑉ ᐃᑭᖅᓴᖓᑕ ᐱᖓᓐᓇᖓᓂᑦ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᑐᓂᔾᔪᓯᐊᖅᑎᑦᓯᔨᐅᔪᑦ ᐊᒻᒪ ᓈᑕᐅᓂᓇᔪᖓ ᐅᑭᐅᑦᑕᖅᑐᒥ ᑭᖑᒃᐸᖕᒋᓐᓂᑦ ᐃᖅᑲᓗᒃᑕᐅᓇᓱᖕᓇᑎᒃ ᑭᖑᒃᐸᒃᑕᐅᕙᒃᑐ ᐊᖅᑭᒃᓯᒪᓂᖓ ᓄᓇᕗᑦ/ᓄᓇᕗᒃ ᑲᓇᖕᓇᖓᓂᑦ. ᑖᒃᑯᐊ ᐊᓯᔾᔨᖅᑕᐅᔪᑦ ᐊᒃᑐᖅᓯᓂᖃᕐᓂᐊᖅᑐᑐᐊᑦ ᐃᖅᑲᓗᒐᓱᖕᓂᕐᒧᑦ ᐃᓚᒋᔭᐅᔪᓂᑦ ᓄᓇᕘᒥ ᐊᒻᒪ ᓄᓇᕕᖕᒥ, ᐱᔪᓇᐊᑭᓕᖅᑎᑕᐅᓗᓂ ᐃᖅᑲᓗᒃᑕᐅᔪᑦ ᐅᓂᒃᑲᐅᓯᓇᔪᐅᓂᖕᒥᑕ ᐱᓕᕆᔾᔪᓯᖕᒥᓂᑦ.

ᓯᕗᓂᐊᒍᑦ ᖁᔭᓐᓇᒦᖅᐸᒃᑲ ᑲᑎᒪᔩᑦ ᖃᓄᖅᑑᕈᑎᖃᕐᓂᐊᕐᓂᖓᓄ ᓄᓇᕘᒥ ᐊᒻᒪ ᓄᓇᕕᖕᒥ ᐃᖅᑲᓗᒐᓱᒃᑎᖏᑕ ᐊᑐᓕᖁᓯᒪᔭᖏᓐᓂᑦ ᑖᓐᓇ ᐅᖃᐅᓯᐅᕙᖅ ᐱᔾᔪᑎᒋᓪᓗᒍ. ᐃᓱᒪᒋᓪᓗᒍ ᐊᒃᑐᖅᓯᓂᖃᓗᐊᔾᔮᖏᓐᓂᓇᔪᖓ ᖁᓛᓂ ᑐᒃᓯᕋᐅᑎᓕᐊᕆᔭᐅᕙᖅ, ᐊᐱᕆᒍᒧ ᓱᒃᑲᔪᒥᒃ ᓈᑕᐅᖁᓪᓗᒍ ᐊᑐᓕᖁᔭᐅᓯᒪᔪᒧᑦ ᐱᖁᓯᓇᔪᖓᓂᑦ, ᑕᒪᒃᑯᐊ ᐊᑐᓕᖅᑎᑦᑎᓂᐅᔪᑦ ᑲᔪᓯᔪᓐᓇᕐᓂᐊᕐᒪᑕ 2019ᒥ ᐃᖅᑲᓗᒐᓱᖕᓂᕐᒧᑦ ᐊᕐᕌᒍᒥᔪᓂᑦ ᑖᒃᑯᓇᓂ ᐊᕙᑎᐅᔪᓂᑦ.

ᐃᓚᓐᓈᑎᑦ;

ᔨᐅᓇ ᐃᐅᑦ

ᔫᐊᓇ ᐃᐅᑦ	ᐅᓵᔪᖅ ᐊᑭᔪᒃ	ᓴᓕ ᐅᐊᑦ ᐊᖓᔪᒃᑎᖅ
ᐃᒃᓯᕙᐅᑕᖓᑦ	ᐃᒃᓯᕙᐅᑕᖓᑦ	ᐊᖓᔪᖅᑳᖓᑦ
ᖁᑭᖅᑖᓗᖕᒥ ᐃᖅᑲᓗᓕᕇᑦ	ᖁᑭᖅᑖᓗᒃ ᑯᐊᐳᕇᓴᓐ	ᒪᑭᕕᒃ ᑯᐊᐳᕆᓴᓐ

ᐊᔾᔨᖏᓐᓂᑦ ᑐᓂᓯᕕᐅᔪᑦ

ᔭᓇᑕᓐ ᐅᐃᓪᑭᓐᓴᓐ, ᒥᓂᔅᑕᖓᑦ ᐃᒪᖅᒥᐅᑕᓕᕆᔩᒃᑯᑦ, ᑲᓇᑕᐅᑉ ᒐᕙᒪᖓᓂ
ᓗᑎ ᑑᒪᓯ, ᐃᒃᓯᕙᐅᑕᖓᑦ, ᐅᑭᐅᖅᑕᖅᑐᒥ ᐃᖅᑲᓗᓕᕆᓂᕐᒧᑦ ᑲᑐᔾᔨᖃᑎᒌᖕᒋᓐᓂᑦ
ᐲᑕ ᕿᓚᐸᖅ, ᐃᒃᓯᕙᐅᑕᖓᑦ ᐸᖕᓂᖅᑑᑉ ᐃᖅᑲᓗᓕᕆᔨᖅᑯᖕᒋᓐᓂᑦ
ᓴᑭᐊᓯ ᓴᐅᓪᓗᐊᐱᒃ, ᐃᒃᓯᕙᐅᑕᖓᑦ, ᐸᖕᓂᖅᑑᑉ ᐃᖅᑲᓗᓕᕆᔨᖕᒋᑦ

ᑕᒪᓐᓇ ᐊᓯᔾᔨᓂᖅ ᑐᑭᖃᖅᐳᖅ ᓄᓇᕗᒻᒥ ᐊᒻᒪ ᓄᓇᕕᖕᒥ ᐃᖃᓗᓕᕆᓂᕐᒧᑦ ᐱᓕᕆᕕᖕᒥᑦ ᑲᑎᑦᑐᒥᑦ ᑐᓂᔾᔪᓯᐊᒃᑲᓐᓂᖅᑕᐅᕙᓐᓂᖕᒥᑦ ᐃᖃᓗᒃᑕᐅᒐᔪᖅᐳᑦ ᓇᓕᐊᖕᓂᑐᐃᓐᓇᖅ ᑳᓐᑕᓇᓂ ᐅᓚᕐᑎᓂᕐᒧᑦ ᐊᕕᒃᑐᖅᑕᐅᓯᒪᔪᖕᓂᑦ. ᐊᑐᓂ ᑲᒻᐸᓂᐅᔪᑦ ᐊᑕᐅᓯᕐᒥᒃ ᑐᓂᔾᔪᐊᖃᓕᕐᓯᔪᖅᐳᑦ, ᑐᓐᖓᕕᒋᔪᒥᑦ ᖃᔅᓯᐅᓂᕐᓴᐅᔪᑦ ᑳᓐᑕᓇᓂ ᐊᕕᒃᑐᖅᑕᐅᒃᑲᓐᓂᕐᓯᒪᔪᓂᑦ ᑐᓂᔾᔪᐊᖅᓴᓂᑦ ᑕᒪᕐᒥᒃ ᐊᐸᑎᐅᔪᓂᑦ ᐊᖅᑯᑎᒥᓗᒥᑦ ᐊᐅᓪᓕᕆᐊᖅᑐᑦ ᐱᓕᕆᔭᐅᔪᑦ ᐊᑯᓐᓂᖓᓂ ᐅᓚᕐᑎᓂᕐᒧᑦ ᑲᑎᒪᔨᐅᔪᑦᑦ ᐊᒻᒪᓗ ᒥᓂᔅᑕᖅ.

ᓇᐃᓪᑎᕐᓗᒍ, ᓄᓇᕗᒻᒥ ᐊᒻᒪ ᓄᓇᕕᖕᒥ ᑭᖑᒃᐸᓕᔪᓐᓂᖏᑦ ᐱᓕᕆᔨᖏᓐᓄᑦ ᐃᓚᒋᔭᐅᔪᑦ ᐃᑲᔪᖅᑐᐃᔾᔪᑦ ᑐᒃᓯᕋᐅᑎᓕᐊᕆᔭᒥ ᑲᑎᖓᓕᖅᑎᑦᓯᕈᓯᓂᕐᒨᖓᔪᑦ ᓄᓇᕗᑦ/ᓄᓇᕕᒃ ᑲᓇᖕᓇᖅᐸᓯᖓᓂᑦ ᐊᒻᒪ ᕿᑭᖅᑖᓗᖅ ᐃᑭᓴᖓᑕ ᐱᖓᓐᓇᖓᓂᑦ ᐅᓚᕐᑎᓂᕐᒧᑦ ᑐᓂᔾᔪᐊᖅᑎᑦᓯᐆᔪᑦ ᐊᒻᒪ ᓅᑕᐅᓂᕐᓴᖓ ᐅᑭᐅᖅᑕᖅᑐᒥ ᑭᖑᒃᐸᖕᓂᖕᓂᑦ ᐃᖃᓗᒃᑕᐅᓇᓱᖕᓇᑎᒃ ᑭᖑᒃᐸᒃᑕᐅᕙᒃᑐ ᐊᖅᑭᒃᓯᒪᓂᖓ ᓄᓇᕗᑦ/ᓄᓇᕗᒃ ᑲᓇᖕᓇᖓᓂᑦ. ᑳᒃᑯᐊ ᐊᓯᔾᔨᖅᑕᐅᔪᑦ ᐊᒃᑐᖅᓯᓂᖅᑲᓐᓂᐊᖅᑐᑐᐊᑦ ᐃᖃᓗᓕᕆᓂᕐᒧᑦ ᐃᓚᒋᔭᐅᔪᓂᑦ ᓄᓇᕗᒻᒥ ᐊᒻᒪ ᓄᓇᕕᖕᒥ, ᐱᔭᓇᐊᑭᓕᖅᑎᑕᐅᓗᓂ ᐃᖃᓗᒃᑕᐅᔪᑦ ᐅᓂᒃᑲᐅᓯᓇᔭᐅᓂᖓᑕ ᐱᓕᕆᔭᐅᔪᓂᑦ.

ᓯᕗᓂᐊᒍᑦ ᓴᐳᓐᓇᒥᖅᐸᒃ ᑲᑎᒪᔩᑦ ᖃᓄᖅᑑᕈᑎᖃᕐᓂᐊᕐᓂᖅᑐᖅ ᓄᓇᕗᒻᒥ ᐊᒻᒪ ᓄᓇᕕᖕᒥ ᐃᖃᓗᓕᕆᔨᑎᖅᑕ ᐊᑐᓕᖁᔨᒪᔭᕆᓐ-
ᓂᑦ ᑖᓐᓇ ᐅᖃᐅᓯᐅᔪᖅ ᐱᔾᔪᑎᒋᓪᓗᒍ. ᐃᓱᒪᒋᓪᓗᒍ ᐊᑦᑐᖅᓯᓂᖃᓗᐊᕈᓐᓃᖅᑎᓐᓂᖅᓴᔪᖅ ᖁᑳᓂ ᑐᒃᓯᕋᐅᑎᓕᐊᕆᔭᐅᔪᖅ, ᐊᐱᕆᓗᒍ ᓱᒃᑲᓕᒥᒃ ᓅᑕᐅᖁᓪᓗᒍ ᐊᑐᖅᓯᕐᓗᓯᒪᔪᓐᓄᑦ ᐱᖅᑯᓯᕐᓇᔭᐅᓂᑦ. ᑕᒪᒃᑯᐊ ᐊᑐᓕᖅᑎᑦᑎᓂᐅᔪᑦ ᑲᔪᓯᔪᓐᓇᕐᓂᐊᕐᒪᑕ 2019ᒥ ᐃᖃᓗᓕᕆᓂᕐᒧᑦ ᐊᖏᕈᑎᓯᔪᓐᓂᑦ ᑳᓐᑕᓇᓂ ᐊᐸᑎᐅᔪᓂᑦ.

ᐃᓚᓐᓈᑎᑦ;

ᐆᐊᓇ ᐃᐅᓪ
ᐃᒃᓯᕙᐅᑕᖅ
ᕿᑭᖅᑖᓗᖕᒥ ᐃᖃᓗᓕᕆᔩᑦ

ᐅᓛᕙᖅ ᐊᑭᓱᒃ
ᐃᒃᓯᕙᐅᑕᖅ
ᕿᑭᖅᑖᓗᒃ ᑯᐊᐳᓅᓴᓐ

ᓴᓕ ᐅᐊᑦ ᐊᖓᔮᒃᑎᖅ
ᐊᖓᔭᖅᑲᖓᑦ
ᒪᑭᕕᒃ ᑯᐊᐳᓴᓐ

ᐊᒃᐆᑎᓐᓂᑦ ᑐᓂᓯᕕᐅᔪᑦ
ᔫᓇᑕᓐ ᐅᐃᓪᑭᓐᓴᓐ, ᒥᓂᔅᑕᖓᑦ ᐃᒪᕐᒥᐅᑕᓕᕆᔨᒃᑯᑦ, ᑲᓇᑕᐅᑉ ᒐᕙᒪᖓᓂ
ᓘᑎ ᑑᒪᓯ, ᐃᒃᓯᕙᐅᑕᖅ, ᐅᑭᐅᖅᑕᖅᑐᒥ ᐃᖃᓗᓕᕆᓂᕐᒧᑦ ᑲᑐᔾᔨᖃᑎᒌᖑᔪᓂᑦ
ᐲᑕ ᕿᓚᐸᖅ, ᐃᒃᓯᕙᐅᑕᖅ ᐸᖕᓂᖅᑑᑉ ᐃᖃᓗᓕᕆᔨᐅᑐᖅᑯᑎᒋᔭᐅᓂᑦ
ᓴᑭᐊᓯ ᓴᐅᓪᓗᐊᐱᒃ, ᐃᒃᓯᕙᐅᑕᖅ, ᐸᖕᓂᖅᑑᑉ ᐃᖃᓗᓕᕆᔨᖏᑦ

ᑕᒪᓐᓇ ᐊᓯᔾᔨᓂᖅ ᑐᑭᖓᖃᖅ ᓄᓇᕗᒻᒥ ᐊᒻᒪ ᓄᓇᕕᖕᒥ ᐃᖃᓗᒐᓱᒐᓂᕐᒧᑦ ᐱᓕᕆᕕᖏᑕ ᑲᑎᑦᑐᒋᑦ ᑐᓂᔾᔪᐊᒃᑲᓐᓂᖅᑕᐅᕙᓐᓂᖏᑦ ᐃᖃᓗᒃᑕᐅᒐᔭᖅᐳᑦ ᓇᓕᐊᓐᓂᑐᐃᓐᓇᖅ ᑖᒃᑯᓇᓂ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐊᕕᒃᑐᖅᑕᐅᓯᒪᔪᖏᓐᓂᑦ. ᐊᑐᓂ ᑲᒻᐸᓂᐅᔪᑦ ᐊᑕᐅᓯᕐᒥᒃ ᑐᓂᔾᔪᐊᖃᓕᕐᓱᖅᐳᑦ, ᑐᓐᖓᕕᒥᓗᒥᑦ ᖃᔅᓯᐅᓂᕆᔪᖏᑦ ᑖᒃᑯᓇᓂ ᐊᕕᒃᑐᖅᑕᐅᒃᑲᓂᖅᓯᒪᔪᓂᑦ ᑐᓂᔾᔪᐊᒃᓴᓂᑦ ᑕᒪᕐᒥᒃ ᐊᕙᑎᐅᔪᓂᑦ ᐊᖅᑯᑎᒥᓗᒥᑦ ᐊᔾᔨᒌᖏᑦᑐᑦ ᐱᓕᕆᔾᔪᑎᐅᔪᑦ ᐊᑯᓐᓂᖏᓐᓂᑦ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᑲᑎᒪᔨᐅᔪᑦᑦ ᐊᒻᒪᓗ ᒥᓂᔅᑕᖓᑦ.

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ᓯᕗᓂᐊᒍᑦ ᖁᔭᓐᓇᒦᖅᐸᒃ ᑲᑎᒪᔩᑦ ᖃᓄᖅᑐᕈᑎᖃᕐᓂᐊᕐᓂᖏᓐᓄ ᓄᓇᕗᒻᒥ ᐊᒻᒪ ᓄᓇᕕᖕᒥ ᐃᖃᓗᒐᓱᒃᑎᖏᑕ ᐊᑐᓕᖁᔨᒪᔪᖏᓐᓂᑦ ᑖᓐᓇ ᐅᖃᐅᓯᐅᔪᖅ ᐱᔪᓐᓂᓕᖓᓗᒍ. ᐃᓱᒪᓕᖓᓗᒍ ᐊᒃᑐᖅᓯᓂᖃᓗᐊᓪᔪᖏᓐᓂᕆᔭᖓ ᖁᓖᓂ ᑐᓂᔾᔪᑎᓕᐊᕆᔭᐅᔪᖅ, ᐊᐱᕆᒍ ᓱᒃᑲᓕᒻᒥᒃ ᓈᑕᖁᔨᓐᓗᒍ ᐊᑐᓕᖁᔭᐅᓯᒪᔪᒧᑦ ᐱᖅᑯᓯᕆᔭᐅᖏᓐᓂᑦ, ᑕᒪᒃᑯᐊ ᐊᑐᓕᖅᑎᑦᑎᓂᐅᔪᑦ ᑲᔪᓯᔾᔭᓐᓇᕐᓂᐊᕐᒪᑕ 2019ᒥ ᐃᖃᓗᒐᓱᒐᓂᕐᒧᑦ ᐊᕐᕋᒍᓕᕐᔪᖓᓂᑦ ᑖᒃᑯᓇᓂ ᐊᕙᑎᐅᔪᓂᑦ.

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JOINT SUBMISSION TO
THE NUNAVUT WILDLIFE MANAGEMENT BOARD AND
THE NUNAVIK MARINE REGION WILDLIFE BOARD

Information: X **Decision:**

Issue: Nunavut and Nunavik fisheries added to the List of Foreign Fisheries for review by the United States of America (USA) under import provisions of the Marine Mammal Protection Act (MMPA)

Background:

The US is preparing to implement import provisions described in the MMPA. These import provisions are intended to ensure that the US will only accept imports of fish and fish product originating from foreign fisheries that have levels of marine mammal bycatch that are comparable to US standards. The rule to implement the import provisions was finalized in 2016, with a 5-year exemption period ending on January 1, 2022. During this time, Fisheries and Oceans Canada (DFO) has consulted with industry, the NWMB and the NMRWB to facilitate meeting the requirements of the import provisions.

The MMPA process is being administered by the US National Oceanic and Atmospheric Administration ("NOAA"). Harvesting nations that export fish or fish products to the US are required to provide NOAA with a List of Foreign Fisheries ("LOFF") that lists all of its export fishing operations. After reviewing each country's LOFF, NOAA will determine which export fisheries qualify for a comparability finding. Those that do not receive a NOAA comparability finding will not be able to export fish and fish products to the US after January 1, 2022. (TAB 1)

Fisheries and Oceans Canada (DFO) is updating Canada's portion of the LOFF for a progress report due to NOAA, and will include all fisheries that export to the US, or may wish to do so in future. DFO will be submitting a Progress Report on July 31, 2019 which will provide Canadian fisheries with feedback on which fisheries require more work before submitting a final comparability finding on March 1, 2021. Feedback on the information included in the submission has been requested from relevant parties (TAB 2). Comparability finding decisions will be made by November 30, 2021 and must be renewed every 4 years.

Current Situation:

DFO (Central & Arctic Region) has identified northern fisheries that currently export (or may wish to export) fish or fish products to US markets (Table 1). It is recommended that these fisheries be registered on Canada's section of the LOFF.

Each fishery added to the LOFF will default to an "export" category pending NOAA review, after which NOAA will use the information provided to classify each fishery as "exempt" or "export". The requirements for Canadian fisheries to obtain a NOAA comparability finding will depend on how they are classified (i.e. "export" or "exempt").

NOAA has advised that there will be an opportunity to add additional fisheries prior to the publication of the LOFF in 2020. Prior to this additional deadline, DFO will continue to work with the NWMB, the NMRWB, and co-management organizations to recommend additional fisheries for inclusion in Table 1.

Table 1. DFO (Central & Arctic Region) fisheries that currently export (or may wish to export) fish or fish products to U.S. markets.

Fishery	Species	Gear Type	Listing
Cambridge Bay	Arctic Char	Fixed gear; Gillnet	Export
Cumberland Sound	Arctic Char	Fixed gear; Gillnet	Export
NU Fisheries	Arctic Char	Fixed gear; Gillnet	Export
Cumberland Sound Turbot Management Area (CSTMA)	Greenland Halibut	Fixed gear; Longline	Export
NAFO Subarea 0, 100 ton **	Greenland Halibut	Fixed gear; Pots	Export**
NAFO Subarea 0¥	Greenland Halibut	Fixed gear	Export
NAFO Subarea 0¥	Greenland Halibut	Mobile gear	Export
Shrimp Management Units (SMU) 0, 1, EAZ, WAZ¥	Shrimp	Mobile gear	Export

** Exploratory fishery, may be classed as 'Exempt' after NOAA review

¥ See maps in Figure 1 (a) and (b) below.

Figure 1 (a). Groundfish and shrimp administrative areas in Atlantic Canada

Figure 1 (b). Northern Shrimp Fishery Zones:
- Eastern Assessment Zone "EAZ" (blue)
- Western Assessment Zone "WAZ" (green)

Consultation:

DFO Central & Arctic Region has informed stakeholders of the Shrimp, offshore Greenland Halibut and Cambridge Bay arctic char fisheries through in person meetings. Also, DFO has created 2-page summaries for each of the fisheries listed in Table 1. These summaries were distributed on May 8, 2019 to regional stakeholders for review and feedback prior to final submission. Final comments were required by May 21, 2019 for inclusion in the Progress Report that Canada will submit to NOAA on July 31, 2019. A complete list of consultation activities is appended for reference in (TAB 2).

Recommendation:

That NWMB and NMRWB notify DFO Central & Arctic Region of any concerns about which fisheries are considered for inclusion on Canada's section of the LOFF.

Prepared by:

Aimee Finley and Caitlin Bartel, DFO, Resource Management, Central and Arctic Region.
(204) 983-0599 / (204) 984-2338

Date:

May 8, 2019

TAB 1. Timeline to implement the import provisions of the U.S. MMPA.

TAB 2: List of regional stakeholders consulted for input on DFO Central & Arctic LOFF submissions

LOFF Addition	Consulted Organization(s)	Method of Consultation
Cambridge Bay Arctic Char	Kitikmeot Foods Ltd. (KF) Ekaluktutiak HTO Cambridge Bay Community Elders Nunavut Wildlife Management Board Nunavik Tunngavik Inc. Nunavik Marine Regional Wildlife Board Makivik Government of Nunavut	KF Post-Season Meeting (Jan 2019) Request for comment prior to submission (May 2019)
Cumberland Sound Arctic Char	Pangnirtung HTO: Nunavut Wildlife Management Board Nunavut Inuit Wildlife Secretariat Nunavik Tunngavik Inc. Nunavik Marine Regional Wildlife Board Makivik Government of Nunavut	Request for comment prior to submission (May 2019)
Nunavut Arctic Char Fisheries (remainder)	Community HTOs: Clyde River, Resolute Bay, Pond Inlet, Qikiqtarjuaq, Arctic Bay, Igloolik, Hall Beach, Grise Fiord ,Cape Dorset, Iqaluit, Kimmirut, Sanikiluaq, Gjoa Haven, Taloyoak, Kugaaruk, Kugluktuk, Bathurst Inlet Kitikmeot Regional Wildlife Board Nunavut Wildlife Management Board Nunavik Tunngavik Inc. Nunavik Marine Regional Wildlife Board Makivik Government of Nunavut	Request for comment prior to submission (May 2019)
Cumberland Sound Turbot Management Area (CSTMA) Greenland Halibut	Pangnirtung HTO Cumberland Sound Fisheries Ltd./Pangnirtung Fisheries Ltd. Nunavut Wildlife Management Board Nunavut Inuit Wildlife Secretariat Nunavik Tunngavik Inc. Nunavik Marine Regional Wildlife Board Makivik Government of Nunavut	NFA – DFO Meeting (Dec 2018) Request for comment prior to submission (May 2019)
NAFO Subarea 0, 100 ton	Community HTOs: Arctic Bay, Pond Inlet, Clyde River, Qikiqtarjuaq, Resolute Bay, Grise Fiord, Nunavut Wildlife Management Board Nunavut Inuit Wildlife Secretariat Nunavik Tunngavik Inc. Nunavik Marine Regional Wildlife Board Makivik	Request for comment prior to submission (May 2019)

	Government of Nunavut	
NAFO Subarea 0 Greenland Halibut (Fixed and Mobile Gear)	Nunavut Wildlife Management Board Nunavut Fishery Association (NFA) Eastern Arctic Groundfish Stakeholders Advisory Committee (EAGSAC) Nunavik Tunngavik Inc. Nunavik Marine Regional Wildlife Board Makivik Government of Nunavut	NFA – DFO Meeting (Dec 2018) EAGSAC Stakeholder Advisory Meeting (Feb 2019) Request for comment prior to submission (May 2019)
SMU 0, 1, EAZ, WAZ Shrimp	Nunavut Wildlife Management Board Northern Shrimp Advisory Committee (NSAC) Nunavik Tunngavik Inc. Nunavik Marine Regional Wildlife Board Makivik Government of Nunavut	NSAC Meeting (Mar 2019) Request for comment prior to submission (May 2019)

SUBMISSION TO THE NUNAVUT WILDLIFE MANAGEMENT BOARD May 2019

FOR
Information: X **Decision:**

Issue: Development of Nunavut Fishery Regulations

Background:

Although the *Nunavut Agreement* (NA) came into effect in 1993 and Nunavut was established in 1999, Nunavut fisheries are still managed under various regulations including the *Northwest Territories Fishery Regulations,* the *Atlantic Fishery Regulations* and the *Marine Mammal Regulations.*

In this context, the new Nunavut Fishery Regulations (NFR) aim at updating the regulatory framework application to fisheries in Nunavut and adjacent marine areas, notably by recognizing and respecting the rights of Inuit, the roles of Hunters and Trappers Organizations (HTOs) and Regional Wildlife Organizations (RWOs), and the role of the Nunavut Wildlife Management Board as the main instrument of wildlife management in the Nunavut Settlement Area, as set out in the *Nunavut Agreement*.

A joint statement was released on July 9, 2018 – the 25th anniversary of the signing of the *Nunavut Agreement* – indicating the parties' renewed commitment to co-develop fisheries regulations for the Nunavut Settlement Area.

In September 2018, Makivik Corporation joined the discussions to represent Nunavik Inuit interests as the Areas of Equal Use and Occupancy in the *Nunavut Agreement* also fall within the Nunavik Inuit Land Claims settlement area. A formal Nunavut Fishery Regulations Working Group was formed to lead the co-development of the drafting of the NFRs and is comprised of Fisheries and Oceans Canada (DFO), Nunavut Tunngavik Incorporated (NTI), Nunavut Wildlife Management Board (NWMB), the Government of Nunavut (GN), and Makivik Corporation.

In October 2018 the parties agreed to consider extending the application of the proposed NFR. The proposed scope of the regulations currently applies to all fish (including marine mammals) and includes the areas within the Nunavut Settlement Area (including the Areas of Equal Use and Occupancy). It is also intended to include the Nunavik Marine Region, Hudson Bay and James Bay. This adds further complexity and may result in delays due to increased engagement and consultation requirements as well as consideration of additional regulatory boundaries and consequential amendments.

A target date of December 2019 has been established for pre-publication in Canada Gazette, Part I. All parties recognize that this timeline is extremely ambitious, especially given the area of application has expanded considerably since the July 9, 2018 Joint Statement.

Consultations:

Engagement and consultations on the NFR have begun and are anticipated to continue throughout 2019. On November 27-28, 2018, a workshop was held in Iqaluit with the regional wildlife organizations from

Nunavut and Nunavik to discuss the NFR development concepts and gather information and perspectives from the different regional wildlife organizations.

The co-development parties undertook an extensive community engagement tour of 19 Nunavut communities in February and March, 2019. Additional engagement and consultations with other potentially affected rights holders and stakeholders will continue into the spring and summer of 2019.

A Communications Working Group has been formed and is comprised of communications managers from the co-development organizations. The purpose of the Communications Working Group is to develop a Communications Plan and strategic engagement/consultation activities focused on the communities that will be impacted by the NFR.

A Consultation Website has been established: http://dfo-mpo.gc.ca/fm-gp/peches-fisheries/comm/consultation/nunavut-eng.htm

A Policy Intention document will be drafted for review by the co-development working group in June 2019. This will include a report on the engagement and consultation activities. This document will form the basis of drafting instructions, which will take place between June and October 2019.

Recommendation:

The timeline is extremely ambitious. The inclusion of the Nunavik Marine Region and all fish (as defined by the *Nunavut Agreement* and the *Fisheries Act*) adds additional complexity, which may require the timeline to be modified.

While broadening the application of the proposed regulations will lead to a more robust regime, the added complexity, along with the coming election, may result in unavoidable delays.

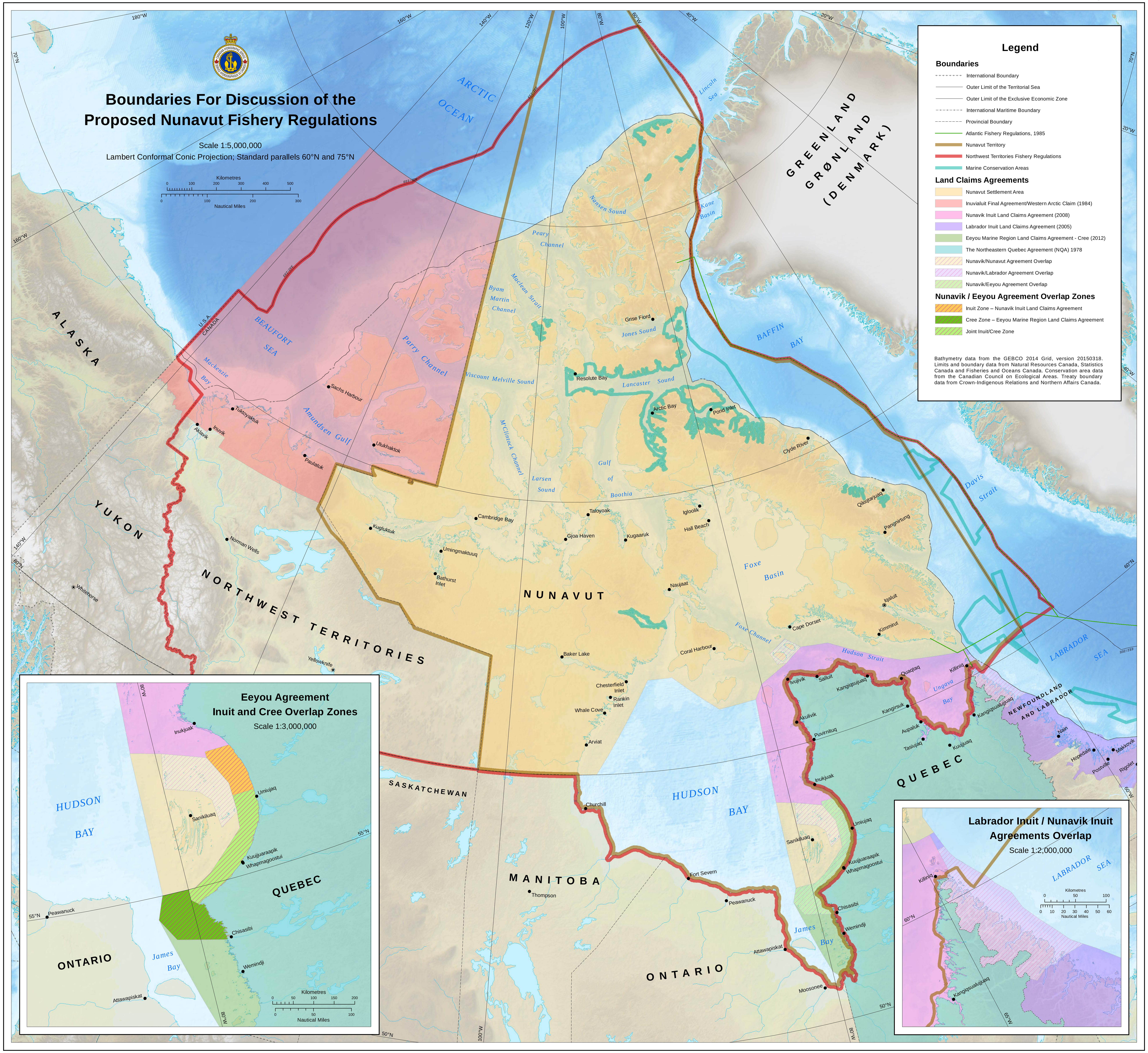
In order to realize the ambitious timelines, we need the continued and active engagement of all co-development organizations, including the Nunavut Wildlife Management Board.

Prepared by: Nunavut Fishery Regulations Co-development Working Group
(DFO, NTI, NWMB, GN and Makivik)

Date: May 15, 2019

Fisheries and Oceans Canada / Pêches et Océans Canada

Canada



FOR ILLUSTRATIVE PURPOSES ONLY

<u>SUBMISSION TO THE</u>
<u>NUNAVUT WILDLIFE MANAGEMENT BOARD</u>
<u>June 2019</u>

<u>FOR</u>

Information: **Decision: X**

Issue: Fisheries and Oceans Canada and the Parks Canada Agency – Tuvaijuittuq Marine Protected Area Proposal

Background:

Fisheries and Oceans Canada (DFO) and Parks Canada Agency (PCA) are interested in advancing marine protection measures for a portion of the high arctic basin multi-year pack ice called 'Tuvaijuittuq'. Protection efforts are currently focused on Tuvaijuittuq because of the ecological significance of the area, stakeholder and partner interests as well as the potential risks from anticipated increases in Arctic Ocean activities. As an interim measure DFO is proposing to use a Ministerial Order under the *Oceans Act*, to freeze the footprint of the area for up to 5 years. This tool will only be available if the Bill C-55 receives Royal Assent.

In December of 2018 DFO sought Nunavut Wildlife Management Board (NWMB) advice on potential protection measures for a portion of the High Arctic Basin that lies outside of the Nunavut Settlement Area. This proposal was for a phased approach to protection which included the use of the Ocean Act Ministerial Order followed by information (science and Inuit Qaujimajatuqangit) collection, stakeholder engagement and collaboration, and long term protection measure determination. At the time the board recommended that DFO undertake additional consultations.

Following this meeting, representatives from PCA, DFO and the Qikiqtani Inuit Association (QIA) negotiated and reached an Agreement in Principle (AiP) on the Inuit Impact and Benefit Agreement (IIBA) for Tallurutiup Imanga National Marine Conservation Area (TINMCA) that committed the parties to, among other things, work collaboratively with the Government of Nunavut (GN) to advance protection of Tuvaijuittuq, including the consideration of interim protection measures under the proposed revisions to the *Oceans Act*. During this time the boundary of the area was extended into the Nunavut Settlement Area to include the coastal waters of northern Ellesmere Island (Figure 1). DFO and PCA (representing Canada), QIA and the GN and have since signed a Memorandum of Understanding (MoU) to develop a process for consideration of environmental designations in Tuvaijuittuq. The MoU provides for the establishment of a Tuvaijuittuq Steering Committee (TuvSC) with representatives from Canada, GN and QIA to guide the feasibility assessment for long-term marine protection in Tuvaijuittuq. The TuvSC is also guiding this proposal for an interim protection measure for Tuvaijuittuq.

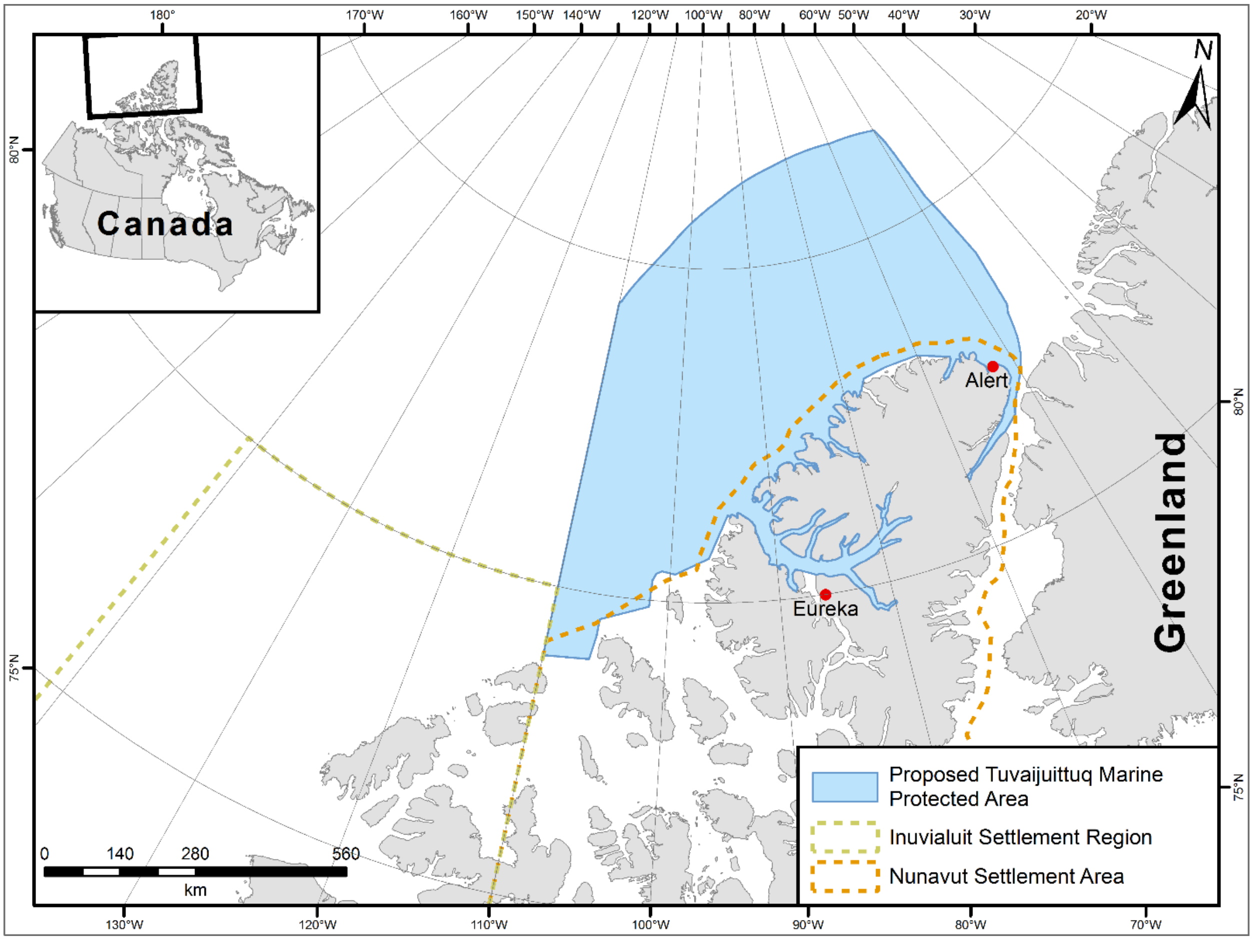


Figure 1. Proposed Tuvaijuittuq Marine Protected Area

Consultations

To date, DFO and PCA have provided information to, and requested feedback from, many stakeholders and partners on a proposed phased approach to marine protection whereby interim protection would be established in Tuvaijuittuq to allow time for the collection of baseline scientific information and for further engagement with co-management partners and stakeholders with regard to long-term protection options. Use of the interim protection option will be dependent on support from parties to the MoU and direction of the Steering Committee.

In addition to QIA and GN, key partners engaged in this process include Nunavut Tunngavik Inc., Inuvialuit Regional Corp., Inuvialuit Game Council, Fisheries Joint Management Council, Government of Northwest Territories, and Government of Yukon Territory.

Initial engagement of communities closest to Tuvaijuittuq began in April 2018. More recently (February 25-28, 2019), DFO and PCA engaged with the Hunter's and Trapper's Organizations (HTOs) and communities of Arctic Bay, Resolute Bay and Grise Fiord in response to recommendations from the NWMB. At these meetings potential protection measures and ongoing

DFO Science initiatives in Tuvaijuittuq were discussed. Representatives from both the GN and the QIA also participated in these meetings. HTOs and attending members from all three communities were generally supportive of both interim and long-term protection of Tuvaijuittuq, as well as the collection of scientific data to better understand the area. Community concerns related to Tuvaijuittuq included the appropriate regulation of small and large vessel traffic to avoid impacts to ice, marine mammals and other biota, and potential impacts from activities such as oil and gas exploration and research.

In April 2019, the Government of the Northwest Territories wrote to DFO expressing concerns with the proposed Tuvaijuittuq MPA boundary While the Government of Canada has the authority under the *Oceans Act* to establish a marine protected area in any area of the sea, the boundary of the Tuvaijuittuq proposed MPA was modified to remove the area that caused concern in the spirit of collaboration (Figure 1).

Request:

DFO is requesting approval for establishment of a conservation area for Tuvaijuittuq, through designation of a Marine Protected Area by Ministerial Order under the proposed *Oceans Act* amendment (Bill C-55). Consistent with the Nunavut Agreement s9.3.2 (establishment of conservation areas).

A decision is requested by July 3, 2019.

Prepared by: Central and Arctic Region – Fisheries and Oceans Canada, Oceans Program
Date: May 15, 2019

Consultation and Engagement Summary

Link to Tallurutiup Imanga National Marine Conservation Area

In the Fall of 2018, QIA expressed their interest to include an area of the Tuvaijuittuq area as part of the Inuit Impact and Benefits Agreement (IIBA) for Tallurutiup Imanga National Marine Conservation Area (TINMCA). The PCA, along with DFO and Transport Canada are engaged in the negotiation of the IIBA. In response to QIA's proposal, representatives from PCA and DFO and QIA negotiated and reached an Agreement in Principle (AiP) on the IIBA that committed the parties to, among other things, work collaboratively with the Government of Nunavut (GN) to advance protection of Tuvaijuittuq, including the consideration of interim protection measures under the proposed revisions to the Oceans Act.

Following signing of the AiP, PCA and DFO (representing the Government of Canada), the Government of Nunavut, and the QIA negotiated a Memorandum of Understanding (MoU) on the desirability and feasibility of protection measures for Tuvaijuittuq. The MoU provides for the establishment of a steering committee with representatives from the Government of Canada, the Government of Nunavut and QIA to guide the feasibility assessment for marine protection in Tuvaijuittuq. It is the intent of the parties that any IIBA considerations for the protection measures to be established in Tuvaijuittuq, including a potential national marine conservation area and a potential *Oceans Act* marine protected area, will be covered under the TINMCA IIBA, the signing of which is expected in June 2019.

Change to boundary related to engagement efforts

Between April 2018 and January 2019, key partners and stakeholders were engaged through various methods regarding protection options for the area of Tuvaijuittuq situated outside the Nunavut Settlement Area and Inuvialuit Settlement Region. The decision to begin work outside the boundaries of the settlement area was based on the urgent need for baseline ecological information in the context of climate change, and the Qikiqtani Inuit Association's (QIA) priority at that time to focus their efforts on other initiatives in the Qikiqtani region. Starting in February of 2019, engagement efforts were focused on an expanded area, which includes a portion of the Nunavut Settlement Area. This revised area was based on the study area identified in the AiP associated with the TINMCA IIBA negotiations.

Engagement to date

DFO has engaged with partners (including Indigenous organizations, Territorial Governments and nearby communities), other federal departments and key stakeholders to identify all ongoing and authorized activities in the proposed area in the last 12 months and to seek feedback regarding both interim and long-term protection in Tuvaijuittuq. In May 2017, a Nunavut Marine Conservation Target (MCT) Steering Committee, with participation from senior-level representatives from Environment and Climate Change Canada (ECCC), PCA, Crown-Indigenous Relations and Northern Affairs Canada (CIRNA), Transport Canada, DFO, the Government of Nunavut Department of Environment, and Nunavut Tunngavik Inc. (NTI) was established to provide a coordination mechanism on marine conservation activities planned and underway within and surrounding Nunavut. This group has been a primary forum for updating and engagement of key partners in the Nunavut Settlement Area. In the Inuvialuit Settlement Region, key partners have been engaged through the Beaufort Sea Regional Coordination

Committee, which is comprised of the Inuvialuit Regional Corporation (IRC), the Inuvialuit Game Council, the Fisheries Joint Management Committee (FJMC), PCA, CIRNA, the Government of the Northwest Territories (GNWT), the Yukon Government, ECCC, Natural Resources Canada (NRCan) and Transport Canada.

In April 2018, DFO traveled to the communities of Resolute Bay and Grise Fiord to meet with Hunters and Trappers Organization (HTO) boards to provide updates on potential areas of interest (AOIs) in Canada's Arctic, to gauge community support for protection measures in the High Arctic marine environment, and to consult on the scientific field work proposed by DFO in the vicinity of communities between 2018 and 2020. At that time, the Iviq (Grise Fiord) board indicated that they required more information regarding the High Arctic before they could support protection in that region. Resolute Bay HTO supported protection measures in the area but expressed concern regarding the Government of Canada's capacity for enforcement.

In June 2018, a proposal to use a phased approach for marine protection in Tuvaijuittuq (or "High Arctic Basin") was presented to the Nunavut MCT Steering Committee. Subsequently, letters were sent to both Eastern and Western Arctic Inuit representatives and Territorial governments outlining a proposed approach to provide interim protection to Tuvaijuittuq. Letters were sent from the Assistant Deputy Minister (ADM) of DFO and the Vice President of PCA to the President of NTI, the President of the QIA, the ADM of the Department of Environment for the Government of Nunavut, the Chief Executive Officer and Chair of the IRC, the Chair of the IGC, the Chair of the FJMC, the Superintendent of the Department of Environment and Natural Resources with the Government of Northwest Territories, and the Senior Oil and Gas Advisor with the Yukon Government. Later that month, information packages were sent to Eastern Arctic Inuit representatives outlining a proposed phased approach to protect Tuvaijuittuq. The letters sought feedback on the proposal.

In July 2018, following senior-level correspondence with key stakeholders, information was sent to other key federal partners, including the Department of National Defense (DND), Global Affairs Canada (GAC), ECCC, Transport Canada, the Canadian Coast Guard (CCG), NRCan, and the Department of Justice (DoJ) by way of email. The emails described the proposed approach for protection in Tuvaijuittuq and asked for feedback on interim protection for the area.

Feedback associated with engagement activities in June and July 2018 was as follows:

- Within the MCT Nunavut Steering Committee concerns were expressed related to Canada's obligations under the Nunavut Agreement and refinement of the Tuvaijuittuq boundary;
- The Government of Nunavut sent a letter to Canada's Minister of Fisheries and Oceans on October 1, 2018 expressing concern over the use of an interim protection measure in the High Arctic, including concerns related to due process (i.e., allowing time for consultation and assessment), the rationale for interim protection, and the loss of access to possible resources;
- Arctic Security Consultants expressed full support for interim protection of Tuvaijuittuq;

- The Nunavut Fisheries Association communicated their support for interim protection of Tuvaijuittuq, as well as for the conduct of additional research in the area. They indicated that protecting the area will have no impact on the fishing industry;
- Oceans North verbally communicated their support for interim protection in this area;
- WWF has been calling for the protection of the Last Ice Area (which includes the proposed IPMPA) for many years. WWF verbally communicated that they will support interim protection in this area; and
- The Nunavut Wildlife Management Board recommended that DFO seek formal advice from the Board as per section 5.2.34 of the Nunavut Land Claims Agreement (NLCA).

In early September 2018, the proposal for protection of Tuvaijuittuq was provided to the Beaufort Sea Regional Coordinating Committee and the IGC at regular meetings. The proposal yielded no comment/questions from participants except that the Inuvialuit Regional Corporation does not support establishment of new marine protected areas in the Inuvialuit Settlement Region until Inuvialuit concerns with the current MPA funding model and northern Oil and Gas moratorium were addressed.

In September 2018, the proposed approach was also presented to the FJMC at a face to face meeting. The FJMC was supportive of work to strengthen the MPA program in the Western Arctic and requested continued updates on Tuvaijuittuq. Later in September 2018, the information package was sent to a broader distribution list, which included Nunavut Inuit Wildlife Secretariat, Nunavut Fisheries Association, Nunavut Wildlife Management Board/Nunuavut Marine Council, Nunavut Impact Review Board, Qikiqtaaluk Wildlife Board, Inuit Circumpolar Council, Qikiqtaaluk Corp., the Resolute Bay, Grise Fiord and Arctic Bay HTOs, and the Ecology Action Centre. In November 2018, the same information was sent to the shipping industry through the Canadian Marine Advisory Council distribution list, which includes hundreds of stakeholders.

In December 2018, DFO formally presented the proposal to the Nunavut Wildlife Management Board and requested advice. DFO received a letter from the Nunavut Wildlife Management Board on January 2, 2019 indicating that additional engagement was required prior to providing official advice. Following the Nunavut Wildlife Management Board's recommendation, plans were made for additional engagement with interested communities involving DFO, PCA, Government of Nunavut and QIA. In February 2019, DFO, PCA and the Government of Nunavut visited the communities of Arctic Bay, Resolute and Grise Fiord to update the communities with respect to research programs and seek feedback on potential protection options for Tuvaijuittuq. Local QIA representatives attended the HTO meetings and provided valuable feedback. Both the HTO's and communities of Arctic Bay, Resolute and Grise Fiord were generally supportive of long-term protection measures as well as the use of the interim protection tool.

DFO met with the Nunavut MCT Steering Committee and the Beaufort Sea Partnership Regional Coordinating Committee in February 2019 and March 6, 2019, respectively, to provide updates for Tuvaijuittuq and associated Ministerial Order Policy Intent proposed under Bill C-55. Participants in the

Regional Coordinating Committee meeting included IRC, IGC, FJMC, PCA, CIRNA, GNWT, Yukon Government, ECCC, NRCan, and TC. There were no comments or questions.

DFO met with the Beaufort Sea Regional Partnership Coordinating Committee in March 2019 to provide updates on Tuvaijuittuq and associated Policy Intent. Participants in the meeting included IRC, IGC, FJMC, PCA, CIRNA, GNWT, Yukon Government, ECCC, NRCan, and TC. There were no comments or questions.

On April 5th 2019, DFO met with the Nunavut Marine Council Working Group which has representation from the Nunavut Planning Commission, the Nunavut Wildlife Management Board, Nunavut Water Board and the Nunavut Impact Review Board. The representative from the Nunavut Impact Review Board was unable to attend. An overview of the proposal was provided and the Nunavut Marine Council representatives indicated that the update was appreciated and advised on the role of their respective organizations in the process.

In March 2019, the Government of Nunavut, the Qikiqtani Inuit Association and Canada reached a Memorandum of Understanding on the desirability and feasibility of protection measures for the Tuvaijuittuq. The MoU provides for the establishment of a steering committee with representatives from Canada, the Government of Nunavut and QIA to guide the feasibility assessment for long term marine protection in Tuvaijuittuq and consideration an interim protection measures. The Tuvaijuittuq Steering Committee first met on April 18, 2019 and continues to meet frequently and guide advancement of marine protection considerations. The Steering Committee has provided support to proceed with submission of a Marine Protected Area by Ministerial Order proposal to the Nunavut Wildlife Management Board for decision at the next meeting. Official party positions on the proposal will be submitted ahead of this meeting.

In April 2019, in light of recent negotiations between the GoC, the Government of Northwest Territories (GNWT), the Yukon Government, and the Inuvialuit Regional Corporation (IRC) on future offshore oil and gas activity in the Beaufort Sea, the GNWT expressed concerns with the boundary of the study area of the Canada-Nunavut-Qikiqtani Inuit Association MoU on protecting Tuvaijuittuq. While the Government of Canada has the authority under the Oceans Act to establish a marine protected area in any area of the sea, the boundary of the Tuvaijuittuq proposed MPA was modified to remove the area that caused concern in the spirit of collaboration.

Proposed Protection of Tuvaijuittuq

(the High Arctic Basin)

P. Coupel

P. Coupel

Proposal to Establish a Protected Area in Tuvaijuittuq for up to 5 years

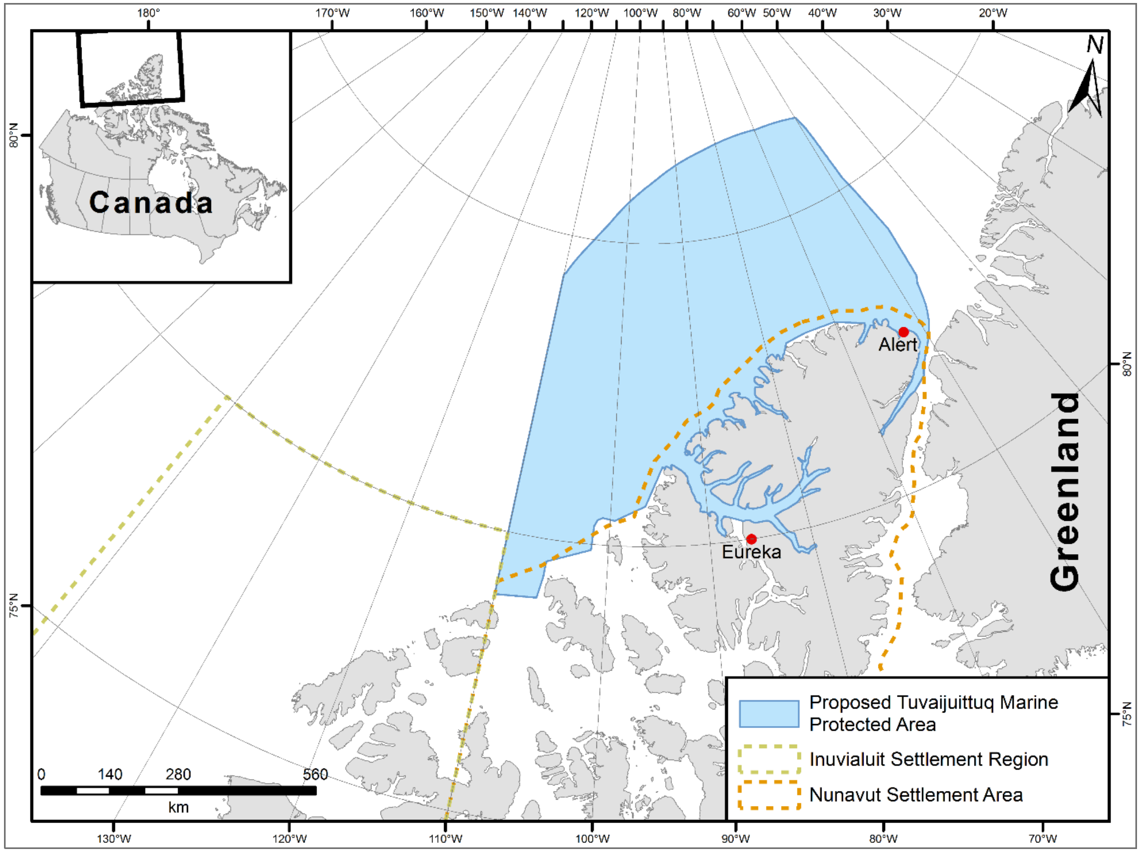
- Tuvaijuittuq
  - Request for Approval
  - Background
  - Ecological Importance
  - Socio-economic considerations
  - Protection Options
  - Consultation
  - Next Steps


P. Coupel


P. Coupel

Request for approval

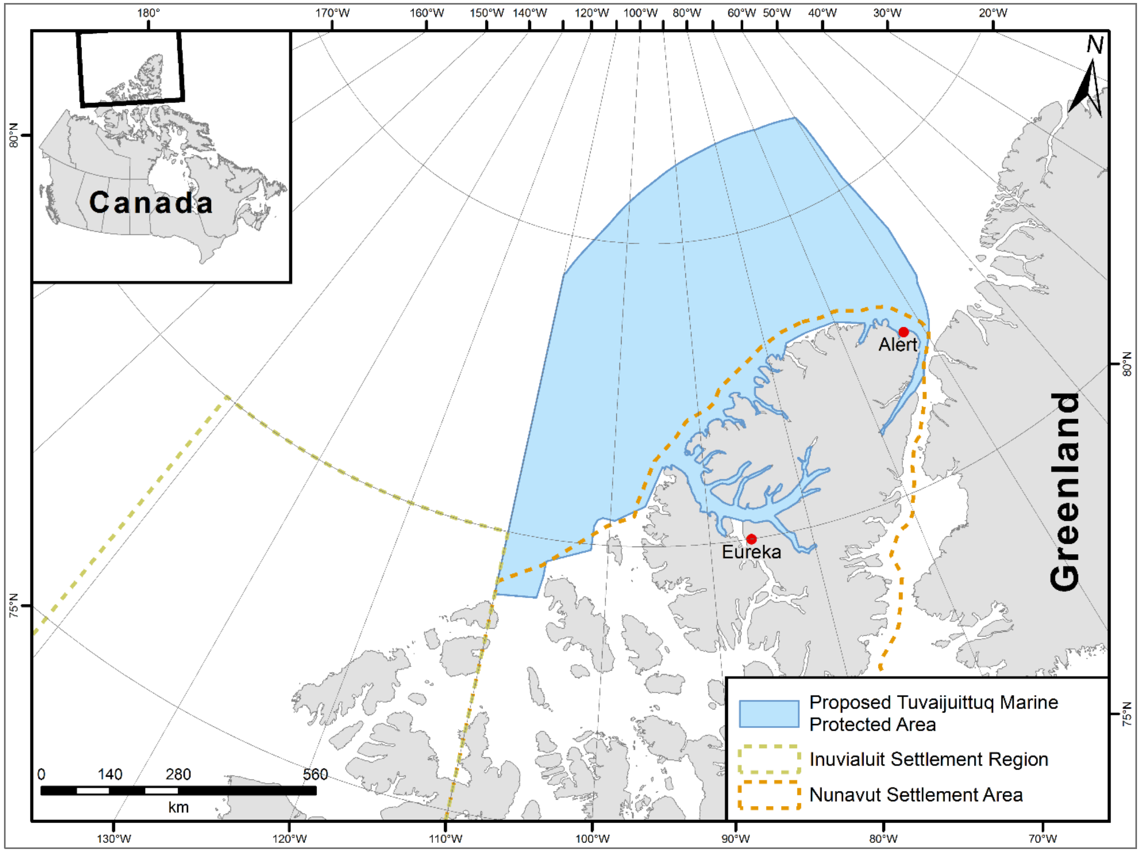
DFO is seeking NWMBs approval of the establishment of a conservation area for Tuvaijuittuq, through designation of a Marine Protected Area by Ministerial Order under the proposed *Oceans Act* amendment (Bill C-55). consistent with the Nunavut Land Claims Agreement s9.3.2



Canada

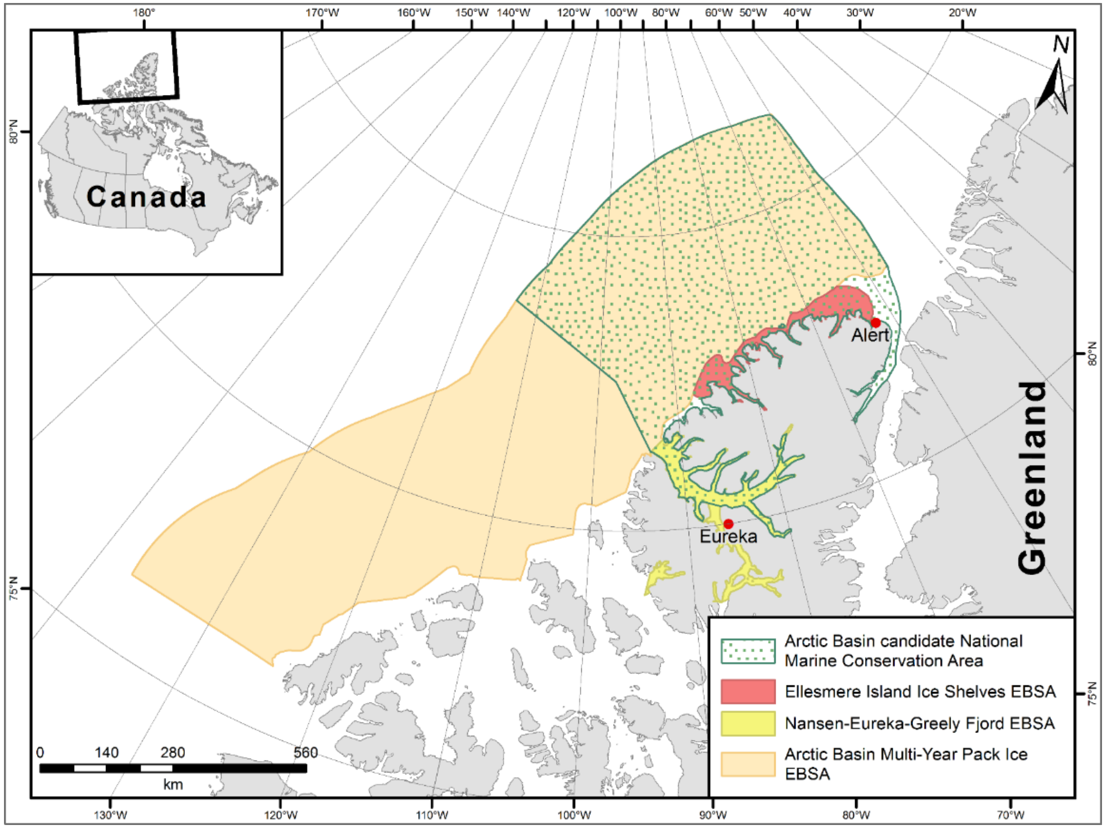
Tuvaijuittuq "the place where the ice never melts"

- Located west of Ellesmere Island and Canadian Arctic Archipelago
- Contains the oldest multi-year ice in the Arctic
- An area where summer sea ice is expected to remain the longest



What is Tuvaijuittuq?

- Portions of this area have been identified by DFO as Ecologically and Biologically Significant Areas (EBSAs)
- PCA has identified a portion of Tuvaijuittuq as a candidate National Marine Conservation Area (NMCA)
- Non-Government Organizations and academia have been studying the 'Last Ice Area' and identified the need for marine protection

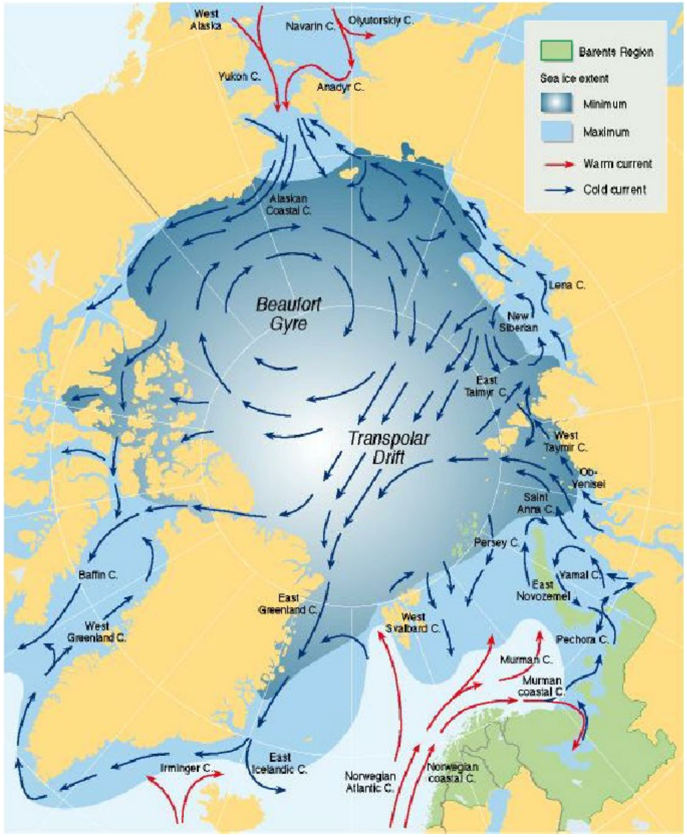


Why is Tuvaijuittuq Important?

- Multi-year ice
  - Provides important habitat to ice-associated species
    - such as Arctic cod, polar bears, seals, walruses
  - Supports and provides protection to under-ice communities
    - Form the basis of local and regional food webs that support higher trophic level species with distributions throughout the Arctic.
  - Expected to provide critical refuge to ice-associated and under-ice communities in the future as sea ice declines

Why Is Tuvaijuittuq Important?

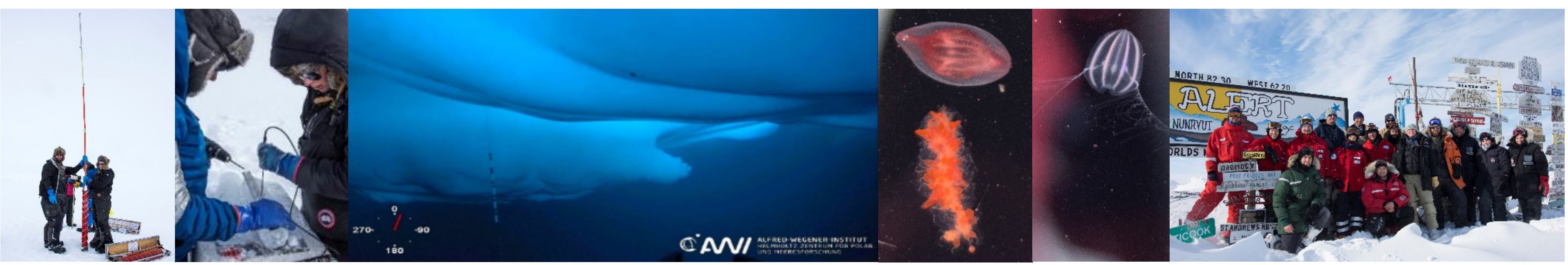
- Unique Ecosystem
  - The Beaufort Gyre, an Arctic Ocean current that contains a globally significant accumulation of fresh water from North American and Eurasian Arctic rivers
  - The Gyre is a major source of multi-year ice to the Arctic via the Canadian Arctic Archipelago
  - This ecosystem is relatively poorly understood and requires further study to define and assess its ecological properties



Canada

Ongoing Scientific Research

- Multidisciplinary Arctic Program (MAP) began in 2018; ongoing to 2022
  - Use of ROVs/AUVs and acoustic profilers to characterize under-ice and benthic invertebrate and fish communities
  - Ice cores, collected for productivity and physical environment (ice) analyses
  - CTD, buoys and moorings deployed to collected oceanographic data
  - Aerial surveys in Archer Fiord



Canada

Socio-economic considerations

- Currently there are very few marine activities in the area because of its remoteness and inaccessibility (assessment of last 12 months)
  - No active commercial and recreational fisheries and aquaculture
  - An initial assessment indicates likely limited (if any) subsistence harvesting
  - No current mining activity and no oil and gas licences
  - No vessel traffic (according to an analysis of AIS data) between March 2017 to November 2018
  - No known tourist or recreational activities
- Climate change impacts in the arctic will result in the continued loss of sea ice (multi-year pack ice).
  - May result in an extended shipping season and routes
  - May increase the feasibility of activities such as mining and, oil and gas exploration, commercial fishing, research and tourism

Protecting Tuvaijuittuq

Given…

- The uniqueness and importance of multi-year ice in Tuvaijuittuq
- The potential for short-term changes due to climate change
- The rapidly growing interest of international shipping and tourism in the High Arctic (potential to exacerbate climate change impacts to the area); and
- The presence of ecologically important species in the area (ice-associated, pelagic, and benthic)

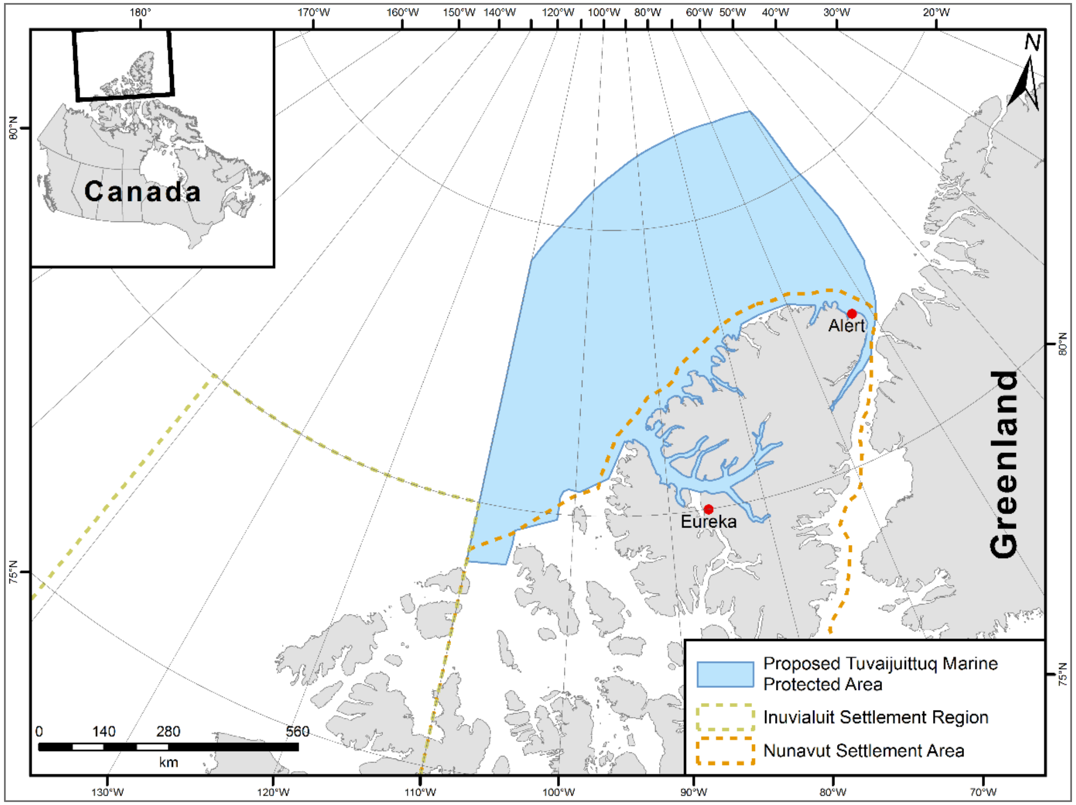
Protection would…

- Signify the areas importance and foster partner collaboration to support the continued assessment of the area
- Increase the profile and awareness of the area by nationally and internationally interested parties
- Allow baseline information collection which will inform future protection measures in the area over the long term

Protecting Tuvaijuittuq

- The proposed approach first establishes an interim protection measure though an *Oceans Act* Marine Protected Area by way of Ministerial Order (this is contingent on Royal Assent of Bill C-55)

- While under interim protection the QIA, GN and Canada will work together with partners and stakeholders to undertake a feasibility assessment which will collect and compile additional information including IQ to produce recommendation for long term protection of the area.



Canada

Oceans Act Ministerial Order

- A Ministerial Order MPA under the *Oceans Act** will:
  - Freeze the footprint of activities in the area for up to 5 years, during which time all activities that occurred in the area over the last 12 months prior to designation (or that have been authorized to occur) would be allowed to continue
  - Within the 5-year period, other longer term protection tools may replace the Ministerial Order. If no permanent protection measures are established, the Ministerial Order MPA shall be repealed
  - Any and all protection measures will be in accordance with the Nunavut Agreement
  - Ongoing activities include:
    - Science
    - DND activities
  - The Ministerial Order will allow:
    - Emergency, public safety, national defense, national security or law enforcement
    - Scientific research
    - Certain activities carried out by a foreign national, entity, ship or state

*Contingent on Royal Assent of Bill C-55.

Inuit Impact Benefit Agreement

- s9.4.1 of the Nunavut Agreement stipulates that Government agencies responsible for conservation areas and DIOs will negotiate an Inuit Impact and Benefits Agreement (IIBA)
- Canada and the Qikiqtani Inuit Association are negotiating the IIBA for Tallurutiup Imanga National Marine Conservation Area (TINMCA)
- It has been agreed that this IIBA will also address potential marine protected area designations within Tuvaijuittuq
- The parties are working toward completing the negotiations for an IIBA for TINMCA by June 2019

Consultation for Tuvaijuittuq

- Initial engagement with communities and key partners in 2018 on the concept of interim measure to protect Tuvaijuittuq
- Further engagement with HTOs/communities (Resolute Bay, Grise Fiord, Arctic Bay) in February 2019
- Memorandum of Understanding (MoU) was signed by Government of Canada, Government of Nunavut and the Qikiqtani Inuit Association in March 2019 to establish a process for assessing the desirability and feasibility of protecting Tuvaijuittuq
- The Tuvaijuittuq Steering Committee (April 2019) established under the MoU will oversee the assessment process including:
  - Conducting additional consultation with co-management partners and stakeholders;
  - Making recommendations interim and long-term protection measures

Next Steps for Interim Protection

- *Oceans Act* amendments required
- Requirements under the Nunavut Agreement
  - Conformity Determination through the Nunavut Planning Commission (NPC)
  - Nunavut Impact Review Board (NIRB) review if conformity is determined
  - Nunavut Wildlife Management Board (NWMB) approvals
- Completion of an IIBA for TINMCA/Tuvaijuittuq
- Canada Gazette 1


Questions?

Proposal to Establish a Conservation Area: Tuvaijuittuq

DFO is seeking approval from NWMB for the establishment of a conservation area for Tuvaijuittuq, through designation of a Marine Protected Area by Ministerial Order under the proposed Oceans Act amendment (Bill C-55), consistent with the Nunavut Land Claims Agreement s9.3.2 (establishment of conservation areas).

1. Proposed Marine Protection Measure for up to 5 years

Fisheries and Oceans Canada (DFO) and Parks Canada Agency (PCA) received funding in Budget 2017 to work with Inuit and Northern partners to pursue marine protection initiatives in the High Arctic marine environment. DFO and PCA are now pursuing establishment of an interim protection measure for the High Arctic Basin, also called Tuvaijuittuq, which means the place where the ice never melts. This area is considered globally, nationally and regionally unique due to the presence of multi-year pack ice. Tuvaijuittuq is believed to be a critically important habitat for Arctic under-ice communities and may also play an important role for ice-dependent species (e.g. beluga, narwhal, walrus, seals, polar bear). This area represents a portion of the Canadian High Arctic projected to retain multi-year ice (MYI) over the long term and will likely become an important refuge for ice-associated biota as sea ice loss continues throughout the Arctic due to climate change.

It is proposed that the area be designated as a Marine Protected Area (MPA) through a Ministerial Order under the *Oceans Act* meaning that it would be in place for up to five years. This proposed interim protection measure will only be available if Bill C-55 and associated proposed amendments to the Oceans Act receive Royal Assent. Protection via a Ministerial Order would allow the Minister of Fisheries, Oceans and the Canadian Coast Guard to freeze the footprint of human activities in the area for up to five years. Before the end of the five year period a decision must be made to establish a long-term protected measure or repeal the order. Freezing the footprint means that any activity that has occurred in the proposed MPA over the twelve months prior to designation (or that has been authorized to occur) would be allowed to continue in the proposed MPA. In addition, scientific research, safety, security and emergency activities, as well as certain activities carried out by a foreign national, entity, ship or state, would be permitted in the proposed MPA. Inuit harvesting rights will be respected in Tuvaijuittuq, consistent with the Nunavut Agreement.

An interim protection measure would help protect and conserve the important biological diversity, structural habitat, and ecosystem functions within the area while additional information is collected and appropriate conservation tools are assessed for long-term protection. The proposed MPA would be the first step in a phased approach to determine long-term objectives and potential protection measures for Tuvaijuittuq. While the Ministerial Order is in place, DFO and PCA would continue to work with key Inuit and northern governments to evaluate options for long-term protection measures in the proposed MPA as set out in the March 2019 Memorandum of Understanding signed by Canada, Nunavut and QIA.

Given the existing and potential importance to this unique environment, and the rapidly growing interest in marine activities in the Arctic, there is a real need to both protect and better understand the ecological importance of this region before additional disturbances intensify the impacts from climate change. Protecting this area would signify its importance and foster partner collaboration to support the continued assessment of the area. It would also increase the profile and awareness of the area by national and internationally interested parties.

2. About the Area

Location

Tuvaijuittuq includes a portion of the marine waters off northern Ellesmere Island starting from the low water mark and extending to Canada's Exclusive Economic Zone (Figure 1). The majority of the area lies outside two adjacent land claim agreement areas, the Inuvialuit Settlement Region and the Nunavut Settlement Area. However, the proposed MPA extends into the Nunavut Settlement Area and thus the Nunavut Agreement provisions apply with respect to the establishment of a conservation area. The eastern portion of this area is located in the Lincoln Sea. Canada has a maritime boundary dispute with Denmark in that area and announced on 28 November 2012 that a tentative agreement on the Lincoln Sea boundary had been reached and ratification of the treaty is ongoing. Once a treaty has been reached between Canada and Greenland on an international border, this portion of the boundary may need to be modified.

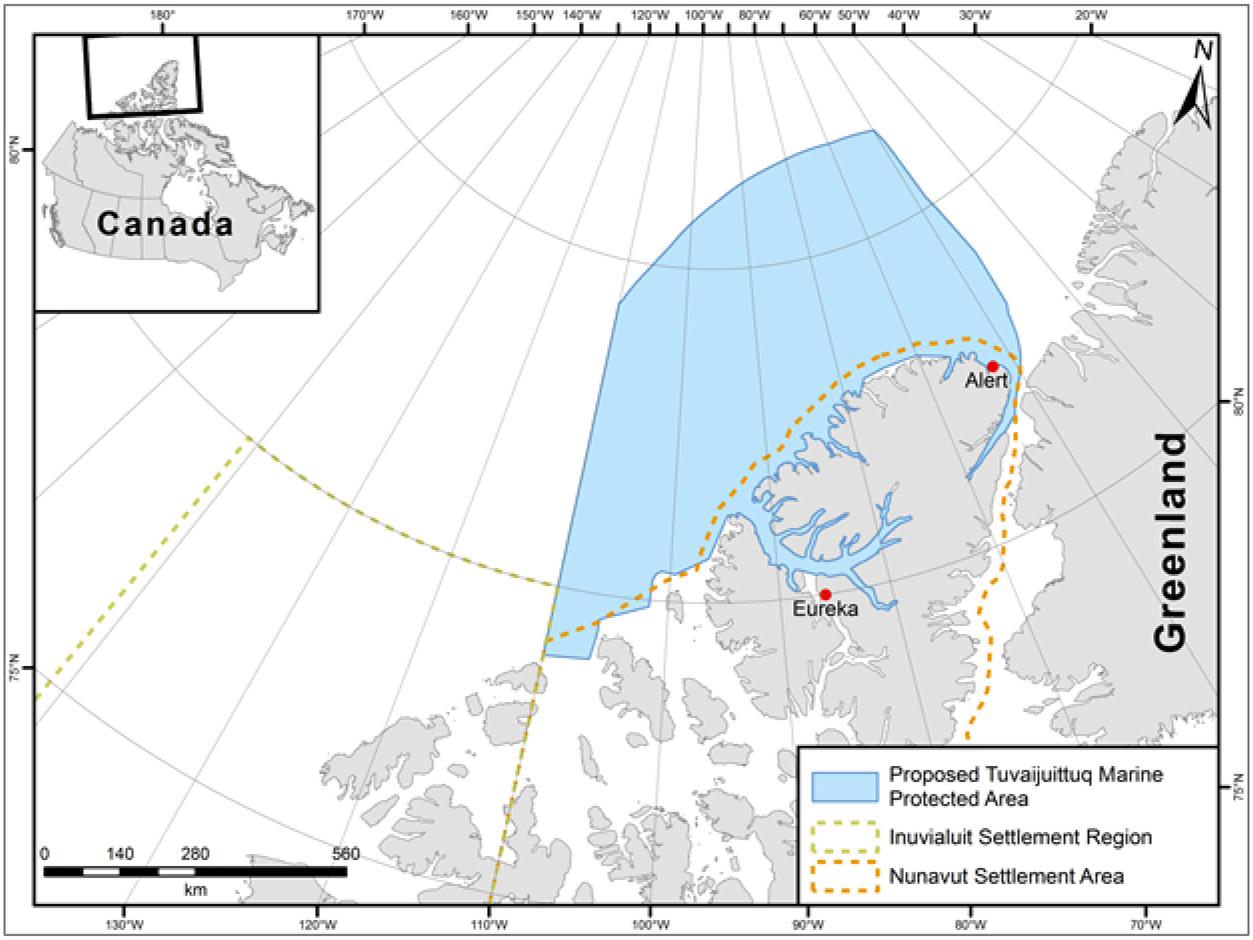


Figure 1. Map of the proposed Tuvaijuittuq Marine Protected Area (MPA)

Ecological Importance

Portions of Tuvaijuittuq were identified by the Department of Fisheries and Oceans as Ecologically and Biologically Significant Areas in 2011, and also selected by the Parks Canada Agency as a candidate site for their system of National Marine Conservation Areas (Figure 2). The ecological importance of this area has been acknowledged by academia and Environmental Non-Government Organizations who have been calling for its protection due to the area's increasing significance under a changing climate.

The Multi-year ice in this area provides important habitat to ice-associated species that depend on it for food, protection from predators, reproduction and other behaviors. This habitat is especially important for under-ice communities as they form the basis of the food web and support higher trophic level species whose distributions include the entire High Arctic region. As a result, significant changes to this habitat may have repercussions for marine communities throughout the Arctic.

The ecosystem of Tuvaijuittuq is also unique due to circulation of the Beaufort Gyre, an Arctic Ocean current that contains a globally significant accumulation of fresh water from North American and Eurasian Arctic rivers. The Gyre transports Multi-year ice to this area making it globally unique ice environment. Because of this, models predict the persistence of Multi-year ice in this area over the long-term meaning that this area may become a critical refuge for ice-associated species as sea ice declines due to climate change.

While relatively little is known is about the about the area, existing ecological information has been collected and compiled when and where available. Available ecosystem information was used to determine the conservation objective for the area which is “to contribute to the conservation, protection and understanding of the natural diversity, productivity and dynamism of the High Arctic sea ice ecosystem”.

While no Inuit Qaujimajatuqangit (IQ) has been collected for this particular proposal, the Department undertook a preliminary scan of existing IQ from nearby communities. This included information from the Nunavut Coastal Resource Inventory as well as IQ collected by the Department of Fisheries and Oceans in 2011 for the purposes of conservation planning. Given that the area is primarily beyond present and historical traditional use by Inuit, little IQ for this area was expected. Collecting IQ will be a priority for future planning.

A DFO science program called Multidisciplinary Arctic Program is currently underway in a portion of Tuvaijuittuq. This research mission aims to study the multi-year ice ecosystem in Canada’s High Arctic. This mission will provide the first ecological assessment of the northern Canadian Archipelago, the knowledge from which is essential to understand the structure, function and role of the sea-ice associated ecosystem in the Arctic Ocean.

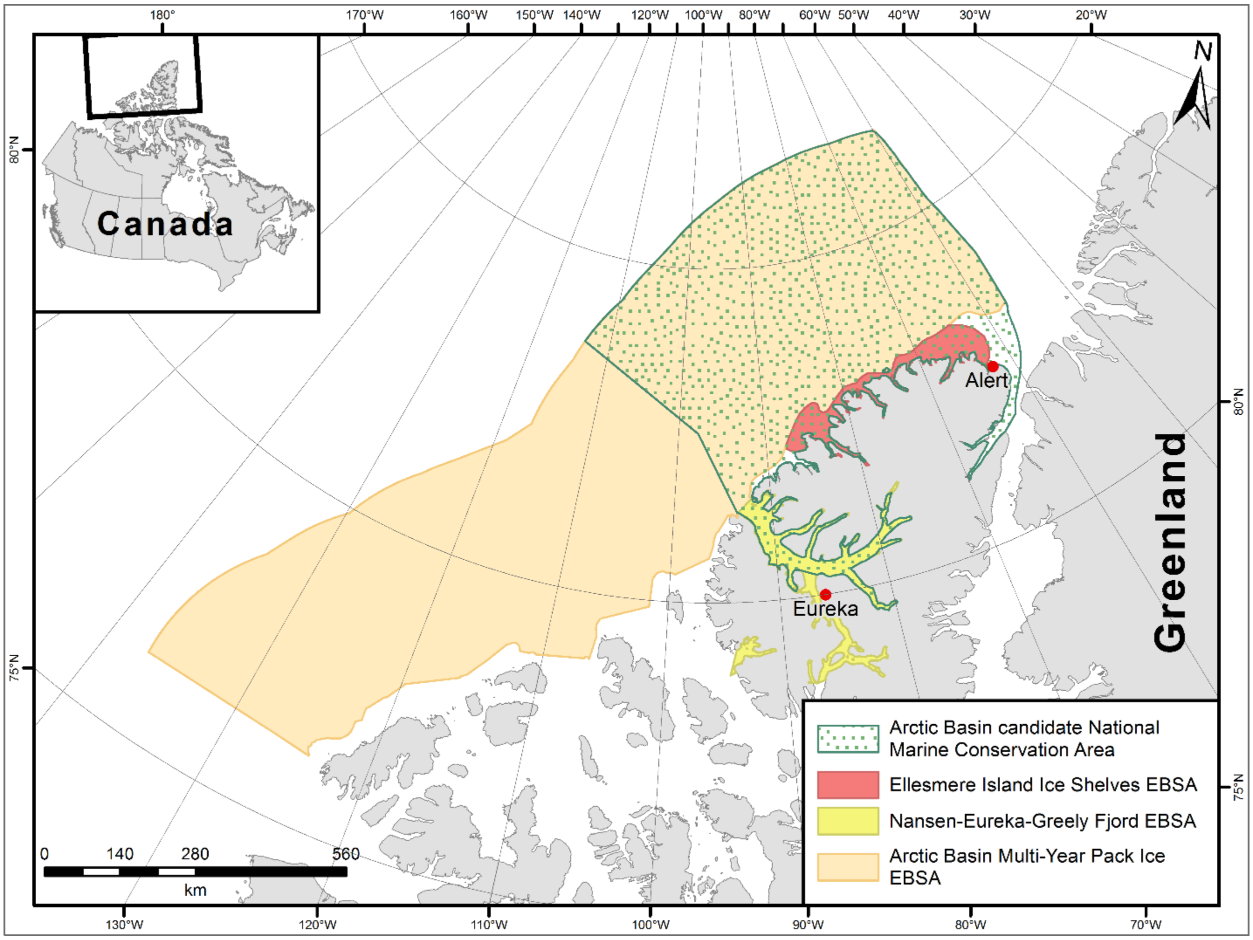


Figure 2. Map of Candidate National Marine Conservation Area and Ecologically and Biologically Significant Areas (EBSAs).

Socio-economic considerations

DFO has compiled socio-economic information to support the socio-economic analysis. Natural Resources Canada has produced a report titled “High Arctic Basin (Tuvaijuittuq) Petroleum Potential”. The socio-economic analysis and Natural Resources Canada report was used to develop a cost-benefit analysis which is based on the proposed Ministerial Order regulations.

There are currently very few marine activities taking place in the area, primarily due to its remoteness and inaccessibility. The area is far from any settled communities and most of it is ice-covered year round. Extensive ice cover in the area results in exceptionally difficult conditions to navigate. The Arctic climate is experiencing rapid change resulting in the loss of sea ice and more specifically, multi-year pack ice. These changes are opening up new opportunities and challenges for the Arctic. For example, warming may result in an extended shipping season and the creation of new shipping routes which, in turn, may increase the feasibility of activities such as mining and, oil and gas exploration, commercial fishing, research and tourism across the Arctic. Increased accessibility for these types of activities poses a risk to the habitat, biodiversity and ecosystem function within Tuvaijuittuq.

3. Consultation, Engagement and Collaboration

In August 2018, the Qikiqtani Inuit Association (QIA) expressed their interest to include an area in Tuvaijuittuq, located in the northwestern-most region of the Arctic Ocean and adjacent to Ellesmere Island, as part of the IIBA for the candidate TINMCA. PCA, along with DFO and Transport Canada are engaged in the negotiation of the IIBA. In response to QIA's proposal, representatives from PCA and DFO, supported by Transport Canada, and the QIA negotiated an Agreement in Principle on the IIBA that committed the parties to, among other things, work collaboratively with the Government of Nunavut (GN) to advance protection of Tuvaijuittuq, including the consideration of interim protection measures under the proposed revisions to the *Oceans Act*.

Pursuant to the agreement in principle signed in April 2019, PCA and DFO (representing Canada), the GN, and the QIA signed a Memorandum of Understanding articulating a process for consideration of environmental designations in Tuvaijuittuq. The memorandum of understanding provides for the establishment of a steering committee with representatives from Canada, GN and QIA to guide the feasibility assessment for marine protection in Tuvaijuittuq

To date, DFO and PCA have provided information to, and requested feedback from, many stakeholders and partners incluing the QIA and GN, Nunavut Tunngavik Inc., Inuvialuit Regional Corp., Inuvialuit Game Council, Fisheries Joint Management Council, Government of Northwest Territories, and the Yukon Government on a proposed phased approach to marine protection whereby interim protection would be established in Tuvaijuittuq to allow time for the collection of baseline scientific information and for further engagement with co-management partners and stakeholders with regard to long-term protection options. Use of the interim protection option will be dependent on recommendations from the Steering Committee and the support of the parties to the memorandum of understanding .

Initial engagement of communities closest to Tuvaijuittuq began in April 2018. QIA led a community tour (November, December 2018) to provide an update to the five adjacent communities associated with Tuvaijuittuq on the agreement in principle described above. Community members supported in principle the potential protection of Tuvaijuittuq, but echoed the importance of Inuit being involved in research taking place in the area. More recently (February 25-28, 2019), DFO and PCA engaged with the Hunter's and Trapper's Organizations (HTOs) and communities of Arctic Bay, Resolute Bay and Grise Fiord to discuss potential protection measures and ongoing Science initiatives in Tuvaijuittuq. Representatives from both the GN and the QIA also participated in these meetings. HTOs and attending members from all three communities were generally supportive of both interim and long-term protection of Tuvaijuittuq, as well as the collection of scientific data to better understand the area. Community concerns related to Tuvaijuittuq included the appropriate regulation of small and large vessel traffic to avoid impacts to ice, marine mammals and other biota, and potential impacts from activities such as oil and gas exploration and research.

The parties have committed to completion of an IIBA for TINMCA by June 2019. This document will be made public once ratified by all parties. Additional information can be found in the 'consultation and engagement' summary.

4. General Timelines

This proposal requires the use of a Ministerial Order under the *Oceans Act* which would freeze the footprint of the area for up to 5 years. This tool will only be available to the Minister of Fisheries and Oceans Canada if Bill C-55 receives Royal Ascent.

Oceans Act Marine Protected Areas (including those established through Ministerial Order) fall within the definition of 'Conservation Areas' under the Nunavut Agreement and are therefore subject to the requirements that apply to the establishment of Conservation Areas pursuant to the Nunavut Agreement. The Department is therefore required to seek conformity determination through the Nunavut Planning Commission (NPC) prior to designation under the *Oceans Act*. Should the NPC find the project proposal in conformity with the existing North Baffin Regional Land Use Plan, the NPC will forward the proposal to the Nunavut Impact Review Board for screening. In the case that it does not conform other processes set out in the *Nunavut Planning and Project Assessment Act* would apply.

Section 9.4.1 of the Nunavut Agreement stipulates that Government agencies responsible for conservation areas and Designated Inuit Organizations will negotiate an Inuit Impact and Benefits Agreement (IIBA). Parks Canada, along with DFO and Transport Canada are engaged with the Qikiqtani Inuit Association in the negotiation of the IIBA for Tallurutiup Imanga National Marine Conservation Area (TINMCA). The parties have committed to completion of an IIBA for TINMCA by June 2019, with agreement that the IIBA will also address potential marine protected area designations within Tuvaijuittuq. This document will be made public once ratified by all parties.

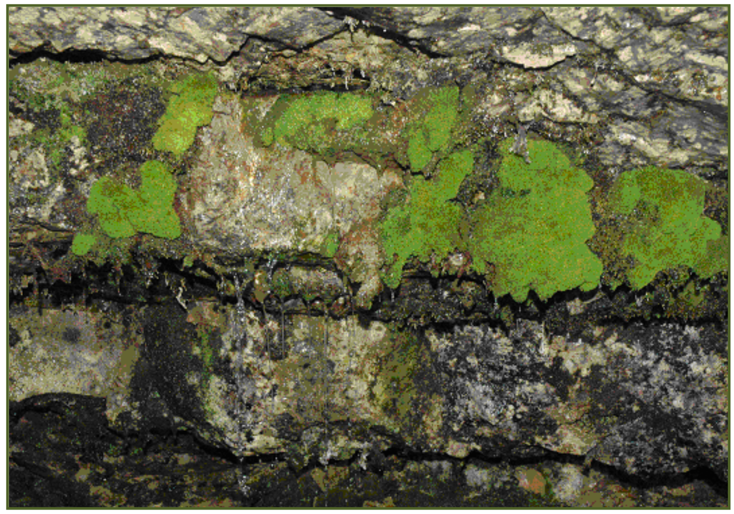
If supported by the Parties to the Tuvaijuittuq MOU DFO will advance this proposal by seeking additional public comment through Canada Gazette 1 in June 2019. Through this public comment period the public will be made aware of the proposal, including the fact that the Department is seeking approvals from the Nunavut Wildlife Management Board, the Nunavut Planning Commission and the Nunavut Impact Review Board prior to considering establishment of an MPA.

Environment Canada Environnement Canada

SUBMISSION TO THE NWMB FOR

Information: **Decision**: X

Issue: The Proposed Final Action Plan for the Porsild's Bryum *(Mielichhoferia macrocarpa)* in Canada, pursuant to the *Species at Risk Act* (SARA)



Background:

Porsild's Bryum was listed as a Threatened species under the *Species at Risk Act* (Schedule 1, 02/04/2011). In response to the listing, a recovery strategy was collaboratively developed, and population and distribution objectives were established for the recovery of Porsild's Bryum in Canada.

The species is a small moss that grows in bright green colonies and inhabits mountainous areas on wet calcareous cliffs where there is constant water seepage and winter desiccation. There are 17 known populations of Porsild's Bryum in Canada and they are broadly distributed; including sites in Alberta, British Columbia, Newfoundland and Labrador, and Nunavut (Figure 1). The total population size is at least 960 colonies in Canada. In Nunavut, it is only found in Quttinirpaaq National Park, with three populations identified in the Tanquary Fiord area (Figure 2).

Canada

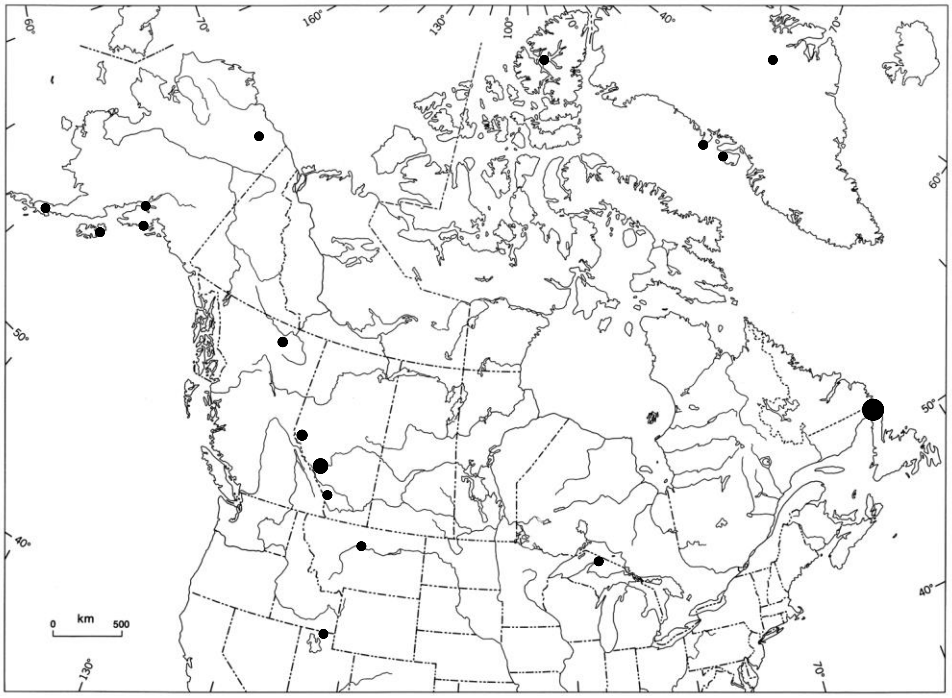


Figure 1. This figure shows the North American distribution of Porsild's Bryum. The three dots in Alberta cover 6 populations, the one dot in British Columbia covers 1 population, the Newfoundland and Labrador dot covers 7 populations and the Nunavut dot covers 3 populations.

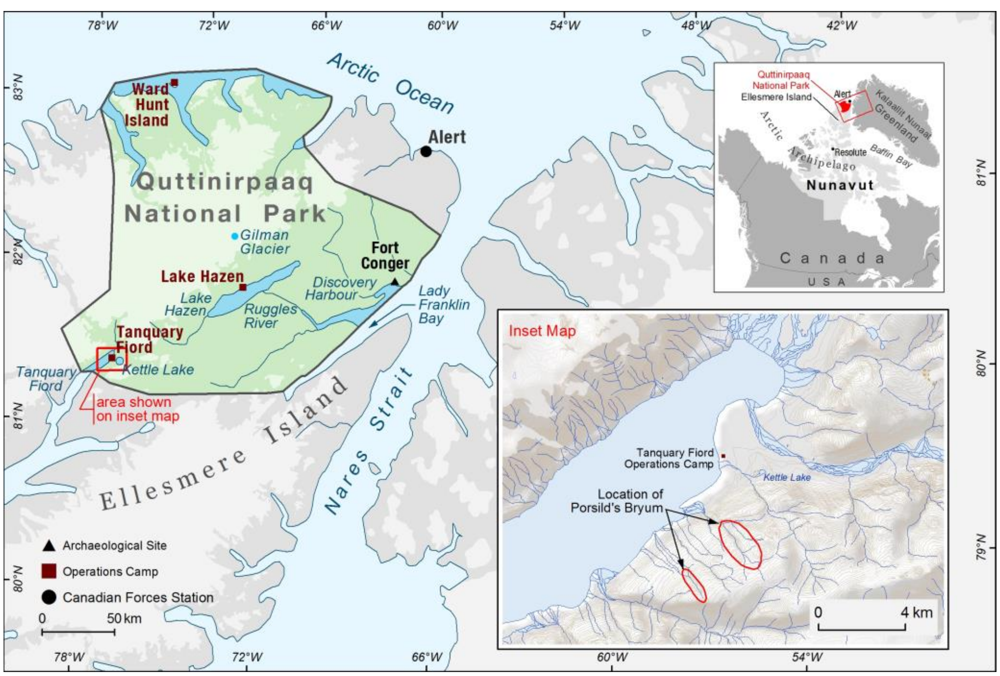


Figure 2. This figure shows the locations of Porsild's Bryum in Quttinirpaaq National Park of Canada.

Action Plan

Under *SARA*, if a species is listed as Threatened, a recovery plan must be prepared. The recovery plan is made up of two documents: a recovery strategy and an action plan. The final *Recovery Strategy for Porsild's Bryum in Canada* was posted on the Species at Risk Public Registry in December 2017. While the recovery strategy addresses broad recovery goals and objectives, the action plan addresses the recovery actions for the species by outlining specific recovery measures.

The recovery strategy identifies the following population and distribution objective for Porsild's Bryum:

"To maintain or increase the number of colonies, and sub-populations for all known extant populations of Porsild's Bryum, while also maintaining or increasing the distribution of colonies and sub-populations within each population, and, where feasible, to re-establish the species to locations where it has been extirpated and previously known to exist."

This action plan should be considered along with the recovery strategy. The recovery strategy provides more details on the strategic direction and approaches for recovery of Porsild's Bryum, critical habitat information, and background information on the species and its threats. Recovery measures in this proposed final action plan address 5 broad strategies: (1) inventory and monitoring, (2) research, (3) outreach/stewardship, (4) habitat management, and (5) reintroduction and/or population re-establishment.

Under the *SARA,* habitat that must be protected in order for a species to survive and recover is called 'critical habitat.' Once an area is identified as critical habitat (in a recovery strategy or an action plan), the federal government is legally responsible to make sure that the habitat is properly protected.

Critical habitat was partially identified for Porsild's Bryum in the recovery strategy. The recovery strategy also contains details about the identified critical habitat, its extent, habitat characteristics, and activities that are likely to destroy critical habitat. No additional critical habitat can be identified in this proposed final action plan because it is not possible at this time given the best available information. Critical habitat will likely be updated in an updated recovery strategy or later action plan.

The direct financial and socials costs of implementing these recovery measures (and thus this action plan) are anticipated to be low over the short term (2019 to 2023 years) and the long term (2023 onward).

Community Consultation:

Since the locations of Porsild's Bryum are strictly within the Quttinirpaaq National Park, in 2016 the Parks Canada Agency conducted consultations on a draft version of the action plan for Porsild's Bryum in two communities: Grise Fiord and Resolute Bay, NU. In response to the consultations, and upon reviewing a draft of the proposed action plan, both the Iviq Hunters and Trappers Organization of Grise Fiord, and the Resolute Bay Hunters and Trappers Association acknowledged and supported the proposed action plan through the submission of support letters and emails addressed to Parks Canada in April and June of 2016, respectively. The proposed action plan was posted on the Species at Risk Public Registry on December 22, 2017, for a 60-day public comment period, which ended on February 20, 2018. Comments were taken into consideration and the current proposed final action plan was drafted.

Next Steps:

We are coming to the NWMB to ask for approval of the proposed final action plan. Once the action plan is finalized it will be re-evaluated and updated every 5 years or as necessary.

Prepared by:
Canadian Wildlife Service, Yellowknife 14 April 2019

Environment and Climate Change Canada
Environnement et Changement climatique Canada

The *Species at Risk Act* and You

PROPOSED FINAL PORSILD'S BRYUM ACTION PLAN SUMMARY FOR CANADA

Porsild's Bryum Moss
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Summary

This is a summary of the information provided in the Proposed Final Action Plan for the Porsild's Bryum (*Mielichhoferia macrocarpa*) moss species. In November of 2003 Porsild's Bryum was assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as Threatened. In 2011, in response to the COSEWIC assessment, Porsild's Bryum was added to Schedule 1 of the *Species at Risk Act* (SARA), and a recovery strategy was developed and posted in December 2017. The Proposed Final Action Plan complements the recovery strategy and will be implemented across the species distribution in Alberta, British Columbia, Newfoundland and Labrador, and Nunavut. While general, this summary will aim to highlight pertinent information specific to Porsild's Bryum in Nunavut.

The action plan outlines the projects and activities necessary to meet the population and distribution goals and objectives identified in the recovery strategy. The document outlines proposed measures to protect critical habitat, as well as steps for implementing the recovery strategy, and evaluates the socio-economic costs of the action plan and implementation benefits. The action plan should be considered in conjunction with the *Recovery Strategy for the Porsild's Bryum in Canada* (Environment and Climate Change Canada 2016).

Species Information

Porsild's Bryum species description

- Small, brilliant green moss.
- Located in shaded calcareous cliffs or rock outcrops with continuous or intermittent seepage.
- Slow regeneration and limited dispersal ability.
- Narrow substrate requirements makes recovering from threats, such as drought, temperature

Canada

extremes, recreational activities and unpredictable events, difficult.

Where is Porsild's Bryum found?

- Found throughout the north-western hemisphere.
- 17 known populations in Canada:
  - 1 in British Columbia
  - 6 in Alberta
  - 7 in Newfoundland and Labrador
  - 3 in Nunavut

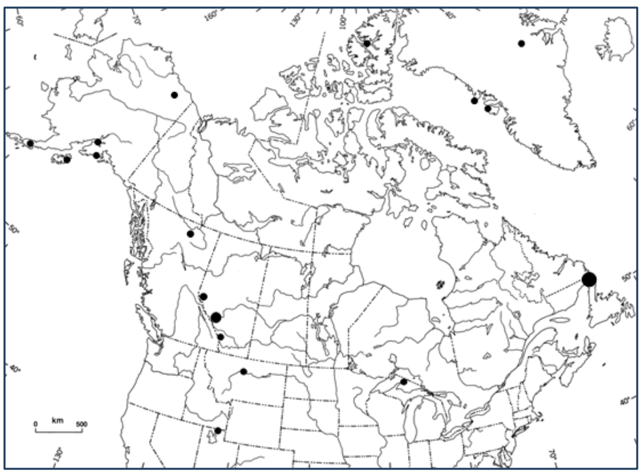


Figure 1.The distribution and occurrence of Porsild's Bryum in the north-western hemisphere. The three dots in Alberta cover 6 populations, the one dot in British Columbia covers 1 population, the Newfoundland and Labrador dot covers 7 populations, and the dot in Nunavut's high Arctic includes 3 populations.

Recovery Actions

In addition to the national recovery strategy, provincial recovery documents for Porsild's Bryum have been developed in Alberta and Newfoundland/Labrador. These documents summarize provincial-specific distribution and habitat patterns, threats, and recovery initiatives. The national recovery strategy identifies a broad population and distribution (P&D) objective for Porsild's Bryum across Canada:

"To maintain or increase the number of colonies, and sub-populations for all known extant populations of Porsild's Bryum, while also maintaining or increasing the distribution of colonies and sub-populations within each population, and, where feasible, to reestablish the species to locations where it has been extirpated and previously known to exist."

To achieve the national P&D objectives, recovery measures are required to be implemented within a given timeframe. To date, only one recovery measure has been completed: *critical habitat for known populations on federal lands is legally protected.*

The action plan outlines all ongoing recovery measures, which are related to five broad strategies:

1. **Inventory and monitoring**
2. **Research**
3. **Outreach / Stewardship**
4. **Habitat management**
5. **Reintroduction and/or population augmentation**

Each is summarized in depth in the action plan document and is assigned a specific timeline. Below are examples of the ongoing recovery measures necessary to meet the broad strategies based on priority ranking (high, medium or low).
For full timeline see action plan document.

High priority:

- Work with provinces and landowners to secure effective protection of critical habitat for known populations on non-federal land by 2020.
- Further identify limiting factors and threats by 2021.
- Develop and implement a long-term monitoring program by 2021.
- Conduct seasonal field surveys to determine the full extent of the species population size and distribution.
- Survey known sites to identify threats and their impacts.
- Develop and implement a research plan to determine the biological and habitat needs of the species.

Medium priority:

- Encourage the involvement of all stakeholders in implementation efforts, including monitoring, by 2021.
- Develop a re-introduction protocol and determine feasibility by 2022.
- Develop educational material and public outreach to increase public understanding of threats and promote stewardship.
- Work with stakeholders to minimize known threats and collaborate with industry partners to minimize effects of industrial activities.
- Install infrastructure to protect subpopulations vulnerable to recreational activities.
- Restore habitat at damaged locations and reintroduce plants as required.
- Monitor effectiveness of reintroductions as required.

Low priority:

- Create a habitat model to predict species presence.
- Develop minimum viable population estimates by 2028.

Protecting Critical Habitat

To the extent possible, critical habitat and activities likely to result in destruction of critical habitat are described in the national recovery strategy. No additional critical habitat is identified in the action plan. The action plan identifies the proposed measures to protect critical habitat on federal and non-federal lands.

Protection on federal lands

In Nunavut, critical habitat of Porsild's Bryum is identified in Quttinirpaaq National Park and legally protected under the *Species at Risk Act* as well as the *Canada National Park Act.* The Parks Canada agency may also prevent destruction of critical habitat by posting notices, restricting access to the area, and educating visitors.

Protection on non-federal lands

If the Minister is of the opinion that the laws of the province and territory do not effectively protect the critical habitat of Porsild's Bryum on non-federal lands, the Minister must make a recommendation to the Governor in Council that an order be put in place to prevent the destruction of critical habitat.

The implementation of conservation measures is an important complementary strategy for preserving the species critical habitat. Environment and Climate

Change Canada will work with provincial and territories governments, non-governmental organizations, and individuals to protect critical habitat on non-federal lands, as well as facilitate the implementation of conservation measures.

Socio-Economic Evaluation

The socio-economic evaluation presented in the action plan addresses only the cumulative socio-economic costs of implementing the action plan from a national perspective, as well as the social and environmental benefits that would occur if the action plan were implemented in its entirety. The intent of the socio-economic evaluation is to inform the public and to guide decision making on implementation of the action plan by partners.

The document outlines the various legislative, regulatory and management tools currently in place (e.g. *Canada National Parks Act*, provincial recovery strategies, etc.), as well as the affected demographic, the costs and benefits of implementation, and the distributional impacts associated with the action plan, which are summarized below.

Who would be affected?

There are few communities or individuals that would be affected by the implementation of the measures identified in the action plan for Porsild's Bryum. With the exception of populations in Newfoundland and Labrador, most populations of Porsild's Bryum occur within federal and provincial protected areas and parks. In Nunavut, for example, all populations are found within the Quttinirpaaq National Park. The park is within the Nunavut Land Claims Agreement and is an important area to Inuit of Grise Fiord and Resolute Bay. The implementation of this action plan is expected to have little to no effects on these communities.

Socio-economic costs

The costs associated with implementation are financial and social. Both are expected to be minimal.

Financial costs:

- Short term (2019 to 2023) costs are expected to be minimal at the national and regional (territorial and provincial) scale. Nationally, direct and indirect costs of implementing the recovery measures are estimated at $0 to $5 million.
- Long-term (2023 onwards) costs are expected to be minimal.

Social costs:

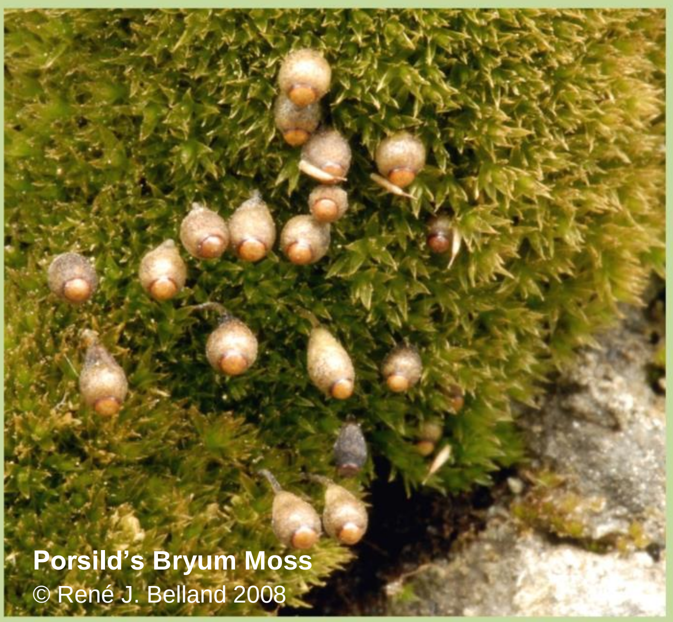
There are few known populations and the majority are found in protected areas. Given the lack of human-use associated with the species the social costs are projected to be low.

Socio-economic benefits

An opinion poll found that three quarters of surveyed Canadians feel that preserving natural areas and a diverse plant and animal life is important. The implementation of the action plan would:

- Help with the recovery of the species.

- Promote a healthy ecosystem by supporting and enhancing biodiversity.
- Increase eco-tourism activity in near-by parks.


Porsild's Bryum Moss
© René J. Belland 2008

Distributional Impacts

Porsild's Bryum occurs on provincial, federal, and private properties, and the majority of sites are within protected areas. Private landowners are not expected to absorb the direct incremental costs for the species' recovery. Any indirect incremental costs resulting from the implementation of recovery measures will be shared. Should additional populations of Porsild's Bryum be discovered on private land through activities identified in this action plan, the distributional impacts will be re-assessed.

Measuring Progress

In addition to the five performance indicators presented in the recovery strategy, progress will be monitored through:

1. Reporting on the implementation of the action plan by assessing progress towards implementing the broad strategies.

2. Reporting on the ecological and socio-economic impacts of the action plan by assessing the results of monitoring the recovery of the species and its long-term viability.

For more information, please contact us directly at:
Canadian Wildlife Service
5019 52nd Street
PO Box 2310
Yellowknife, NT
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ec.sarnt-lepnt.ec@canada.ca

You can also visit the following websites for more information:
SARA Public Registry (www.sararegistry.gc.ca)

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Species at Risk Act
Action Plan Series

Action Plan for the Porsild's Bryum (*Mielichhoferia macrocarpa*) in Canada

Porsild's Bryum

2019

Government of Canada Gouvernement du Canada

Canada

Recommended citation:

Environment and Climate Change Canada. 2019. Action Plan for the Porsild's Bryum (*Mielichhoferia macrocarpa*) in Canada. *Species at Risk Act* Action Plan Series. Environment and Climate Change Canada, Ottawa. v + 13 pp.

For copies of the action plan, or for additional information on species at risk, including the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Status Reports, residence descriptions, recovery strategies, and other related recovery documents, please visit the Species at Risk (SAR) Public Registry[1].

Cover illustration: © René J. Belland 2005

Également disponible en français sous le titre
« Plan d'action pour le bryum de Porsild (*Mielichhoferia macrocarpa*) au Canada »

ISBN
Catalogue no.

[1] www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html

Preface

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996)[2] agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of action plans for species listed as Extirpated, Endangered, and Threatened for which recovery has been deemed feasible. They are also required to report on progress within five years after the publication of the final document on the SAR Public Registry.

Under SARA, one or more action plan(s) provides the detailed recovery planning that supports the strategic direction set out in the recovery strategy for the species. The plan outlines what needs to be done to achieve the population and distribution objectives (previously referred to as recovery goals and objectives) identified in the recovery strategy, including the measures to be taken to address the threats and monitor the recovery of the species, as well as the proposed measures to protect critical habitat that has been identified for the species. The action plan also includes an evaluation of the socio-economic costs of the action plan and the benefits to be derived from its implementation. The action plan is considered one in a series of documents that are linked and should be taken into consideration together. Those being the COSEWIC status report, the recovery strategy, and one or more action plans.

The Minister of Environment and Climate Change and Minister responsible for theParks Canada Agency is the competent minister under SARA for the Porsild's Bryum and has prepared this action plan to implement the recovery strategy, as per section 47 of SARA. To the extent possible, it has been prepared in cooperation with the provinces of British Columbia, Alberta, and Newfoundland and Labrador and Nunavut Territory, as per section 48(1) of SARA.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions and actions set out in this action plan and will not be achieved by Environment and Climate Change Canada and the Parks Canada Agency, or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this action plan for the benefit of the Porsild's Bryum and Canadian society as a whole.

Implementation of this action plan is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

The recovery strategy sets the strategic direction to arrest or reverse the decline of the species, including identification of critical habitat to the extent possible. It provides all

[2] www.canada.ca/en/environment-climate-change/services/species-risk-act-accord-funding.html#2

Canadians with information to help take action on species conservation. When critical habitat is identified, either in a recovery strategy or an action plan, SARA requires that critical habitat then be protected.

In the case of critical habitat identified for terrestrial species including migratory birds SARA requires that critical habitat identified in a federally protected area[3] be described in the *Canada Gazette* within 90 days after the recovery strategy or action plan that identified the critical habitat is included in the public registry. A prohibition against destruction of critical habitat under ss. 58(1) will apply 90 days after the description of the critical habitat is published in the *Canada Gazette*.

For critical habitat located on other federal lands, the competent minister must either make a statement on existing legal protection or make an order so that the prohibition against destruction of critical habitat applies.

If the critical habitat for a migratory bird is not within a federal protected area and is not on federal land, within the exclusive economic zone or on the continental shelf of Canada, the prohibition against destruction can only apply to those portions of the critical habitat that are habitat to which the *Migratory Birds Convention Act, 1994* applies as per SARA ss. 58(5.1) and ss. 58(5.2).

For any part of critical habitat located on non-federal lands, if the competent minister forms the opinion that any portion of critical habitat is not protected by provisions in or measures under SARA or other Acts of Parliament, or the laws of the province or territory, SARA requires that the Minister recommend that the Governor in Council make an order to prohibit destruction of critical habitat. The discretion to protect critical habitat on non-federal lands that is not otherwise protected rests with the Governor in Council.

[3] These federally protected areas are: a national park of Canada named and described in Schedule 1 to the *Canada National Parks Act*, The Rouge National Park established by the *Rouge National Urban Park Act*, a marine protected area under the *Oceans Act*, a migratory bird sanctuary under the *Migratory Birds Convention Act, 1994* or a national wildlife area under the *Canada Wildlife Act* see ss. 58(2) of SARA.

Acknowledgments

This action plan was written by Krista Baker of Environment and Climate Change Canada - Canadian Wildlife Service (ECCC-CWS) with input from the following people and organizations: Andrew Boyne, Kathy St. Laurent and David Andrews – ECCC-CWS (Atlantic Region); Lisa Pirie, Candace Neufeld, Sarah Lee, Victoria Snable and Mark Wayland – ECCC-CWS (Prairie Region); Ian Parnell, Kella Sadler and Matthew Huntley – ECCC-CWS (Pacific Region); Richard Cannings (Royal Alberta Museum); Brenda Costanzo and Anna McIndoe (British Columbia Ministry of Environment); Chris Pasztor (British Columbia Ministry of Natural Gas Development); and Joanne Tuckwell (Parks Canada Agency).

Executive Summary

Porsild's Bryum (*Mielichhoferia macrocarpa*) is a small brilliant green moss, often associated with waterfalls and calcareous rock and known to occur in at least 17 populations throughout Canada. It was listed as Threatened on the *Species at Risk Act* (SARA) Schedule 1 in 2011.

This action plan complements the *Recovery Strategy for the Porsild's Bryum in Canada* (Environment and Climate Change Canada 2016) and will be implemented in British Columbia, Alberta, Nunavut and Newfoundland. The proposed recovery measures in this action plan address the objective set out in the recovery strategy for the entire population and distribution of Porsild's Bryum in Canada.

No additional critical habitat is identified in this action plan, but it is expected that as the Schedule of Studies is completed, additional critical habitat may be identified and presented in an updated recovery strategy or action plan(s). Critical habitat identified in the species' recovery strategy is located on non-federal land and a federal protected area and proposed measures to protect this critical habitat are presented in section 1.4 of this action plan.

The recovery measures included in this action plan are required to implement the recommended recovery approaches outlined in the recovery strategy. Recovery measures proposed for the Porsild's Bryum are related to five broad strategies: (1) inventory and monitoring, (2) research, (3) outreach / stewardship, (4) habitat management, and (5) reintroduction and/or population augmentation.

The socio-economic evaluation was completed and it was determined that the direct and indirect costs of implementing this action plan are anticipated to be low over the short term (2019-2023) and the long term (2023 onwards). The implementation will benefit other species, habitat and ecosystems.

Table of Contents

1. Recovery Actions

1.1 Context and Scope of the Action Plan

The taxonomic designation of Porsild's Bryum has changed over time. At the time of the 2003 COSEWIC assessment, it was considered to be in the genus Mielichhoferia (*Mielichhoferia macrocarpa* (Hooker) Bruch & Schimper ex Jaeger & Sauerbeck). It was then placed in the genus Bryum (*Bryum porsildii* (I Hagen) Cox & Hedderson) and more recently in the genus Haplodontium (*Haplodontium macrocarpum* (Hooker) Spence). The currently accepted name of the species is *Haplodontium macrocarpum*. These names are synonomous and all refer to the Porsild's Bryum.

Porsild's Bryum was assessed as Threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2003, then subsequently listed as such on Schedule 1 of the *Species at Risk Act* (SARA) in 2011 using the name *Mielichhoferia macrocarpa*. As such, this is the name used for the purposes of this action plan.

Porsild's Bryum is a small brilliant green moss associated with shaded calcareous cliffs or rock outcrops and continuous or intermittent seepage (COSEWIC 2003; Environment and Climate Change Canada 2016). The distribution extent has changed little since it was assessed by COSEWIC in 2003. It is known to occur in at least 17 populations in Canada: 1 in British Columbia, 6 in Alberta, 7 in Newfoundland and Labrador, and 3 in Nunavut (Environment and Climate Change Canada 2016). There is limited information available to determine reliable trends in the population though loss of individuals and colonies, and a decline in habitat quality, has been noted at some locations (COSEWIC 2003). Porsild's Bryum has slow regeneration, limited dispersal ability, and narrow substrate requirements that likely make recovering from threats such as drought, temperature extremes, recreational activities, or stochastic events difficult (COSEWIC 2003; Belland and Limestone Barrens Species at Risk Recovery Team 2006).

The recovery strategy identifies the following population and distribution objective for Porsild's Bryum:

> "To maintain or increase the number of colonies, and sub-populations for all known extant populations of Porsild's Bryum, while also maintaining or increasing the distribution of colonies and sub-populations within each population, and, where feasible, to reestablish the species to locations where it has been extirpated and previously known to exist."
> (Environment and Climate Change Canada 2016)

This action plan addresses all populations of Porsild's Bryum in Canada and should be considered along with the *Recovery Strategy for Porsild's Bryum in Canada* (Environment and Climate Change Canada 2016). The recovery strategy provides more details on the strategic direction and approaches for recovery of Porsild's Bryum, critical habitat information, and background information on the species and its threats.

Provincial recovery documents for Porsild's Bryum have been developed in Alberta (Alberta Porsild's Bryum Recovery Team 2010) and Newfoundland and Labrador (Belland and Limestone Barrens Species at Risk Recovery Team 2006). These documents summarize provincial-specific distribution and habitat patterns, threats, recovery initiatives, etc.

1.2 Measures to be Taken and Implementation Schedule

Table 1. Implementation Schedule

#	Recovery Measures	Priority[a]	Threats or objectives addressed	Timeline
Broad Strategy: Inventory and Monitoring				
1	Conduct field surveys to locate Porsild's Bryum populations and subpopulations, both within and adjacent to the species' known range and in other potential locations deemed to have suitable habitat, to determine the species complete population size and distribution. Alberta Porsild's Bryum Recovery Team (2010), Belland and Limestone Barrens Species at Risk Recovery Team (2006), and Environment and Climate Change Canada (2016) identify areas of particular interest.	High	Knowledge gaps	Ongoing to 2023
2	Survey all sites to determine baseline population sizes, and identify threats and their impacts.	High	Knowledge gaps; All threats	Ongoing to 2021
3	Develop and implement a long-term monitoring program which examines population sizes and dynamics, colony numbers, threats, habitat trends (e.g., air temperature, relative humidity, and water quality), and microclimate trends at selected sites throughout the species' range.	High	Knowledge gaps; All threats	By 2021, then regularly (frequency dependent on location)
Broad Strategy: Research				
4	Develop and implement a research plan to determine the detailed biological needs of the species (e.g., physiological tolerances to light and temperature, water chemistry and substrate requirements, and resilience to disturbance), and habitat conditions.	High	Knowledge gaps; All threats	Ongoing to 2021
5	Further identify limiting factors and natural threats not already presented in the *Recovery Strategy for the Porsild's Bryum in Canada* (Environment and Climate Change Canada 2016).	High	Knowledge gaps	By 2021

6	Create a habitat model to predict species presence at potential sites.	Low	Knowledge gaps	Ongoing to 2022
7	Develop minimum viable population estimates.	Low	Knowledge gaps	By 2028
Broad Strategy: Outreach / Stewardship				
8	Develop educational material (e.g., brochures, displays at interpretative centres, and signage within protected areas) and other outreach initiatives to increase public understanding of threats to the species and promote stewardship.	Medium	Recreational activities	Ongoing to 2021
9	Work with various levels of government, stakeholders, and the general public to identify solutions for minimizing known threats (e.g., preventing campfires at Whitehorse Creek, Alberta, or preventing recreational use of cliffs at Ribbon Creek, Alberta).	Medium	Recreational activities; Industrial activity	Ongoing to 2021
10	Where appropriate, collaborate with industrial partners to minimize the effects of industrial activities (e.g., road dust in Mountain Park, Alberta). Avenues for collaboration include (but are not limited to) regular meetings / discussions, the development of beneficial management practices, and reviewing work procedures.	Medium	Industrial activity	Ongoing to 2021
11	Encourage the involvement of the public and industrial stakeholders in implementation efforts, including monitoring (where feasible) (e.g., through *Adopt-a-Plant Alberta* program).	Medium	Recreational activities; Industrial activity; Knowledge gaps	By 2021
Broad Strategy: Habitat Management				
12	Ensure critical habitat for extant populations on federal lands is legally protected.	High	Recreational activities; Industrial activity	Completed)
13	Work with provinces and landowners to secure effective protection of critical habitat for extant populations on non-federal lands.	High	Recreational activities; Industrial activity	By 2020
14	Install and maintain fencing, signage, etc. in strategic locations to conserve subpopulations vulnerable to recreational activities	Medium	Recreational activities	Ongoing to 2021, then as required

	(e.g., Ribbon Creek Lower and Upper, Whitehorse Creek 2, and Whitehorse Creek Boulder), if deemed necessary for population survival and recovery.			
15	When feasible, restore habitat at damaged locations. The necessity, extent and type of restoration will be site specific.	Medium	Recreational activities; Industrial activity; Stochastic events	As required
Broad Strategy: Reintroduction and Population Augmentation				
16	Develop reintroduction protocols.	Medium	All threats	By 2022
17	Determine the feasibility of reintroduction and population augmentation and identify priority sites for implementation.	Medium	All threats	By 2023
18	Re-introduce plants to restored habitat and/or implement population augmentation, if deemed feasible.	Medium	All threats	As required
19	Monitor effectiveness of reintroductions.	Medium	All threats	For at least 5-10 years post reintroduction

[a] "Priority" reflects the degree to which the measure contributes directly to the recovery of the species or is an essential precursor to a measure that contributes to the recovery of the species. High priority measures are considered those most likely to have an immediate and/or direct influence on attaining the population and distribution objectives for the species. Medium priority measures may have a less immediate or less direct influence on reaching the population and distribution objectives, but are still important for the recovery of the population. Low priority recovery measures will likely have an indirect or gradual influence on reaching the population and distribution objectives, but are considered important contributions to the knowledge base and/or public involvement and acceptance of the species.

1.3 Critical Habitat

1.3.1 Identification of the Species' Critical Habitat

Critical habitat of Porsild's Bryum was partially identified in section 7 and Appendix A of the federal recovery strategy (Environment and Climate Change Canada 2016). The recovery strategy also contains details about the identified critical habitat including its geospatial extent and biophysical attributes (section 7.1) (Environment and Climate Change Canada 2016). Please refer to that document for details.

Given the best available information, no additional critical habitat for Porsild's Bryum can be identified in this action plan. Critical habitat will be updated in an amended recovery strategy or additional action plan once the Schedule of Studies is completed. Refer to section 7.2 of the federal recovery strategy for a Schedule of Studies necessary to complete critical habitat identification (Environment and Climate Change Canada 2016).

1.3.2 Activities Likely to Result in Destruction of Critical Habitat

Examples of activities likely to result in the destruction of critical habitat may be found in section 7.3 of the federal recovery strategy (Environment and Climate Change Canada 2016).

1.4 Proposed Measures to Protect Critical Habitat

1.4.1 Proposed protection measures on Federal Lands

Critical habitat of Porsild's Bryum in Nunavut is identified within Quttinirpaaq National Park of Canada and has been legally protected by the process outlined in subsection 58(2) of SARA, as well as by the *Canada National Parks Act*. In addition, the Parks Canada Agency may use existing management tools to prevent destruction of critical habitat, such as posting notices, restricting access to the area, and educating visitors.

1.4.2 Proposed protection measures on Non-federal Lands

With regard to critical habitat on non-federal lands, Environment and Climate Change Canada will work with the Governments of British Columbia, Alberta, Nunavut, and Newfoundland and Labrador to report on critical habitat protection.

SARA requires that if, after consulting with the appropriate provincial or territorial minister, the Minister is of the opinion that the laws of the province or territory do not effectively protect the critical habitat of the species, then the Minister must make a recommendation to Governor in Council that an order be put in place to prevent the destruction of critical habitat.

The implementation of conservation measures is an important complementary strategy for preserving this species' critical habitat. Environment and Climate Change Canada will work with the applicable provinces, non-governmental organizations, and individuals to facilitate the implementation of conservation measures.

2. Evaluation of Socio-Economic Costs and of Benefits

The *Species At Risk Act* requires that an action plan include an evaluation of the socio-economic costs of the action plan and the benefits to be derived from its implementation (SARA 49(1)(e), 2002). This evaluation addresses only the incremental socio-economic costs of implementing this action plan from a national perspective as well as the social and environmental benefits that would occur if the action plan were implemented in its entirety, recognizing that not all aspects of its implementation are under the jurisdiction of the federal government. It does not address cumulative costs of species recovery in general nor does it attempt a cost-benefit analysis. Its intent is to inform the public and to guide decision making on implementation of the action plan by partners.

The protection and recovery of species at risk can result in both benefits and costs. The Act recognizes that "*wildlife, in all its forms, has value in and of itself and is valued by Canadians for aesthetic, cultural, spiritual, recreational, educational, historical, economic, medical, ecological and scientific reasons*" (SARA 2002). Self-sustaining and healthy ecosystems with their various elements in place, including species at risk, contribute positively to the livelihoods and the quality of life of all Canadians. A review of the literature confirms that Canadians value the preservation and conservation of species in and of themselves. Actions taken to preserve a species, such as habitat protection and restoration, are also valued. In addition, the more an action contributes to the recovery of a species, the higher the value the public places on such actions (Loomis and White 1996; Fisheries and Oceans Canada 2008). Furthermore, the conservation of species at risk is an important component of the Government of Canada's commitment to conserving biological diversity under the *International Convention on Biological Diversity*. The Government of Canada has also made a commitment to protect and recover species at risk through the Accord for the Protection of Species at Risk. The specific costs and benefits associated with this action plan are described below.

2.1 Policy Baseline

The provinces of British Columbia, Alberta, and Newfoundland and Labrador, the Territory of Nunavut, and the federal government have access to many legislative, regulatory, and management tools for the conservation and stewardship of Porsild's Bryum (e.g., endangered species legislation, protected areas legislation, and environmental assessments). For example, Porsild's Bryum is listed as Endangered under Alberta's *Wildlife Act* and Threatened under Newfoundland and Labrador's *Endangered Species Act*. In addition, the populations in Nunavut occur within a national park and are subject to the *Canada National Parks Act* while the population in British Columbia occurs within a provincial park subject to British Columbia's *Park Act*.

Both Alberta and Newfoundland and Labrador have published recovery strategies for the species and recovery activities have been initiated in Alberta (AESRD 2013). For example, microclimatic sensors were installed at the Mountain Park population in Alberta (2011-12) to document key temperature and relative humidity conditions during the growing season. In addition, baseline site characteristics, including water and rock chemistry data, was obtained from several of the Alberta populations (AESRD 2013). A sign was erected at one site in Alberta near a popular campground by to inform campers about several plant species present, including Porsild's Bryum, and the importance of protecting them. Nationally, field surveys have recently (ca. 2015) been conducted at several of the populations of Porsild's Bryum in Canada in support of an updated COSEWIC status report.

Industrial policies and work procedures already in place may also contribute to the implementation of this action plan and thus the conservation of Porsild's Bryum. For example, dust levels along a haul road servicing a coal mine site adjacent to Mountain Park, Alberta, have been monitored to inform potential mitigative measures to reduce any impact to the species (Alberta Government 2014).

Additionally, many recovery measures can be carried out by federal or provincial species at risk funding programs, contributions by recovery biologists, or research by university partners.

2.2 Socio-economic Profile and Baseline

The measures outlined in this action plan relate primarily to inventory and monitoring, research, outreach and education and habitat management. Populations of Porsild's Bryum occur primarily within federal and provincial protected areas and parks. There are few communities or individuals that would be affected by the implementation of the measures identified in the action plan for Porsild's Bryum.

Within British Columbia, Porsild's Bryum is only known to occur within Muncho Lake Provincial Park and in Nunavut all populations are currently known from Quttinirpaaq National Park. Quttinirpaaq National Park is within the Nunavut Land Claims Agreement and is an area particularly important to Inuit from Grise Fiord and Resolute Bay.

However, the implementation of this action plan (i.e., inventory and monitoring, research, outreach and education and habitat management) is expected to have little to no effects on these communities.

Although Porsild's Bryum is found outside of federal or provincial protected areas in Newfoundland and Labrador, a non-governmental organization is actively involved with conservation and stewardship initiatives in the nearby limestone barrens. This recovery and conservation partnership has been ongoing in the area for several years in an effort to restore habitat and promote the long term protection and conservation of Porsild's Bryum and other species at risk in the area.

In Alberta, most of the recovery measures for the species will take place in various provincial protected areas with varying levels of protection. Potential affected stakeholders include transmission and telecommunication companies with dispositions on provincial lands and the mining industry. Porsild's Bryum is found within traditional territories of numerous First Nations in Alberta, but the implementation of the action plan (i.e., inventory and monitoring, research, outreach and education and habitat management) is expected to have little to no effects on these communities.

2.3 Socio-economic Costs of Implementing this Action Plan

Costs are those directly associated with the implementation of the recovery measures identified in the implementation schedule (Table 1), as well as those encountered as a result of that implementation. Only the incremental costs are considered and therefore do not include ongoing actions or initiatives discussed in section 2.1 (Policy Baseline). The direct and indirect costs of implementing the action plan are expected to be low (between $0 and $5 million) over the short term (2019-2023). Costs at the regional or provincial scale are expected to be minimal. Long-term (2023 onwards) costs are also expected to be minimal.

Social costs are the potential costs associated with implementing the action plan, which may have an impact on various stakeholders. Because there are a small number of known occurrences, the majority of occurrences are in protected areas, and there is lack of human-use associated with this species, the social costs anticipated from the implementation of this action plan are low.

2.4 Benefits of Implementing this Action Plan

2.4.1 Value of biodiversity to Canadians

It is anticipated that this action plan will contribute to the recovery of Porsild's Bryum and lead to the achievement of the population and distribution objective and the conservation and protection of habitat for the species.

Biodiversity is essential for healthy ecosystems, human health, prosperity, security, and wellbeing. Canadians derive many benefits from biodiversity including recreational, aesthetic, educational, cultural benefits as well as ecological goods and services essential to human survival. Care for the environment is consistently ranked as one of Canada's top priorities in public opinion polls[4]. An opinion poll found that three quarters of Canadian respondents feel that preserving natural areas and the variety of native plant and animal life in Canada is important to them[5].

The total value of endangered species consists of non-consumptive use values (such as recreation, spiritual/cultural, research, and education), indirect use values (value of the ecological role of a species in an ecosystem), and non-use values (i.e., preserving the benefits of nature for future generations)[6]. Implementing the recovery measures of this action plan will have a positive impact on society. The direct value of this implementation, for the preservation or the enhancement of biodiversity, is not easily estimated.

2.4.2 Eco-tourism and cultural values

Eco-tourism is the fastest-growing area of the tourism industry (Mastny 2001; UNEP 2013). In 2004, this market grew three times faster than the industry as a whole and the World Tourism Organization estimates that global spending on eco-tourism is increasing by 20% a year, about six times the industry-wide rate of growth (TEEB 2008). Many of the Porsild's Bryum subpopulations are already located in or near parks (see Table 2 of the recovery strategy for details), but it is possible that education and stewardship activities may lead to a small increase in eco-tourism activity.

2.5 Distributional Impacts

Porsild's Bryum occurs on provincial, federal, and private properties, and the majority of sites are within protected areas. Thus, private landowners are not expected to absorb the direct incremental costs for the species' recovery. Any indirect incremental costs resulting from the implementation of recovery measures will be shared. Should additional populations of Porsild's Bryum be discovered on private land through activities identified in this action plan, the distributional impacts will be re-assessed.

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[4] Canada's Fourth National Report to the United Nations Convention on Biological Diversity, 2010. Available online http://www.cbd.int/doc/world/ca/ca-nr-04-en.pdf Accessed December 3, 2010.
[5] Ipsos Reid Opinion Poll "Nine in Ten (87%) Canadians Say That When Connected to Nature They Feel Happier." Released January 7, 2011, www.ipsos.ca
[6] Non-use values include bequest value (satisfaction of knowing that future generations will have access to nature's benefits), altruist value (satisfaction of knowing that other people have access to nature's benefits) and existence value (satisfaction of knowing that a species or ecosystem exists).

3. Measuring Progress

The performance indicators presented in the associated recovery strategy provide a way to define and measure progress toward achieving the population and distribution objectives.

Reporting on implementation of the action plan (under section 55 of SARA) will be done by assessing progress towards implementing the broad strategies.

Reporting on the ecological and socio-economic impacts of the action plan (under s. 55 of SARA) will be done by assessing the results of monitoring the recovery of the species and its long-term viability, and by assessing the implementation of the action plan.

4. References

Alberta Environment and Sustainable Resource Development (AESRD). 2013. Analysis of habitat requirements for Porsild's Bryum (*Haplodontium macrocarpum* [Hooker] Spence) in Alberta. Alberta Environment and Sustainable Resource Development. Species at Risk Report No. 150. Edmonton, AB. 52 pp.

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Appendix A: Effects on the Environment and Other Species

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals*[7]. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making and to evaluate whether the outcomes of a recovery planning document could affect any component of the environment or any of the Federal Sustainable Development Strategy's[8] (FSDS) goals and targets.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that implementation of action plans may also inadvertently lead to environmental effects beyond the intended benefits. The planning process based on national guidelines directly incorporates consideration of all environmental effects, with a particular focus on possible impacts upon non-target species or habitats. The results of the SEA are incorporated directly into the action plan itself, but are also summarized below in this statement.

The measures set out in this document are expected to have no negative effects on other species. Many of the measures pertain to inventory / monitoring or research and therefore should not adversely impact other species. Other actions pertaining to outreach / stewardship and habitat management may create benefits for the surrounding habitat and ecosystems.

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[7] www.canada.ca/en/environmental-assessment-agency/programs/strategic-environmental-assessment/cabinet-directive-environmental-assessment-policy-plan-program-proposals.html

[8] www.ec.gc.ca/dd-sd/default.asp?lang=En&n=CD30F295-1

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FOR INFORMATION: Federal Addition to the National Polar Bear Management Plan – The Path Forward

Presentation to the Nunavut Wildlife Management Board

June 19, 2019

Presentation by Lauren Schmuck and Sam Iverson

Wildlife Management and Regulatory Affairs Division, Canadian Wildlife Service

Outline

1. Overview of the National Polar Bear Management Plan
2. Conservation Designation and Status of Management Plans or Recovery Strategies in Canadian jurisdictions
3. Management Authority
4. Federal Addition Contents
5. Cooperation and Coordination with Co-Management Partners
6. Anticipated Timeline
7. Rights Holder Consultation and Board Approval Process
8. Thank you and questions

1. Overview of the National Polar Bear Management Plan

- The National Polar Bear Management Plan will include seven parts:
  - Part 1: Federal Addition
  - Parts 2-7: Provincial and Territorial documents
    - Inuvialuit Settlement Region (NWT/YK) (Part 2) and Ontario (Part 5) are complete
    - Nunavut (Part 3) is nearly complete
    - Manitoba (Part 4), Québec-EMR-NMR (Part 6) and Newfoundland and Labrador (Part 7) require additional work

- A draft of the Federal Addition has been completed. However, ECCC will not seek to finalize the federal addition until most (or all) provincial and territorial documents are complete

2. Conservation Designation and Status of Management Plans or Recovery Strategies in Canadian jurisdictions

Jurisdiction	Legislation	Designation	Year	Status
Newfoundland & Labrador	*Endangered Species Act*	Vulnerable*	2002	In progress
Manitoba	*Endangered Species Act*	Threatened	2008	In progress
Ontario	*Endangered Species Act, 2007*	Threatened	2009	Complete
Québec	*Loi sur les Espèces Menacées ou Vulnéable*	Vulnérable*	2009	In progress
Nunavut	*Nunavut Wildlife Act*	No listing	–	In progress
Northwest Territoires	*Species at Risk (NWT) Act*	Special Concern	2014	Complete (ISR joint co-management plan)
Yukon	*Yukon Wildlife Act*	No listing	–	

3. Management Authority

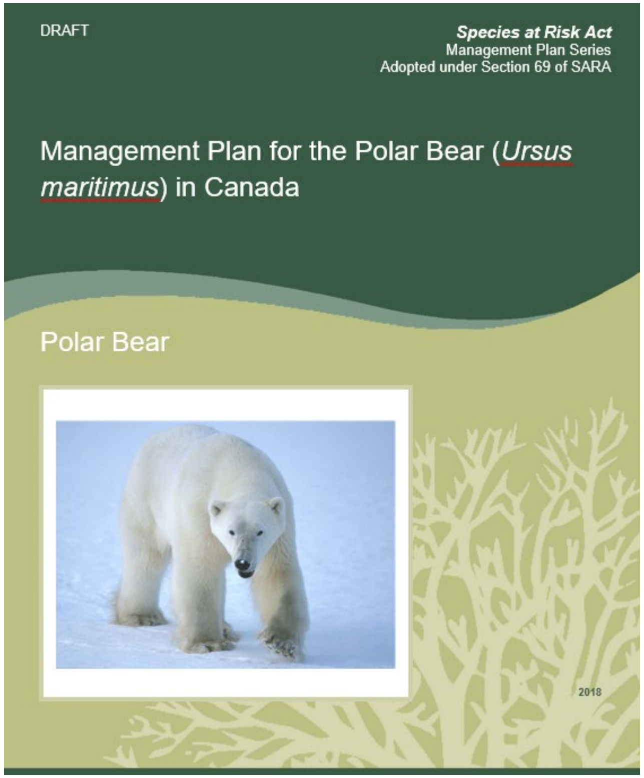
- The Federal Addition recognizes that polar bear management is a shared responsibility of provincial/territorial governments and Wildlife Management Boards

- To address this, the Federal Addition limits federal scope to management responsibilities under federal jurisdiction and refers readers to the provincial and territorial documents for issues under their authority

4. Federal Addition Contents

Table of Contents

1. COSEWIC Species Assessment
2. Species Status
3. Species Information
4. Threats
5. Management Objective
6. Broad Strategies and Management Actions
7. Measuring Progress
8. References



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5. Coordination and Cooperation with Co-Management Partners

- Organizations that are part of Canada's Polar Bear Administrative Committee (PBAC), including the Government of Nunavut, NWMB and NTI, were invited to work in cooperation with ECCC to develop a draft of the Federal Addition by joining a Working Group.
- The resulting draft document was sent for review by PBAC members and Canadian Wildlife Service regions in November 2018
- PBAC members and CWS jurisdictions will have another opportunity to provide feedback on a revised Federal Addition in June 2019

6. Anticipated Timeline:

November 2018 – January 2019

- PBAC members (**including the NWMB**) and CWS regions received draft version of the Federal Addition for review and comment (First opportunity to comment)

June 2019

- The next version of the Federal Addition will be sent to PBAC (**including the NWMB**) for review in June 2019 (Second opportunity to comment)

Fall 2019

- ECCC will review and incorporate second round of comments
- ECCC hopes that all (or most) provincial and territorial plans will be completed

Late 2019/early 2020

- Additional consultations will be conducted as needed on the Federal Addition, including any outreach to rights' holders recommended by WMBs across northern Canada

6. Anticipated Timeline (continued):

Early-mid 2020

- ECCC will review and incorporate comments received during final consultations
- National Polar Bear Management Plan posted as "Proposed" document on SAR Public Registry for 60-day public comment period (Final opportunity to comment)

Mid-late 2020

- Necessary revisions will be made
- National Plan brought before Wildlife Management Boards (**including the NWMB**) for decision

Late 2020/early 2021

- If approved, National Polar Bear Management Plan posted as a Final document on the SAR Public Registry

7. Rights Holder Consultation and Board Approval Process

Board/Indigenous Organization	Community-level consultation advised?	Recommended Board Process for Approval		
		Regular meeting	Written public hearing	In-person public hearing
Inuvialuit Game Council	No	✓		
ISR-WMAC North Slope	No	✓		
ISR – WMAC NWT				
Nunavut Wildlife Management Board				
Nunavik Marine Region Wildlife Board	No		✓	
Hunting, Fishing and Trapping Coordinating Committee (Quebec)	No	✓		
Eeyou Marine Region Wildlife Board				
Torngat WPCB/Nunatsiavut Government	✓			✓

- ECCC staff will work with NWMB staff to determine if additional consultation with rights holders is advised in Nunavut and what process the NWMB prefers to follow when the National Plan is presented for Decision

Thank you

- Questions?