

**ESTIMATING THE ABUNDANCE OF THE M'CLINTOCK CHANNEL POLAR BEAR
SUB-POPULATION BY GENETIC MARK-RECAPTURE**

**FIELD REPORT TO
DEPARTMENT OF ENVIRONMENT**

Pursuant to GN Wildlife Research Permit # WL-2015-014

AND

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AND

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pitquhitigiyangnun angunianginaqtun talvanga MCmi maniliuqluagungnaiqtun. Tamna MC-ngit amigaitilaangit munagiyauvaktun amigaiqyumigianganik, ilitugidjutikhangitlu naunairutiqliqtuq amigaitilaangat nanuit takunaqhiliqtun maniqami MC-mi. Malikhautitigun tamna atuqtauhimaaqtangit talvani 2005mi MC-mi Nanuit Naunaitkut Angiqatigiiknirmut (MOU), ihumagiyauyuniklu nunalaani ilauyunik anguyukharnik amigaitunik nanungnik, nuutaanguyuq 3nik ukiunganik ihivriudjutikharnik havaaqhaq aulatitihimavaktuq 2014mi tuniyaangat naunairutikharnik amigaitilaangitlu nanungnik talvani MC-mi. Amigaitilaangit kihidjutikhangitlu ihivriuqtauniaqtun kitkuumatilaangayut nanuit anguplugit uumayumik.

Talvanga 5 Qiqaiyaqluarvia Imaruqtiqvia 8mi, 2015mi katitiqhimayut 122nik nanungnik (talvani 79nik katimaviinik) allatqiinguyut ukiuqaqtunik tamangnik anguhaluit arnaqluitlu piyauvakhimayut, taima 90nguyut ihivriuqtauvakhimayut, taima naunairutikharnik uvinirmin 8nguyut nanungnin naunairutiqaqpaktun ihivriuqtauyaangat. Kihimi hilaqlungnirmin ayungnautigivaktaingitlu imailiugiangat, naunairutikhangit atungitun tamaini MC-mi; qiniqhivagiaqaqtavut aadjikiiktun ihivriuqtauvaktun nanuit taima nayugaani talvuuna 2014mi ukiungani anguniarvingani. Talvuunattiaq, hanguvaktavut unghiktilaangit hanguvaktavut 10,100 kmiiitanik. Katitiqhimayut naunairutikhangit nallautiqhimaqaqtun taima 1.6nik nanungnik ikaakninirmi qiniqhiavikharnik. Qaffiutilaangit nanuit piyauvakhimayut talvuuna upinngami 2015mi aadjikiiktilaaqaqtuq 43 pusanmik kinguliuyunik 2 tausinik naunaitkuhiqhimayunik anguyauvakhimayut uumayumik amigaitilaangit nallautiqhimayut atuqtauhimaaqtun anguyukharnik munagidjutikharnik. IQnik, kihiani, naunairutiqaqniaqtun taima amigaitilaangat amigaiqyumiqhimayut, taima ihumaliuqnikkut ihivriuqtauyaangat ikikliyumiqniaqtun taima 43 pusanmik. Talvuunattiaq, kitkuumatilaangit naunairutiit pigiaqaqtun havagiaqaqtun naunaiyaiyaangat qaffiuyut allatqiinguyut nanuit hanaqiyauvakhimayut. Upalungairutikhangit aulahimaaqtun pingahuani (taimalu kinguliuniaqtuq) maniqami hanaqidjutikharnik aulatitiyangat Qitiqauyaqviani 2016mi.

PERSON DAYS

Field work during the 2015 field season (17 April – 8 June in the field with sampling days between 5 May and 4 June) involved approximately 110 person days (includes biologist, technician, and HTO assistant).

AIRCRAFT HOURS

We flew a total of approximately 83 hours during our field study, of which 12.7% (or about 10.5 hrs) was ferry time, leaving a total search time of approximately 72.5 hours. Search times per day averaged 5.16 hrs (including days with and without bears being sighted and sampled). We had a total of 13 days where we searched for bears, not including the days for camp-repositioning occasions.

FIELD DATES

Biopsy sampling for the M'Clintock Channel (MC) polar bear study took place between 5 May and 4 June 2015. During this time frame, MC was completely snow and ice-covered and we assumed therefore that the majority of bears are distributed across the study area. The initial start date was set for 17 April, but poor weather conditions as in 2014 did not allow the helicopter to be repositioned from Resolute to Cambridge Bay before 4 May. The start dates were selected so that family groups even with smaller cubs and late den emergence have sufficient time to move from their denning areas onto the sea ice, hence be available for locating and biopsying.

FIELDWORK LOCATIONS

Fieldwork was conducted across the sea ice and smaller islands within the MC study area (Figure 1). In particular, we searched the areas in and around Gateshead Island, Albert Edward Bay, Admiralty Island, portions of the east-side of Victoria Island in M'Clintock Channel proper, Franklin Strait, Victoria Strait, James Ross Strait and Larson Sound (Figure 2). Field bases for this work were Cambridge Bay, Cape Sidney on King William Island, and Fort Ross on Somerset Island.

FIELD ACTIVITIES/ ACCOMPLISHMENTS

A Bell 206L helicopter was used to search for and biopsy dart polar bears across the study area. We began in Cambridge Bay, repositioned our camp through PCSP support to Cape Sidney on 7 May, and moved camp again to Fort Ross on 25 May. All these camp moves occurred about 14 days earlier than in the previous year.

In total, 122 polar bears of various age classes and both sexes in 79 groups were encountered of which a likely 98 (or 80.3%) produced adequate biopsy samples (Figure 2, Table 1). Cubs-of-the-year, which made up 19% of the encountered bears during 2015, were not biopsied because we considered this to be an unsafe practice based on the risk of separation from their mother or of possible inflicted injuries due to their small size at this time of the year.

To reduce potential bias in sampling resulting from non-random distribution of bears within the study area, a semi-systematic search pattern in the form of transect lines was implemented in 2014. Areas that indicated a relatively high and medium bear density (based on experience and bear encounters and signs of bears) were searched with transect lines spaced between 7-10 km apart, whereas low bear density areas were searched at distances of about 10-12 km. The 2015 field season start was again delayed, and sea ice conditions were later as compared to 2014. This meant that no or very few small open leads or cracks were present in the ice where bears could be easily seen. In general, most of the sea ice was still covered by a layer of snow ranging subjectively between 10-30cm in thickness, and no melting had yet occurred.

This delay, coupled with possible further weather-related delays in field work, forced us to maximize flight times and to cover as much ground as possible. For this reason we decided to space transects more evenly so that a greater ice area per distance flown could be covered. During 2015, the transect lines were on average 12.2 km apart (range: 8-16 km, mode 13 km). Unfortunately, we were not able to search the entire MC study area again – something that may cause the final population estimate to be biased unless we will be able to add additional sampling sessions and/or cover the entire study area during the next field season. The area not covered includes the M'Clintock Channel proper; it is uncertain at present what proportion of the MC bears use this area during spring.

Depending on weather and logistical conditions for the 2016 season, we will continue to utilize the semi-structured search approach because it avoids possible biases, and it proved to be efficient. For example, capture effort during the Baffin Bay survey where bears in high densities are concentrated along the Baffin Island coastline was about 1.6 bears per hour (BPH), which is similar to our 1.688 BPH during our semi-structured efforts across low to medium density sea ice.

Because biopsy darting leaves no visible marks, the sample of possible 98 biopsied bears may include individuals that were sampled more than once during the 2015 field season. However, the number of duplicate samples is expected to be low and can be determined once genetic analyses are completed. Several measures were taken to avoid repeated biopsy of individual bears. Daily searches were limited to the extent possible to areas not previously searched. In situations where multiple bears were encountered at the same location duplication of sampling was avoided by distinguishing individuals based on size, sex or visible marks (e.g. scars, stains on fur etc.). To minimize any possible duplication during the next field season we will be using a dart

(Pneudart Inc.) that simultaneously biopsies and marks bears with a temporary dye spot.

The biopsy darting was found to be quick and minimally invasive. However, in order to be able to quantify biopsy darting efforts we recorded the times when a bear was first spotted, when the pursuit to dart the bear began, and when the bear was finally darted. The time between spotting a bear and obtaining a sample typically lasted for about 260 seconds (or 4.3 min; range: 2 – 8 minutes; mode: 3 min; n = 62). This time period includes finding a safe location to drop off the spotters and assistants, finding the bear again, and pursuing it until a dart has been projected to collect the skin sample. The pursuit time itself until a sample was collected lasted on average 2 min (range: 1 – 5 min, mode: 2 min); at times that included darting more than once. Bear behaviour during pursuit varied: many adult males did not move much, or only very slowly whereas subadults and family groups moved at a faster pace but did not run excessively or to exhaustion.

Since the bears were not being chemically immobilized they could be safely darted in all locations. Bears showed little or no reaction to the impact of a dart and no visible marks were left following darting in almost all cases. Immediately after being darted, each bear was allowed to safely move away from the helicopter before the dart was retrieved. Darts had fluorescent flagging tape attached to them to aid retrieval. This tape unrolled during flight and allowed darts to be located when they sank into the snow. Following retrieval each sample was divided into two parts for storage and labelled with a unique biopsy number assigned to each bear that could be used as a cross reference to other data on date, time, location of biopsy, body condition, estimated sex and age and associated confidence assignment, habitat, group size and activity.

PRELIMINARY RESULTS & DISCUSSION

Mark-Recapture Sampling

In 2015, the start-date and location to begin sampling was set to 17 April and Cambridge Bay, which was based on a previous study (Taylor et al. 2006) and suggestions made by HTO members during consultations. However, poor weather conditions did not allow deployment of the helicopter to the study area until 5 May, which affected the remainder of the field season. This delay and the resulting logistical constraints did not allow us to completely survey the study area again. For example, we were not able to search in the areas of M'Clintock Channel proper. Other areas to the south-east and south-west of King William Island were not searched because local knowledge indicated that bears are generally rare in those areas and at that time. Genetic mark-recapture sampling took place from 5 May to 4 June 2015 with a total of 13 sampling days. During this period, approximately 10,100 km (mean \pm SE km/day: 721.93 ± 115.3 km; range: 126 – 1264 km) were flown while searching for polar bears on sea-ice habitat and islands across the MC study area (Figure 1 and 2). When compared to capture locations during the last inventory study (1998-2000), not many

bears were located in MC proper, and our current coverage of the study area appears to incorporate the majority of previous captures locations (Figure 3).

As expected, sea-ice habitat was variable across the area we sampled. Near-shore areas along King William Island, Gateshead Island, Admiralty Island and the surveyed portions along the east-side of Victoria Island were interspersed with annual intermediate and multi-annual rough ice. The area where Franklin Strait, M'Clintock Channel, Victoria Strait and James Ross Strait intersect consisted mostly of flat and intermediate ice types (Plate 2; Figure 4, Table 3). This is also the area where the majority of bears/bear activity and seals were encountered last year. Bears were generally distributed across the same areas as last year, but in lower densities. The fact that we were not able to sample at closer transects may also contribute to that impression. In general, 60% of encountered bear groups were found in flatter ice (Type 1), and 40% in ice with more features (Type 2; Table 3).

In total, 122 polar bears of various age classes and both sexes in 79 groups were encountered (Figure 2, Table 1). Of these, 90 bears were biopsied including some individuals of 24 family groups (7 females with 1 coy, 8 females with 2 coys, 4 females with 1 yearling, and 3 females with 2 yearlings, 1 female with 2 2-yr-olds and 1 female with 1 2-yr old; Table 1). Biopsy samples of an additional 8 bears also could produce reliable genetic results but their quality is currently unknown. About 19% of all encountered bears were not sampled: the majority of those were COYs which we decided not to biopsy because of their small size and potential risk of injury. The other remaining bear was the female adult part of a family group of 3 - they were not sampled because the group split up upon approach of the helicopter, and after several minutes of bringing them together successfully we abandoned the idea of repeated sampling because of concerns of prolonged approach phases and risk to overheating.

Only 4 (about 3.3%) of all encountered bears were observed with a seal kill. Subjectively, about 20-25% of bears were with kills the previous year. The fact that this spring was late by about 2 weeks and no or very few open leads and cracks were observed for seals to haul out and bask in the sun could have contributed to that fact.

Without having covered the entire study area twice it will be difficult to assess the population abundance. In addition, genetic results from the first season are not completely analysed yet by the genetics lab because of the Baffin Bay/Kane Basin studies and their high priority. Once we receive these final genetic results we will be able to assess the individuality of bears and the potential recapture rates.

Although the entire study area was not sampled, preliminary data indicate that the population exhibits relatively high adult survivorship. This is expressed by the fact that about 64% of the collected sample consisted of adult bears (NB: based on field observations without genetic confirmation). The harvest for MC was reduced from 34 bears in 1999 to only 3 bears since 2004 lowering the hunting pressure and harvest mortality. Most adult females were members of family groups, and only a few unencumbered adult females were sampled; similarly only a few subadult males and

females were observed. It is still unclear what the true picture of the age and sex distribution for MC bears looks like without having been able to survey the entire study area. Having genetic analyses completed will also assist in illuminating cub survivorships, which could be negatively affected by the high presence of adult males.

The spatial distribution of bears within the covered search area was somewhat similar to that of bears sampled during the previous 1998-2000 study (Figure 3 and 4). We were subjectively able to discern bear density across the surveyed area based on bear activities and encounters during last field season; however, during this season it appeared bears were more distributed across the sea ice, recognizing that this also could have been a sampling artefact or a result of a late spring season that did not produce open leads for bears to search along for prey. Bear activity was present in moderate densities just east of Fort Ross, between Gateshead Island and Cape Swinburne (e.g. central and northern Larsen Sound), in Franklin Strait, Victoria Strait, eastern Larsen Sound and James Ross Strait. The Dease Strait and Queen Maud Gulf areas up to Jenny Lind Island had very few signs of bear activity and presence and are therefore still considered low bear density areas. On days when bears were encountered ($n = 12$), an average of 10 bears/day was sampled. The mean efficiency of our sampling effort was 1.68 bears/hr (range: 0.14 – 3.2 bears/hr). Observed group sizes varied between 1 and 4 bears; most groups were family groups, 2 male-female pairs, and one female-3 male group.

Our subjective perception is that there are lower numbers of subadults and family groups with cubs-of-the-year and with yearlings. A comparison of the first 2 capture years of the 1998-2000 study to the current study indicates that subadults in fact are in lower proportions (12%) in the current sample than previously (42%). However, we were not able yet to genetically confirm individual capture and recaptures from our recent 2 field season samples to verify actual proportions. The average (\pm SE) COY and yearling litter sizes were 1.5 ± 0.13 ($n = 15$) and 1.4 ± 0.20 ($n = 7$), respectively. We found more offspring in 2015 as compared to 2014, which is indicated by a greater proportion they represent within the overall sample, but we also encountered less bears than the previous field season. At this stage, and without genetic identifications, it is too early to draw any inferences on how these litter sizes compare to other subpopulations that were recently sampled (Table 2).

Body Condition

During 2015, body condition scores [BCS] on a scale of 1 to 5 (leanest to most obese; Stirling et al. 2008) ranged from 2.5 to 4 (Figure 5). Mean adult female and male BCS were 3.3 and 3.2, respectively. Overall, with the exception of a few smaller cubs of the year, bears appeared healthy given the time of year and season (e.g., pre-seal prime feeding season), which is comparable to the previous year.

Genetic Analyses

The Baffin Bay/Kane Basin project samples took longer than expected to analyse by the genetics lab, in part also because of the large quantity of samples that were required –

this affected many other projects, including the MC 2014 sample analyses. DNA extracted from tissue samples collected from bears biopsied in 2014 and 2015 will be genotyped to identify individuals and confirm genetic sex. We will also use past capture samples (e.g., 1998-2000) in this analyses to obtain polar bear survival estimates of recaptured (e.g., re-sampled) bears.

Seal observations

We observed a total of 336 seals in 190 groups (group size ranging from 1 – 17) during the course of our searches for polar bears, across ice-types 1 and 2 (Figure 6, Plate 2). This sharp decline in seal observations between 2014 (about 2200 seals) and 2015 was likely caused by the delayed onset of spring and ice break-up therefore reducing basking opportunities.

COMMUNITY INVOLVEMENT

Following consultation meetings in 2013 and regional KRWB meetings in 2014, the project received (continued) support from the Ekaluktutiak HTA, Spence Bay HTA and Gjoa Haven HTA. We announced and requested support for our field work activities ahead of the field season – all HTOs had interested parties. However, we only were able to have an Ekaluktutiak HTA member participate out of Cambridge Bay. HTA members from Gjoa Haven were initially interested, but did not participate in field activities because of their involvement in another field project. We were unable to take Spence Bay HTA members to Fort Ross because of logistical constraints: we were hampered by bad weather and stuck at Cape Sidney for almost 2 weeks. The decision to relocate to Fort Ross was made unexpectedly one morning in conjunction with a Polar Continental Shelf Program weather discussion so that we were able to continue work – it was a short-notice decision. We explained the situation by phone to the Spence Bay secretary manager.

OTHER INCIDENTAL ICE OBSERVATIONS

We observed a young male brown bear in Albert Edward Bay on the sea ice, and several rough-legged hawks throughout the searched areas either on seal carcasses or just flying.

PLANS FOR NEXT SEASON

Biopsy Sampling in 2016

The currently last field season for the MC polar bear work is coming up in 2016. However, given that we were unable to survey the entire study area, it would be prudent to consider at least one additional year after 2016. If surveying the entire study area will be impossible, issues may arise in the analysis of the data stemming from possible capture bias and heterogeneity in sampling efforts across the study area, and having a biased low population estimate.

We are planning to leave out Cambridge Bay completely in order to avoid helicopter delays – this also seems reasonable since bear densities are low in Dease Strait and Coronation Gulf. After thorough examination it is also possible that areas around Jenny Lind Island and Albert Edward Bay can be reached in the search for bears from Cape Sidney. Until the field season begins, we will examine if it is better to start either later with the field work (around late April to early May) where sea ice will be exposed and open leads will form which will attract some bears and they could be easier to spot as compared to working on a snow-covered ocean, or to start earlier so that we may be able to survey M'Clintock Channel proper but may miss a few family groups due to later den emergence. We will also consider whether it is worthwhile to have 2 helicopters work the study area where one machine will specifically be dedicated to surveying M'Clintock Channel proper, and the other will work what has been surveyed during 2014 and 2015. This potentially could be the helicopter that worked in the Gulf of Boothia area first, and then relocates to Sidney Webb Point.

The GN also needs to seriously consider the purchase of a dome shelter or alternative to be more independent of other cabins that are likely in use while we do our polar bear work, and also to provide some sort of secure shelter (rather than a tent wall). Cape Sidney will likely be a conflict area since other projects are planned that involve local and researcher involvement. This spring proved to be a test on whether our crew can work effectively and un-interrupted in a larger camp setting - when the camp area becomes crowded with various activities of other projects and limited space to accommodate everyone, the working environment in the field setting becomes more stressful, disruptive, and at times safety is at stake. I recommend exploring a mobile dome shelter that will be flexible in set-up location, is cost-effective, and can be used by anyone at any location in our research section.

Abundance estimate

Having not covered the entire study area during several sampling sessions will create issues in estimating the abundance of bears within MC. We will explore and consult with some modeling experts on what possibilities exist to still obtain appropriate abundance results, and whether they come with assumptions and caveats. Options we will explore include mark-recapture analysis and spatially explicit capture-recapture analysis.

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Table 1. Overview of polar bears sampled during the 2015 field season in M'Clintock Channel¹.

Sex/Age Group	Biopsied			Total
	yes	no	maybe*	
Adult female	35	1	2	38
Subadult female	4	0	0	4
Adult male	38	0	3	41
Subadult male	2	0	1	3
Cubs-of-the-year	0	23	0	23
Yearlings	8	0	2	10
2-year old	3	0	0	3
Total	90	24	8	122

* "maybe" means that the collected sample may be adequate for genetic gender and individual identification

¹ Identifications of age/sex classes may change slightly after genetic analyses of biopsy samples.

Table 2. Polar bear litter sizes and number of dependent offspring observed (as proportion of total observations) during recent studies in central and eastern Canada. Litter size data presented as mean (standard error).

Subpopulation	Litter size		Proportion of total observations		Source
	COY	YRLG	COY	YRLG	
M'Clintock Channel (2015)	1.5 (0.13)	1.4 (0.20)	0.18	0.08	GN (unpublished data)
M'Clintock Channel (2014)	1.7 (0.15)	1.4 (0.24)	0.11	0.05	GN (unpublished data)
Baffin Bay (2013)	1.63 (0.08)	1.37 (0.09)	0.16	0.08	GN (unpublished data)
Baffin Bay (2012)	1.47 (0.06)	1.53 (0.08)	0.13	0.10	GN (unpublished data)
Baffin Bay (2011)	1.57 (0.06)	1.51 (0.09)	0.19	0.10	GN (unpublished data)
Western Hudson Bay (2011)	1.43 (0.08)	1.22 (0.10)	0.07	0.03	Stapleton et al. (2014)
Southern Hudson Bay (2011)	1.56 (0.06)	1.54 (0.08)	0.16	0.12	M. Obbard et al. 2013
Foxe Basin (2009-2010)	1.54 (0.04)	1.48 (0.05)	0.13	0.10	Stapleton et al. (2012)

Table 3: The area of habitat types (1 = flat ice, 2= flat with some ridges, 3 = large ice chunks) in the M'Clintock Channel subpopulation area is listed below. Also listed is the observed/expected (O/E) number of polar bear sightings (excluding dependent COYs and yearlings) and seal sightings by habitat type. Preference/Avoidance was calculated as the ratio of observed to expected, and the Fisher's Exact Test probability (p value) of no preference/avoidance was calculated from the 2X2 contingency table of observed and expected sightings for habitat versus all other habitats pooled. Significant preference (O/E > 1) or avoidance (O/E <1) of habitat types is in **bold**.

Habitat Type	1	2	3	TOTAL
Habitat Area (km ²)	27,820	28,947	1,678	58,445
Polar Bear Sightings (O/E)	46/37	31/38	0/2	77/77
O/E Ratio (p value)	1.24 (0.1958)	0.82 (0.331)	- (0.4967)	
Seal Sightings (O/E)	242/134	35/140	5/8	282/282
O/E Ratio (p value)	1.81 (<0.0001)	0.25 (<0.0001)	0.63 (0.5765)	
Seal kills Sightings (O/E)	11/9	7/9	0/0	18/18
O/E Ratio (p value)	1.22 (0.738)	0.78 (0.738)	-	

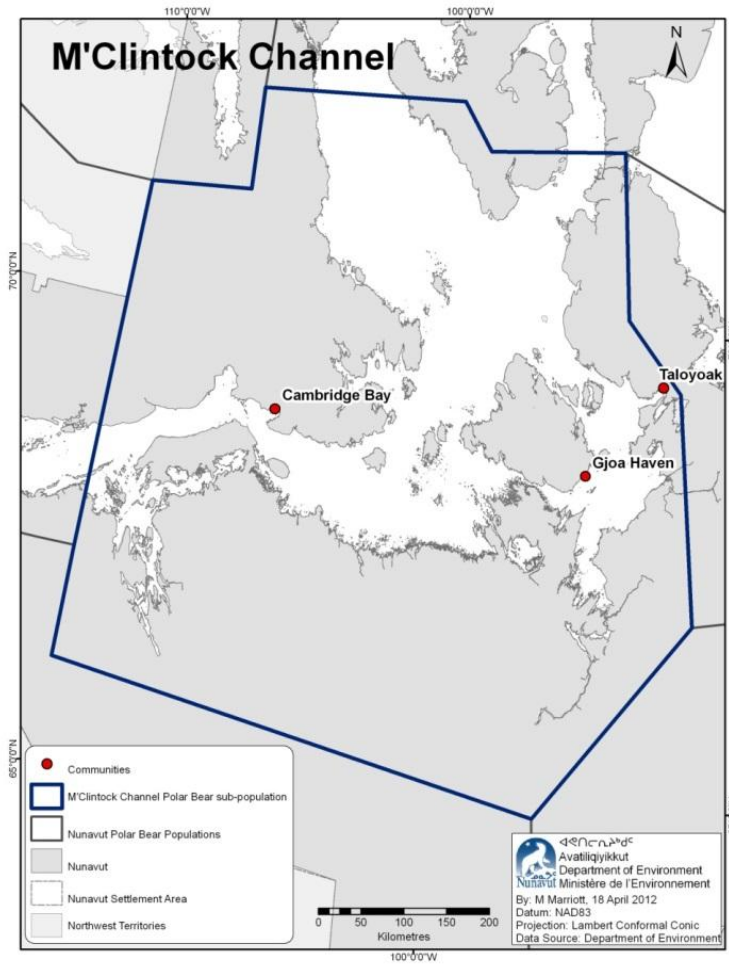


Figure 1. Map of the M'Clintock Channel polar bear subpopulation boundary and location of communities within.

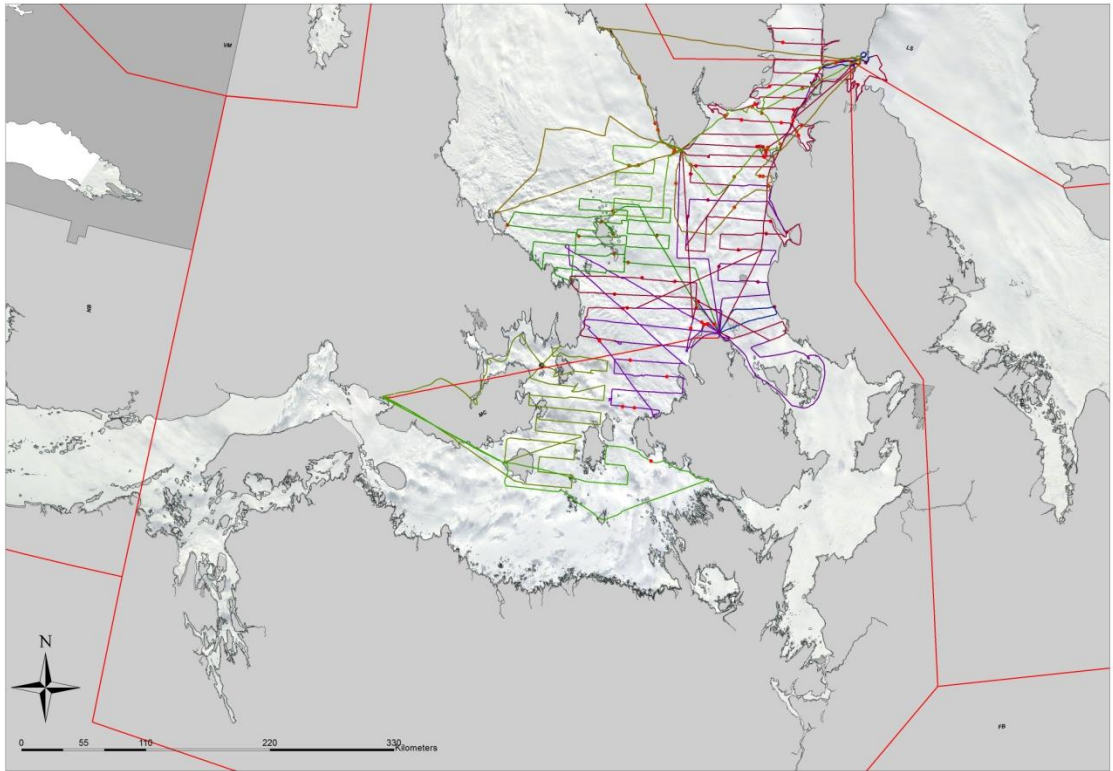


Figure 2. Locations of individual and groups of polar bears encountered during May - June 2015 in M'Clintock Channel (red dots). The lines represent the daily search tracks (NB: not the entire study area was covered; NASA/MODIS satellite image 21 May 2015; blue dot represents a brown bear).

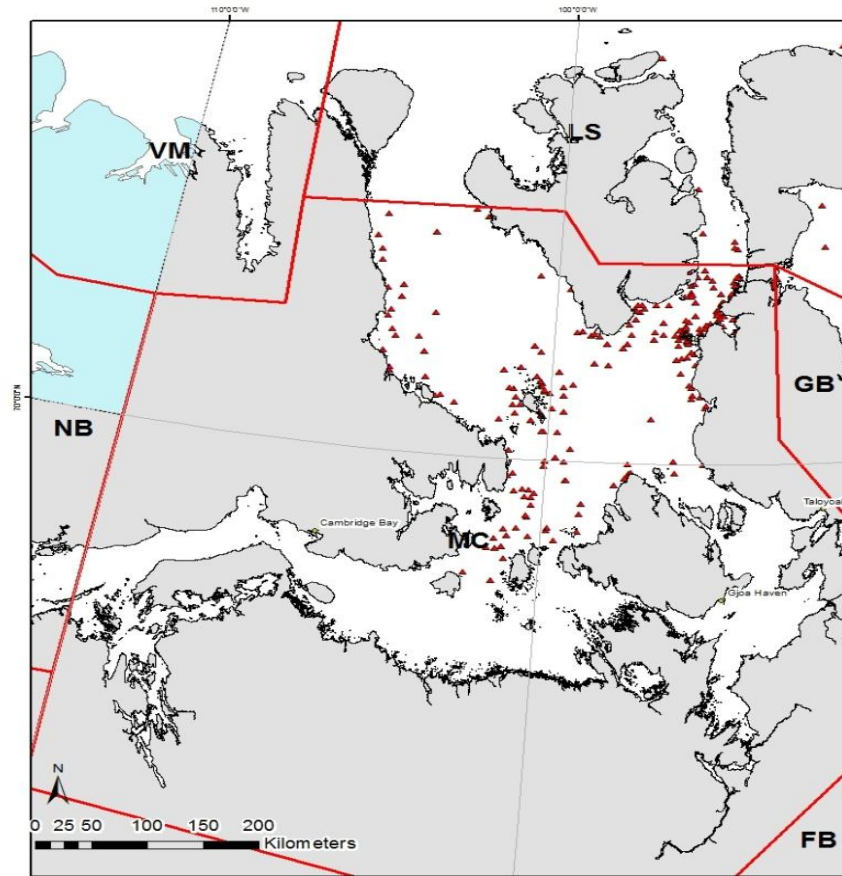


Figure 3. Polar bear capture locations during the past subpopulation study in M'Clintock Channel (1998-2000).

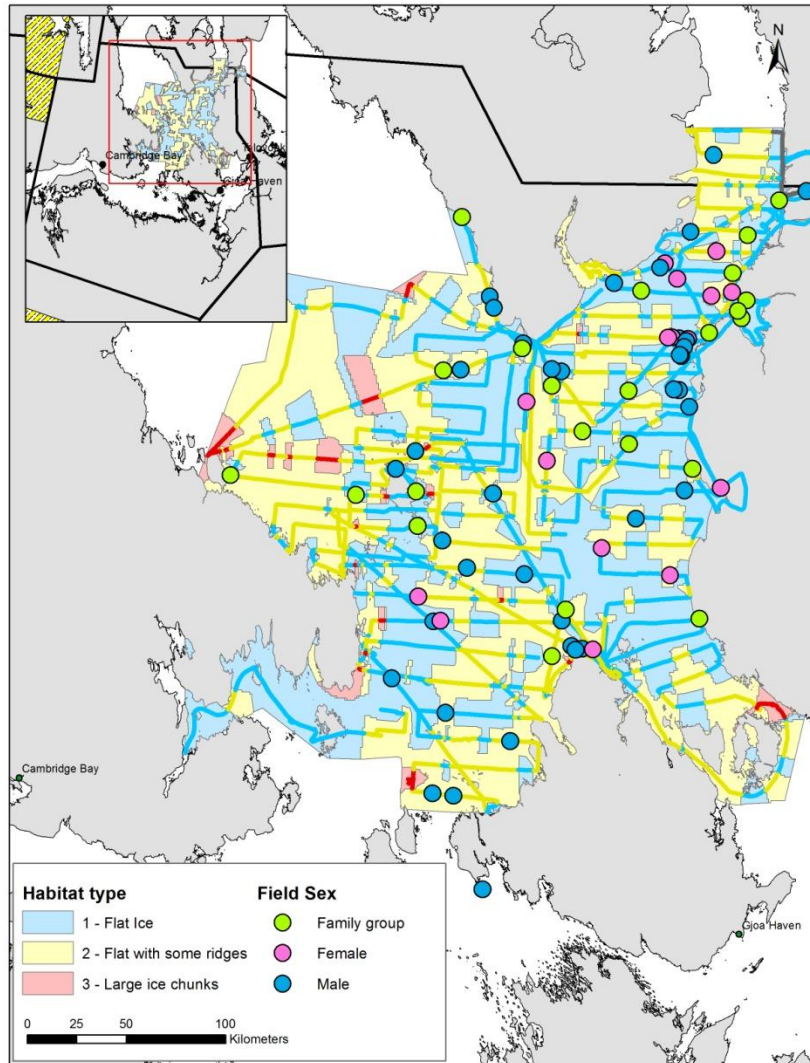


Figure 4. Habitat types (1-3) and polar bear distribution across the area searched during 2015 field activities within the M'Clintock Channel polar bear subpopulation boundary.

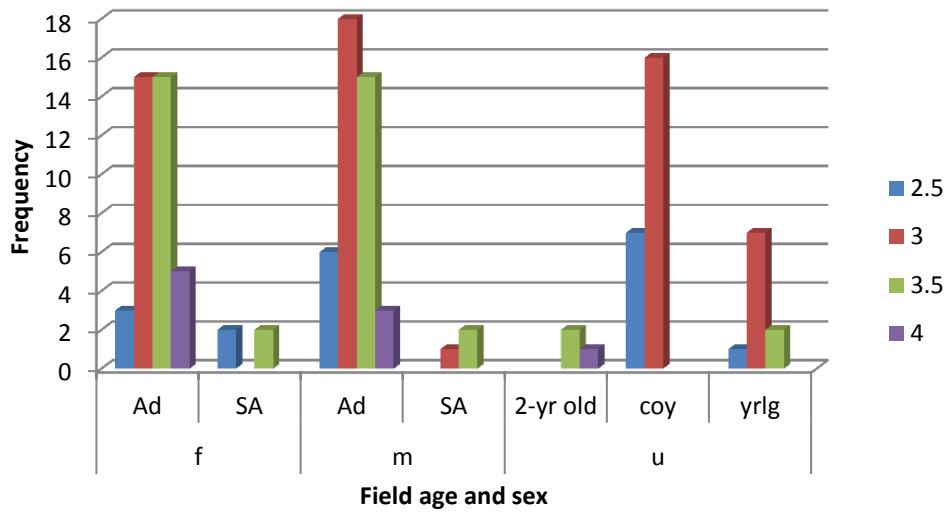


Figure 5. Summary of body condition scores (BCS) for polar bears encountered during sampling in M'Clintock Channel (Nunavut) 2015. Age and sex estimated by distance examination [NB: f = female; m = male; Ad = adult; SA = subadult; u = unknown gender; coy = cub of the year; yrlg = yearling].

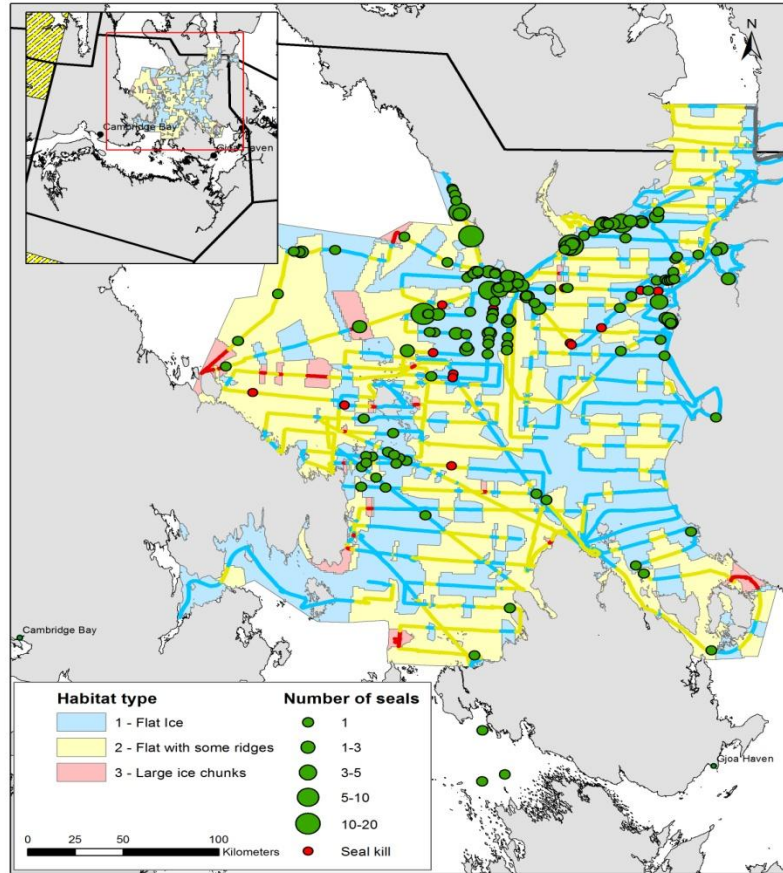


Figure 6. Distribution of seals across the various ice types during the 2015 field season in M'Clintock Channel.



Plate 1. Small skin sample extracted during the DNA biopsy process.

a)



b)



c)



Plate 2. Various ice types encountered in M'Clintock Channel during the 2014 and 2015 spring field work: a) flat (with very few ridges; circle shows a bear on the ice); b) intermediate ice relief with more and higher pressure ridges; and c) rough ice – mixture of multi-annual and annual ice pushed and crushed together, large ice chunks. (Altitude: ~350 - 400 feet).