

**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-2014-007

AND

NWT Animal Care Committee Approval # NWTWCC 2014-003

AND

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**SUMMARY**

M'Clintock Channel (MC) is a smaller polar bear sub-population managed entirely by Nunavut. An initial mark-recapture study (1973-1978) estimated that the population size of both MC and Gulf of Boothia (GB) was a combined 1081 polar bears, not identifying these units as being distinct separate units. The known biased estimate was increased to 900 bears for each unit, given that the harvest at that time was believed to be sustainable. After local knowledge suggested that the population abundance appeared to be low, the population size was lowered to 700. A new population study was conducted between 1998 and 2000 which estimated the MC polar bear population to be 284 bears. Past harvests were too high to sustain this population, and an initial moratorium was implemented following this inventory study which was followed with a reduced total allowable harvest that has been in place up to today. Because of this reduction in harvest opportunities, hunters and communities that traditionally harvested from MC have lost economic and traditional prospects. The MC population has been managed for recovery, and recent local knowledge suggests that in fact more bears are observed in various areas across MC. In accordance with commitments under the 2005 MC Polar Bear Memorandum of Understanding (MOU), and a desire by community members to harvest more bears, a new 3-year research project was initiated in 2014 to provide updated information on the abundance of bears in MC. The sub-population size and status will be assessed by means of genetic mark-recapture.

Between 5 May and 18 June 2014 a total of 155 polar bears (in 119 groups) of various age classes and both sexes were encountered, of which 127 were biopsied, with samples of 8 additional bears possibly also being suitable for analyses. Due to weather



katitiqhimayut taima 1081nik nanungnik, ilitagihimaitumik ukuat katimaviingit taima naunairutiqangitun ayungnautikharnik. Naunaiyagiikhimayut nallautikhimayut angikliyumiqhimayut 9 hananik nanungnik tamangni katimaviani, taima naunaiyagiikhimayuq anguyaangat angutikhat talvuuna ayungnautiqangitun. Talvanga nunalaani ilitugidjutikharnin ihumagiyut amigaitilaangat ikitungnaqhiyut, amigaitilaangat ikikliyumiqhimayut taima 7 hanatmun. Nuutaanguyuuq amigaitilaangitnun ihivriuqnikkut aulavakhimayuq talvuuna 1998mi 2000milu nallautikhimayuq taima MC-ngit nanuit amigaitilaangat piqaqtun 284nik nanungnik. Kinguliqhimayut anguyayut amigaitpalaqmanik uvani amigaitilaangani, talvanga hivulliuyuq nutqaqvikharnik anguyaangat aulavakhimayuq naunaiyagiikhimayuni uvani ihivriurutmi malikhautiqhimayuq ikikliyumiqhimayunut katitiqhimayunik angugiaqaqtunik aulaliqhimayu ublumun. Talvuunattiaq uvanga ikikliyumirutikhatigun anguyaangat hanaqidjutikharnik, anguniaqtiit nunalaanilu anguinaqtun angutingnik talvanga MCmi taimaliqhimayut maniliurutikharnik pitquhitigun maniliurutikharnik. Tamna MCmi amigaitilaangit munagiyauvakhimayut amigaiqyumigiangat, kinguliuyuniklu naunairutingnin ihumaliurutiaqhimayut taima amigaitun nanuit tautuktauhimavaktun qaffiuyunik hanigaqpainik talvani MCmi nunangani. Talvuunattiaq mikhaatigun havagumayainikkut talvanga 2005mi MCngit Nanungnik Iilitugidjutikhat Ilihimayainik (MOU naitumik titraqhimayuq), havagumayainik nunalaani ilauhimaqaqtunut angugiaqaqtun nanungnik, nuutaanguyuuq pingahunik ukiunganik ihivriuqtaudjutikhaq havaaq aulatitihimayuq talvani 2014mi tuniyaangat naunaitumik naunairutikharnik amigaitilaanikkut nanungnik talvani MCmi. Tamna amigaitilaangit kihidjutikhangitlu ihivriuqtauniaqtun talvuuna qanuritmangangit anguhimavakhimayunik naunaitkuhiqtauhimayutlu.

Talvuuna Qiqaiyaqluarvia 5mi Imaruqtirvia 18mi 2014mi katitiqhimayut 155nik nanungnik (talvani 119nik katimaviani) ukiuqaqtunik qanurlikiak katimaviangit anguhaluit arnaqluitluuniit piyauvakhimayut, talvanga 127nik idjuhianganik piyauvakhimayut, naunairutiqaqtunik 8nguyunik ilauqaqtun nanungnik taimaliukpaktun taima ihivriuqtaugiaqaqhutiklu. Hilaqluknikkut ayungnautigivaktun naunairutikhatlu ayukhavyakpaktun naunairutikharnik ukuninga, ihivriudjutikhat ayungnautigivaktun, taima upautauvangitun tamaini talvani MCmi ihivriuqtauvikharnik. Talvuunattiaq, hanguvaktugut katitiqhimayumik unghaqtilaarutikharnik taima 12 tausin 6 hananik unghahiktillaarutingnik. Taima ihivriuqhutik 1.9nik nanungnik ikaaknimik atauhirmik qiniqhiavikharnik. Qaffiuyut nanuit tautuktauhimayut talvuunga upinngami 2014mi aadjikiiktuq taima 55 pusanmik kingulirmi 2000mi ukiungani anguyauvakhimayunik nanuit amigaitilaangani nallautiqhimayuq hadja atuqtauhimayuq angutikharnik munagidjutingnik. Kihiani, idjuhiangit naunairutiit pigiaqagumik nallunaqtun naunaiyaiyaangat qaffiuyut allatqiinguyut nanuit tautuktauhimayut. Pangnairutikhat aulahimaqaqtun kingulikhaq havagiangat taima aulaniaqtuq Qitiqauyaqvia 2015mi.

## **PERSON DAYS**

Field work during the 2014 field season (17 April – 18 June) involved approximately 150 person days (includes biologist, technician, Conservation Officer, and HTO assistants).

## **AIRCRAFT HOURS**

We flew a total of approximately 112 hours during our field study, of which 13% was ferry time, leaving a total search time of approximately 97.5 hours. Search times per day averaged  $5.13 \pm 0.64$  hrs (including days with and without bears being sighted and sampled).

## **FIELD DATES**

Biopsy sampling for the M'Clintock Channel (MC) polar bear study took place between 5 May and 18 June 2014. During this time frame, MC was completely ice-covered and we assumed therefore that all bears are distributed across the study area. The initial start date was set for 17 April, but poor weather conditions did not allow the helicopter to be repositioned from Pond Inlet/Resolute to Cambridge Bay before 4 May. The dates were also selected so that family groups have sufficient time to move from their denning areas onto the sea ice.

## **FIELDWORK LOCATION**

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 Dease Strait, Coronation Gulf, Gateshead Island, 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, Fort Ross, and Cape Sidney.

To reduce potential bias in sampling resulting from non-random distribution of bears within the study area, a systematic search pattern in the form of transect lines was implemented. Areas that indicated a high and medium bear density were searched with transect lines spaced between 7-10 km apart, whereas low bear density areas were searched at distances of about 10 km. Unfortunately we were not able to search the entire MC study area, however, to minimize a possible existing bias, multi-year sampling will be conducted.

## 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 28 May, and moved camp again to Fort Ross on 10 June.

In total, 155 polar bears of various age classes and both sexes in 119 groups were encountered of which a likely 135 (or 87%) produced adequate biopsy samples (Figure 2, Table 1), including hair samples of one bear that visited one of our field camp locales before our arrival. Cubs-of-the-year 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.

We did not have any expectations regarding bear distribution because any available data are dated. Whenever we began our searches for bears, spacing of transect lines was determined ad-hoc on how much bear activity was observed, and how many bears were actually encountered. We believe that this approach minimizes any possible bias, and the data collected during 2014 will aid in field preparations for the next field season.

Because biopsy darting leaves no visible marks, the sample of possible 135 biopsied bears may include individuals that were sampled more than once during the 2014 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 recently developed 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. The time between spotting a bear and obtaining a sample was typically less than 4 minutes. 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 or cracks in the ice. 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 2014, 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 4 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. For example, we were not able to search in the areas of M'Clintock Channel proper. As well, 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 18 June 2014 with a total of 18 sampling days. During this period, approximately 12,600 km (mean  $\pm$  SE km/day; range:  $740.5 \pm 94.2$  km;  $230.00 - 1335.12$  km) were flown while searching for polar bears on sea-ice habitat and islands across the MC study area (Figure 1).

As expected, sea-ice habitat was variable across the area we sampled. Areas of Dease Strait and Coronation Gulf up to the west-side of Jenny Lind Island were dominated by relatively flat annual sea ice with very few pressure ridges intersecting sea ice. This area also showed next to no signs of any bear activity although seals were observed to make use of that sea ice habitat (Figure 3). 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 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). This is also the area where the majority of bears/bear activity and seals were encountered.

In total, 155 polar bears of various age classes and both sexes in 119 groups were encountered (Figure 2, Table 1), including hair samples of one bear that visited one of our field camp locales before our arrival. Of these, 127 bears were biopsied including some individuals of 15 family groups (3 females with 1 coy, 7 females with 2 coys, 3 females with 1 yearling, and 2 females with 2 yearlings; Table 1). Biopsy samples of an additional 8 bears also could produce reliable genetic results but their quality is currently unknown. About 13% 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 3 bears were not sampled because of concerns of prolonged approach phases and risk to overheating. Without having covered the entire study area, the 2014 sample size of 155 bears represents approximately 55% of the previous 2000 mark-recapture population estimate currently being used for harvest management (Taylor et al. 2006). However, we must await the genetic results first in order to determine precisely how many different individual bears were sampled since several bears were likely re-sampled within the 2014 study time frame.

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 67% of the collected sample consisted of adult bears. The harvest for MC was reduced from 34 bears in 1999 to only 3 bears over the past 10 years lowering the hunting pressure and harvest mortality. As well, the standing sex distribution appears to be male-biased (Table 1), but this can only be confirmed once the entire study area was sampled and gender has been verified via genetic testing. Nunavut's polar bear harvest management provides for a harvest that is male-biased (2 males for every female) which generally results in a female-biased standing sex-distribution (Taylor et al. 2008, McLoughlin et al. 2005). A reduced male-biased harvest pressure in MC has likely allowed the male proportion in the population to increase over time. Alternatively, adult male bears from neighbouring populations (e.g., Gulf of Boothia or Lancaster Sounds) may have temporarily or permanently migrated into the MC study area, but more research is needed to confirm this hypothesis.

The spatial distribution of bears within the covered search area was somewhat similar to that of bears sampled in the previous study. From the collected data it appears that the surveyed study area can be classified into high, medium, and low bear density areas. High bear density (based on captures of bears and signs of tracks) in MC can be found in a) areas just east of Fort Ross; and b) between Gateshead Island and Cape Swinburne (e.g. central and northern Larsen Sound). Medium densities of bears were encountered in Franklin Strait, and 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 considered low bear density areas. On days when bears were encountered ( $n = 14$ ), an average of 11 bears/day was sampled. The mean efficiency of our sampling effort was 1.9 bears/hr (range: 0.4 – 4 bears/hr). Observed group sizes varied between 1 and 6 bears; the 6 bears were adult males feeding together on a bearded seal carcass.

Unexpectedly, we encountered low numbers of subadults and family groups with cubs-of-the-year and with yearlings. Again, a complete coverage of the entire study area may provide more detailed information of whether more family groups and subadults are present in this population in areas that could not be sampled during 2014. Nevertheless, mean ( $\pm$  SE) COY and yearling litter sizes were  $1.7 \pm 0.15$  ( $n = 10$ ) and  $1.4 \pm 0.24$  ( $n = 5$ ), respectively. At this stage 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 2014, body condition scores [BCS] on a scale of 1 to 5 (leanest to most obese; Stirling et al. 2008) ranged from 2.5 to 4.5. Most adult bears (94.1%) rated in average condition or better, and only 5.8% (all older adult males) were below average (Table 3). Mean adult female and male BCS were  $3.33 \pm 0.05$  and  $3.32 \pm 0.05$ , respectively, which were not significantly different (t-test,  $p > 0.05$ ). Overall, with the exception of a few smaller cubs of the year, bears appeared well-fed indicating an ample supply and availability of prey items (e.g., bearded and ringed seals). In fact, during our sampling effort we encountered many bears with either fresh or recently killed prey items.



## **Genetic Analyses**

DNA extracted from tissue samples collected from bears biopsied in 2014 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 2169 seals during the course of our searches for polar bears (Figure 3), all across various ice-types (Plate 2). As the season progressed into late May and early June many seals were observed basking along open leads. Although not all seals were identified to species, subjectively ringed seals appeared to be the most abundant.

## **COMMUNITY INVOLVEMENT**

Following consultation meetings in 2013, the project received support from the Ekaluktutiak HTA, Spence Bay HTA and Gjoa Haven HTA. One Spence Bay and Ekaluktutiak HTA member each participated in fieldwork out of Fort Ross and Cambridge Bay, respectively. HTA members from Gjoa Haven could not participate in field activities: some were already involved in another project, others were forced to return to town from Cape Sidney as the melting of snow on the land made the travel back to Gjoa Haven near impossible. However, Gjoa Haven HTO members assisted in fuel drum caching activities by skidoo, as did Ekaluktutiak HTA members out of Cambridge Bay. The Gjoa Haven Conservation Officer participated in logistical preparatory and field operations out of Cape Sidney as well as Fort Ross.

## **PLANS FOR NEXT SEASON**

### **Biopsy Sampling in 2015**

The second year of this three-year project will commence again during spring of 2015 with another genetic biopsy sampling session. Given the success of the first sampling (=marking) season it is expected that the number of genetically marked animals in the population is relatively high. We expect weather conditions to be more cooperative so that the entire study area can be sampled. If this 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.

### **Polar bear movements through telemetry for MC population boundary delineation**

Recent genetic (Saunders, 2005) and traditional information (Keith et al 2005) suggests that bears of both sub-populations likely exchange genetic material or move between both areas (but see Campagna et al. 2013 where both subpopulations are distinct units). In the past, the MC boundary was mainly established based on movement data of females in neighboring subpopulations, and from mark-recapture studies and tag returns through the harvest. In order to re-assess the population MC boundary,

telemetry data are required to examine bear movements. DOE plans to deploy conventional satellite collars (ARGOS GEN IV) and possibly miniaturized satellite ear transmitters (SPOT tags) in MC during spring of 2015 (see Plate 1) for the first time. DOE staff will be in contact with the affected HTAs and RWO to discuss this portion of the MC field study. DOE staff will also be present at the KRWB AGM meeting during October of 2014 for further consultation.

Conventional collars will be fitted to adult females (n=15) whereas the miniaturized tags (n=10) will be attached to ears of adult males and subadult bears (>2 years old) of both sexes. The collars allow collection of movement data for 2-3 years, whereas the ear tags generally only last for up to 6 months. Information from these collars and tags will allow us to examine which area these bears occupy throughout the year. Thus, these data are important in determining population boundaries and whether GB and MC are two distinct units. To deploy collars and Spot tags, bears will be immobilized and handled as described below.

### **Capture of bears in MC if collaring occurs**

For the capture work to deploy collars in MC DOE will follow past procedures that used this technique (Taylor et al. 2005, 2006, 2009; Peacock et al. 2013). In brief, bears and their dependent offspring will be immobilized for capture and marking as outlined by Stirling et al (1989). Upon initial capture, a unique identification number will be applied to each bear using plastic ear tags and a permanent lip tattoo. Standard somatic measurements and biological samples will be taken from all bears handled. This will allow comparison to measurements and samples collected during previous capture periods, and to assess growth of individuals, after harvest was halted and with respect to possible environmental changes that may have occurred since the last inventory. The same handling procedures will be applied to solitary bears (adult males/subadults of both sex) captured to deploy ear satellite tags.



Plate 1. View of SPOT tag (left picture) and ARGOS satellite collar worn by polar bears to study movement patterns.

## Acknowledgements

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Table 1. Overview of polar bears sampled during the 2014 field season in M'Clintock Channel<sup>1</sup>.

Sex/Age Group	Biopsied			Total
	yes	no	maybe*	
Adult female	37	2	0	<b>39</b>
Subadult female	7	0	1	<b>8</b>
Adult male	64	0	1	<b>65</b>
Subadult male	15	0	2	<b>17</b>
Cubs-of-the-year**	0	17	1	<b>18</b>
Yearlings	4	1	2	<b>7</b>
Unknown***	0	0	1	<b>1</b>
<b>Total</b>	<b>127</b>	<b>20</b>	<b>8</b>	<b>155</b>

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

\*\* includes one COY found dead

\*\*\* includes recent hair samples collected in a cabin

**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 (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)
Davis Strait (2005-2007)	1.49 (0.15)	1.22 (0.28)	0.08	0.09	Peacock et al. (2013)

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

**Table 3.** Summary of body condition scores (BCS) for polar bears encountered during biopsy sampling in M'Clintock Channel (Nunavut) 2014. Age and sex estimated by distance examination.

Age Class	Sex	Body Condition Score						TOTAL
		2	2.5	3	3.5	4	4.5	
COY	Unknown		5	10	2			17
Yearling	Unknown			5	1		1	7
Sub-adult	Male			9	6	2		17
	Female			3	5			8
	Unknown							
Adult	Male		6	23	26	9	1	65
	Female (with offspring)			7	7			14
	Female (without offspring)			9	13	1	1	24
	Unknown							
<b>TOTAL</b>			<b>11</b>	<b>66</b>	<b>60</b>	<b>12</b>	<b>3</b>	<b>152</b>

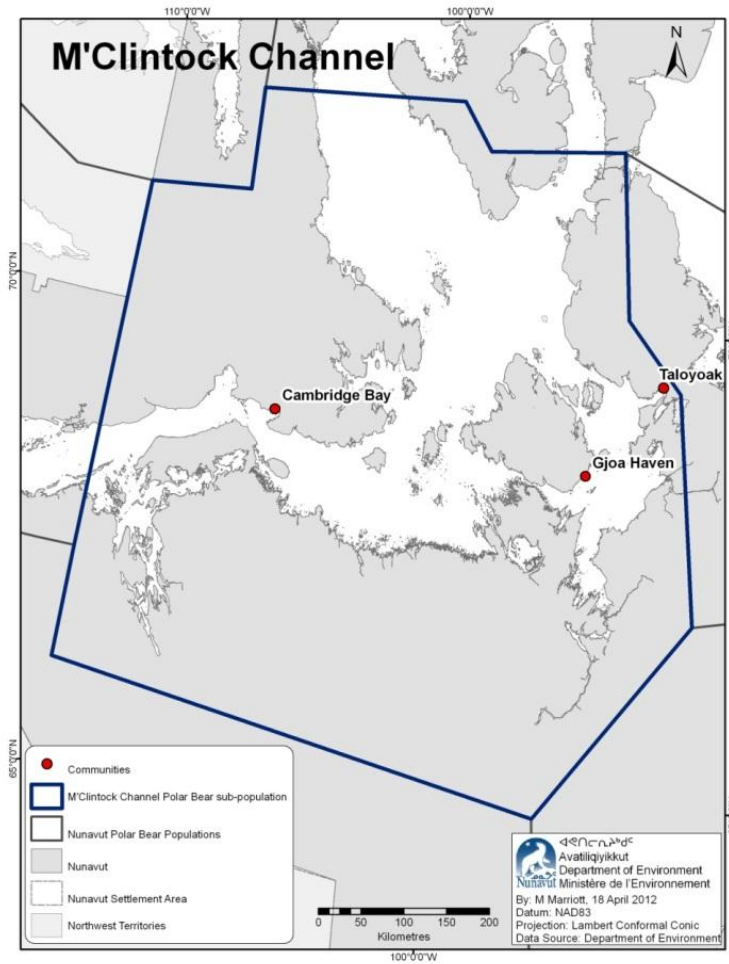


Figure 1. Map of the M'Clintock Channel polar bear subpopulation boundary and location of communities within.

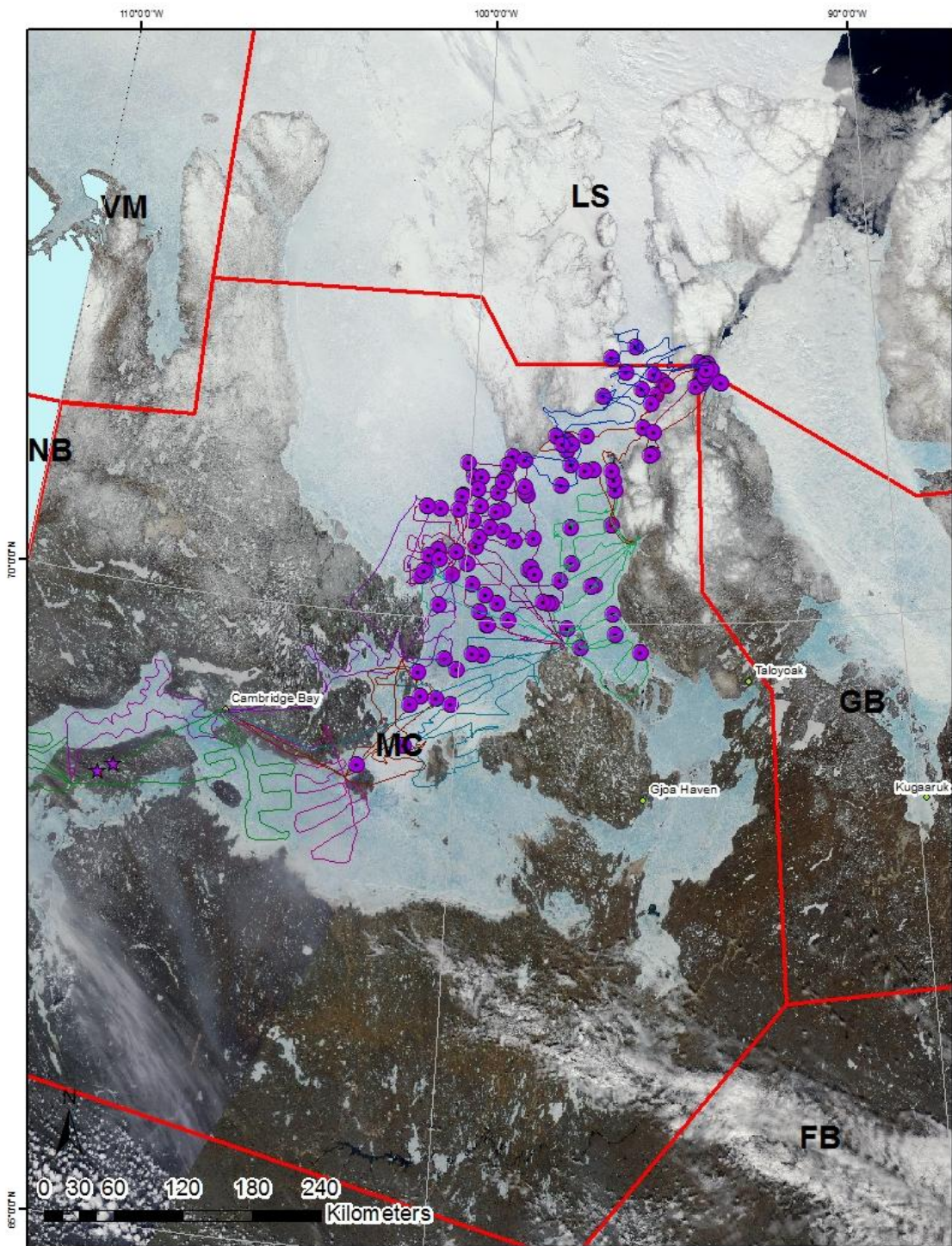


Figure 2. Locations of individual and groups of polar bears encountered during the spring of 2014 in M'Clintock Channel. The 2 stars represent brown bears, and the lines the daily search tracks (NB: not the entire study area was covered; NASA satellite image 25 June 2014).



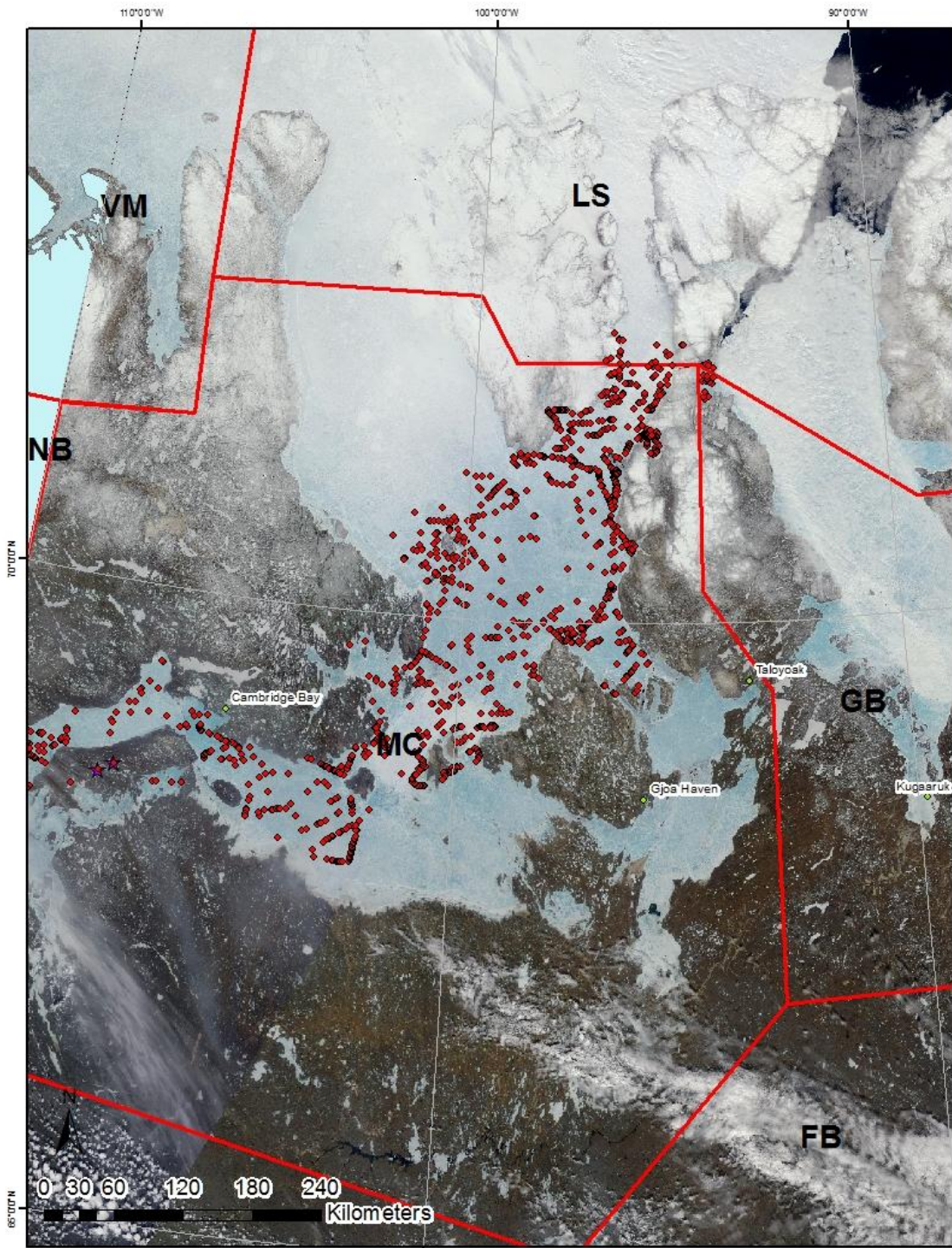


Figure 3. Locations of seal observations recorded during the 2014 field season in M'Clintock Channel (not corrected yet). [NB: NASA satellite image 25 June 2014].



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 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).