ESTIMATING THE ABUNDANCE OF THE GULF OF BOOTHIA POLAR BEAR SUB-POPULATION BY GENETIC MARK-RECAPTURE

INTERIM FIELD REPORT TO

Government of Nunavut, Department of Environment

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In fulfillment of research licence (WL 2017-001) requirements

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1. **NWRT PROJECT NUMBER**: 2-17-04

2. **PROJECT TITLE:** Estimating the abundance of the Gulf of Boothia polar bear subpopulation by genetic mark-recapture

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4. **SUMMARY**

The Gulf of Boothia (GB) polar bear subpopulation is managed entirely by Nunavut. The most recent demographic study on the GB subpopulation estimated the mean total number for the 1998-2000 study period to be 1,592 (SE=361) bears. A new 3-year research project was initiated in 2015 to provide updated information on the abundance of bears in GB. This mark-recapture study differs from the previous studies that relied on chemical immobilization of all bears for capture and marking. This study does not involve capture of bears but instead utilizes DNA extracted from tissue samples obtained using biopsy darts to uniquely identify individuals. The sub-population abundance estimate and status will be assessed by means of genetic mark-recapture. The 2017 field season was the last year of the study.

Between 26 April and 15 May 2017, a total of 115 hours between 2 aircraft was spent searching for polar bears in the study area. A total of 162 bears of various sex and age classes were encountered, of which 130 were successfully biopsied. The rate of sampling averaged 1.6 bears per hour of search time. The number of bears encountered during the spring of 2017 was equivalent to approximately 10.2% of the previous 1998-2000 mark-recapture population estimate currently used for harvest management. However, until genetic results are available it is impossible to discern how many different individual bears were encountered, or how many recaptures occurred.

General impressions from the past 3 years of sampling suggests that polar bears remain relatively abundant and in good condition in GB. Average litter size was 1.6 for both cubs-of-the-year and yearlings which is comparable to bears in Foxe Basin and Baffin Bay. Body condition of adult bears was good, however, offspring appeared to be somewhat below average.

5. **PROJECT OBJECTIVES**

Our project objectives are to:

a) Design and implement a comprehensive survey using genetic biopsy sampling to reliably estimate the abundance of polar bears in GB during the springs (e.g., April – May) of 2015, 2016, and 2017.
b) Estimate the current population size and composition of the GB polar bear subpopulation.

c) Compare a new estimate of abundance with the one derived during a past study in-order to gain insight into population trend and status in GB.
d) Estimate survival and reproductive parameters (to the extent possible) in-order to facilitate population viability analyses.
e) Evaluate polar bear distribution with respect to environmental variables, particularly ice conditions, topography and food availability distribution (to the extent possible).
g) Demonstrate the utility of genetic mark-recapture as a less invasive alternative to physical capture for the purpose of population monitoring.
h) Enhance public participation and provide HTO-designated personnel with training in survey methods.

We completed the last field season of a 3-year project, and all biological field and relevant harvest samples are currently being analysed by Wildlife Genetics International. Results of this genetic analysis are expected by the end of December or early January 2018. Once the genetic results are available we will begin the analyses to estimate population abundance. Throughout the 3-year study we were limited in collecting seal and sea-ice data, but we will attempt to make the best use of the data since so little information is available in general.

6. MATERIALS AND METHODS

The sample design was similar as the 1998-2000 study by Taylor et al. (2009): we searched the Gulf of Boothia geographic area using 2 Bell 206 Long-Ranger (Appendix 1) following daily pre-planned routes, designed to cover the entire area and to avoid a potential directional movement of bears out of the subpopulation area due to helicopter disturbance. We sampled and "marked" all individual polar bears encountered, except for cubs of the year, by DNA biopsy sampling (Pagano et al. 2014). "Marking" in this study does not involve chemical immobilization and physical marking as was done previously. This study used tissue biopsy darts to collect a small skin and fat sample from each bear. These samples were used to establish a unique identity for each bear based on nuclear DNA fingerprinting methods (Chambers et al. 2014, Jefferys 2005). To minimize chances of injuries, we did not dart cubs-of-the-year but yearlings and two-year old offspring were biopsied. In addition, we recorded the following information for each bear encountered: date, time of sighting, biopsy sample collected or not, biopsy label number, location when bear first seen (latitude, longitude), age class (COY, yearling, subadult, adult), age confidence (low or high), sex, sex confidence, and body condition index (ranked 1-5 from poor to excellent condition, Stirling et al. 2008).

As in previous years we were able to provide short-term employment for a few individuals from the communities of Taloyoak (1 person) and Kugaaruk (2) during this field season, which also allowed to provide opportunities to convey how research work is conducted and through which means.

7. PROJECT SCHEDULE – currently project is on schedule

Output or step	Start date (dd/mm/yyyy)	End date (dd/mm/yyyy)
Logistical preparations (e.g. fuel caching, cabin prep, field	Fall 2014 Fall 2015	Spring 2015 Spring 2016

equipment)	Fall 2016	Spring 2017
Biopsy darting	April 2015 April 2016 April 2017	June 2015 June 2016 June 2017
Harvest sampling	April 2015 April 2016	April 2016 April 2017
Analysis of tissue samples	August 2015	December 2017 – in progress
Final data analyses, preparation of reports and peer-reviewed publications	February 2018	October 2018

8. PRELIMINARY RESULTS AND DISCUSSION

The total number of hours spent searching for polar bears in Gulf of Boothia from April 26th to May 15th of 2017 was 104 hours. The total number of polar bears encountered was 162, of which 130 bears were sampled successfully. All bears darted provided sufficient tissue for DNA analyses and fat samples. Most bears that were not sampled were cubs-of-the-year (COYs). The sex and age distribution of polar bears seen during the 2017 Gulf of Boothia survey is provided in Table1.

Table 1. The field-estimated sex and age distribution of 162 polar bears encountered during the 2017 Gulf of Boothia field season

Sex	Cub-of-the-year	Yrlgs	2-YO	Subadults	Adults	All Ages
Male				13	43	**56**
Female				4	53	**57**
Unknown	23	22	4			**49**
Total	**23**	**22**	**4**	**17**	**96**	**162**

Mean litter size for COYs and yearlings was 1.6 for each, which was similar to last field season's results. The proportion of COYs and yearlings with 0.14 for each is similar to what was found during the recent studies in Baffin Bay and Foxe Basin which indicates relatively healthy recruitment. However, these preliminary GB results are currently based on smaller sample sizes, and a proper inference can only be made once the entire dataset has been analysed.

Body condition of most (72%) encountered adult and subadult bears was average (3) or better. As in previous years, offspring body condition was below average. Our sampling occurs early in the year and just after the sun returns. It is unknown how many seals are hunted by polar bears during the dark winter season, but the numbers are likely lower

than during the spring and summer months. Although initially it may appear as a concern that offspring are thinner, one has to remember that they have survived the harshest portion of the year up to that point – with spring and summer upon them, hunting and feeding opportunities will likely be plenty during the following months which also means they will increase their body mass.

Subjectively, overall density of bears within the study area appears to be with what is expected. However, in order to be able to provide a more detailed inference about bear density we have to await the full complement of the population abundance analysis.

9. REPORTING TO COMMUNITIES AND USERS

Community / HTO	Before research	During research	Completion of research
Igloolik HTO Hall Beach HTO Repulse HTO Taloyoak/Spence Bay HTA Kugaaruk HTO Gjoa Haven HTO	Feb 2013, in-community consultation	Spring 2015, 2016 & 2017, in-community during fieldwork for communities that provided field support Winter 2015, 2016 & 2017, by correspondence	Fall 2018, in-community

The affected communities have been informed on an annual basis about the progress of the study after each field season was completed, mostly through letters, emails, and transmitted interim field reports. Community consultations are planned once the study is complete and a final report has been prepared. Final results will also be presented to the respective RWO (e.g., KRWB).

10. ACKNOWLEDGEMENTS

This research was logistically and financially supported by the Government of Nunavut, Nunavut Wildlife Management Board, Environment and Climate Change Canada, and Polar Continental Shelf Program. Additional support was provided by M. Taylor, L. Orman, C. Bruneski, and C. Smith. We also thank the Spence Bay and Kugaaruk HTAs for their support during field activities. The study was conducted under a Nunavut Wildlife Research Permit (WL 2017-001), animal care approval (NWTWCC 2017-001), and Inuit Owned Land permit (170220-KTX116N001).

Appendix 1

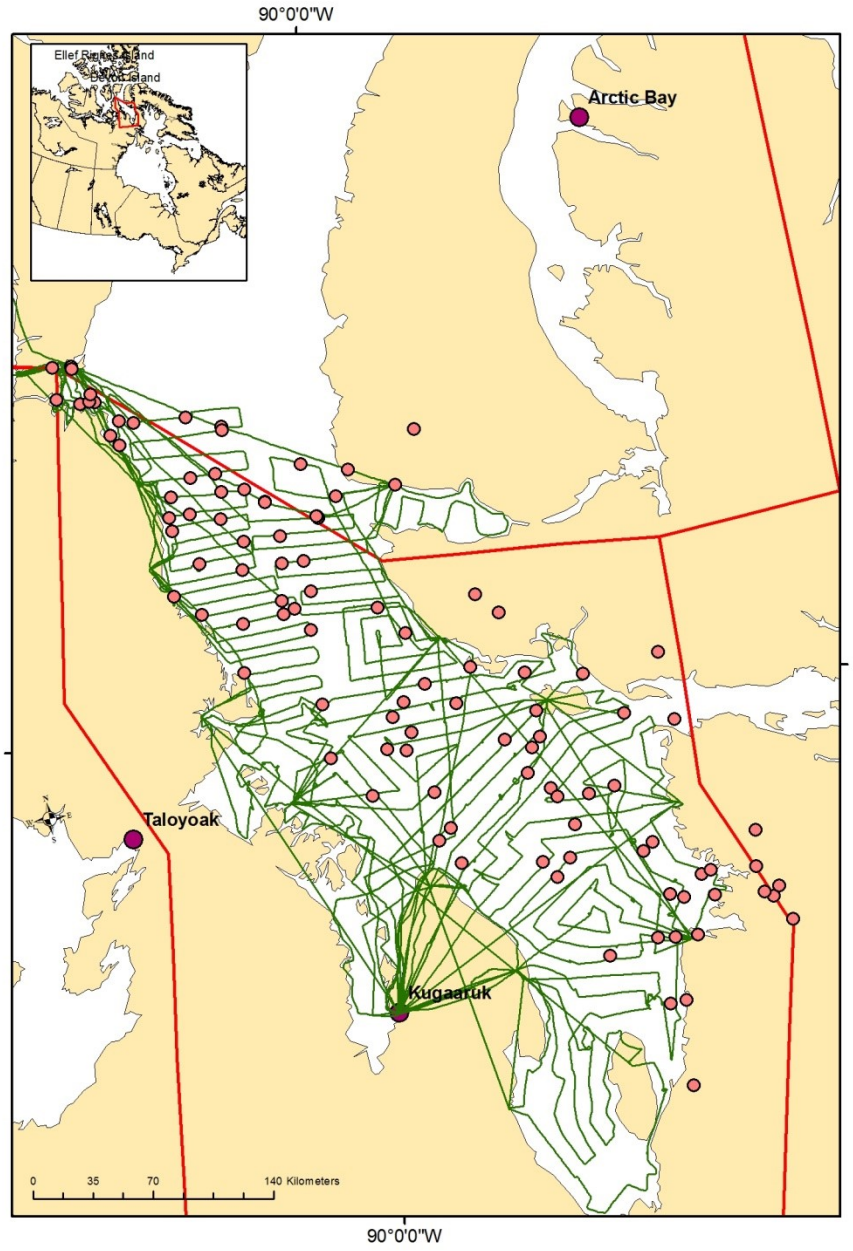

Fig. 1. Overview of polar bear group sightings and the flight paths taken during the 2017 Gulf of Boothia field study. Note that some of the locations have not been quality-controlled yet.

Appendix 2

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Appendix 3

ᓇᐃᒡᓕᒋᐊᖅᓯᒪᔪᖅ

ᕿᑭᖅᑖᓘᑉ ᐃᑭᖓᓂ (GB) ᓇᓄᐃᑦ ᓇᓅᖃᑎᒃᑲᓐᓂᖏᓐᓂᒃ ᐊᐅᓚᑕᐅᕙᑦ ᓄᓇᕗᒻᒥᐅᓕᒫᓂᑦ. ᓇᒨᕐᒐᖅᐸᓪᓕᐊᓂᕆᔭᐅᔪᓄᑦ ᖃᐅᔨᓴᕐᓂᐅᕌᖅᑐᖅ ᕿᑭᖅᑖᓘᑉ ᐃᑭᖓᓂ ᓇᓅᖃᑎᒃᑲᓐᓂᖏᑦ ᓇᓚᐅᑦᑖᖅᑕᐅᓯᒪᔪᖅ ᑲᑎᕝᓗᒋᑦ 1998-2000-ᒧᑦ ᖃᐅᔨᓴᕐᓂᐅᔪᒧᑦ 1,592 (ᓂᒋᖅ ᑲᓇᕐᓇᖏ=361) ᓇᓄᐃᑦ. ᓄᑖᒥᒃ ᐊᕐᕌᒍᖓᓂᒃ ᐱᖓᓱᓂᒃ ᖃᐅᔨᓴᕐᓂᐊᖅᑐᓂᒃ ᐱᒋᐊᖅᑎᑦᑎᓚᐅᖅᐳᑦ 2015-ᒥᑦ ᓄᑖᙳᐃᕆᐊᖅᓯᒪᔪᓂᒃ ᑐᑭᓯᒋᐊᕈᑎᒃᓴᓂᒃ ᓴᖅᑭᑎᑦᑎᕐᑯᓪᓗᒋᑦ ᓇᓄᐃᑦ ᐊᒥᓲᓂᖏᓐᓂᒃ ᕿᑭᖅᑖᓘᑉ ᐃᑭᖓᓂ. ᓇᓗᓇᐃᒃᑯᑦᑎᖅᑕᐅᓯᒪᔪᓂᒃ ᖃᐅᔨᓴᕐᓂᖅ ᑭᖑᓂᑦᑎᓐᓂ ᖃᐅᔨᓴᕈᑎᒋᔭᐅᓚᐅᖅᑐᒥᑦ ᐊᔾᔨᒃᑮᖏᑉᐳᖅ ᓇᓄᓕᒫᑦ ᐱᔭᐅᔪᑦ ᓯᓂᒃᑎᑕᐅᔭᕆᐊᖃᖅᐸᓚᐅᖅᑐᓂᑦ ᐊᒻᒪ ᓇᓗᓇᐃᒃᑯᑦᑎᖅᑕᐅᓗᑎᒃ. ᑖᓐᓇ ᖃᐅᔨᓴᕈᑕᐅᔪᖅ ᓇᓄᕐᓂᒃ ᑎᒍᓯᓇᓱᖃᑦᑕᙱᑉᐳᑦ ᑭᓯᐊᓂ ᐊᑐᖃᑦᑕᖅᐸᓪᓕ ᑮᓇᐅᔾᔪᑎᖏᓐᓂᒃ ᐋᖅᓯᕝᕕᐅᓪᓗᑎᒃ ᐊᒥᖓᓂ/ᒥᖅᑯᖓᓂ ᖃᐅᔨᓴᒐᒃᓴᒥᑦ ᐃᓚᙵᖅᓯᓪᓗᑎᒃ ᓴᒃᑯᒧᑦ ᐊᔾᔨᒃᑲᕐᒋᑦᑐᑦ ᓇᓗᓇᐃᖅᑕᐅᕐᑯᓪᓗᒋᑦᐃᓐᑯᒃᑯᖅᑐᑦ. ᑖᒃᑯᐊ ᓇᓅᖃᑎᒌᑦ ᐅᓄᕐᓂᖏᑦ ᓈᓴᖅᑕᐅᓂᑯᑦ ᒥᒃᓴᐅᓴᒃᑕᐅᓂᖏᑦ ᖃᓄᐃᓕᖓᓂᖏᓪᓗ ᖃᐅᔨᔭᐅᓴᓯᖕᓂᐊᖅᑐᑦ ᑎᒥᖏᑦᑎᒍᑦ ᓇᓗᓇᐃᖅᑕᐅᓗᑎᒃ ᐱᔭᐅᒃᑲᓐᓂᖅᑐᓪᓗ. 2017-ᒥ ᓯᓚᒥ ᐱᓕᕆᓂᐅᓚᐅᖅᑐᖅ ᑭᖑᓪᓕᖅᐹᖑᓚᐅᖅᑐᖅ ᖃᐅᔨᓴᕐᓂᕐᒥᒃ.

ᐊᐃᕿᓕ 26 ᐊᒻᒪ ᒪᐃ 15, 2017 ᐊᑯᓐᓂᖓᓂ, ᑲᑎᕝᓗᒋᑦ 115-ᓂᒃ ᐃᑲᕐᕋᓂᒃ ᒪᕿᔾᔪᓄᑦ ᖃᖓᑕᓲᔾᔪᓄᑦ ᕿᓂᓚᐅᖅᐳᑦ ᓇᓄᕐᓂᒃ ᖃᐅᔨᓴᕝᕕᐅᔫᑉ ᐃᓚᖓᓂ. 162-ᓂᒃ ᓇᓄᕐᓂᒃ ᑕᑯᓚᐅᖅᐳᑦ ᐊᕐᓇᓂᒃ ᐊᖑᑎᓂᒡᓗ ᐊᒻᒪ ᐊᕐᕋᒍᖏᑦ ᐊᔾᔨᒌᙱᖏᕝᓗᑎᒃ, 130-ᓂᒃ ᐃᓚᙵᖅᓯᕙᐅᔪᖃᓚᐅᖅᓗᓂ ᓴᒃᑯᒧᑦ. ᓇᓄᐃᑦ ᐊᒥᓲᓂᖏᑦ ᖃᐅᔨᓴᖅᑕᐅᔪᑦ 1.6 ᓇᓄᐃᑦ ᐃᑲᕐᕋᒧᑦ ᐊᑕᐅᓯᕐᒧᑦ ᕿᓂᖅᑕᐅᔪᓂ. ᓇᓄᐃᑦ ᐅᓄᕐᓂᖏᑦ ᑕᑯᔭᐅᔪᑦ ᐅᐱᕐᖔᒥ 2017–ᒥᑦ ᐊᔾᔨᐸᓗᒋᓚᐅᖅᐸᖓ 10.2->ᓴᓐ ᖃᓂᒋᔮᓂ ᑭᖑᓂᖔᑦᑎᓐᓂ 1998-2000–ᒥᑦ ᓇᓗᓇᐃᒃᑯᑦᑎᖅᓯᒪᔪᑦ ᐱᔭᐅᒃᑲᓐᓂᖅᑐᓂᑦ ᓇᓄᖏᓐᓂᒃ ᓇᓚᐅᑦᑖᖅᑕᐅᓚᐅᖅᑐᓂᑦ ᒫᓐᓇ ᐊᑐᖅᑕᐅᔪᒥ ᐊᖑᓇᓱᒃᑕᐅᕙᒃᑐᑦ ᐊᐅᓚᑕᐅᓂᖏᓐᓂᒃ. ᑭᓯᐊᓂ, ᓯᕗᓕᖅᓯᕈᑎᖏᓐᓄᑦ ᖃᐅᔨᓴᕈᑕᐅᓯᒪᔪᑦ ᐱᔭᒃᓴᐅᓕᖅᐸᑕ ᑐᑭᓯᔪᓐᓇᔾᔮᙱᑦᑐᒍᑦ ᖃᔅᓯᓂᒃ ᐊᔾᔨᙱᑦᑐᓂᒃ ᓇᓄᕐᓂᒃ ᐃᓅᔾᔪᓂᒃ ᑕᑯᔭᐅᔪᖃᓚᐅᕐᒪᖔᑦ, ᐅᖁᓘᓐᓃᑦ ᖃᔅᓯᓂᒃ ᐱᔭᐅᔪᖃᒃᑲᓐᓂᓚᐅᕐᒪᖔᑦ.

ᐃᓂᒋᔭᐅᖃᑦᑕᖅᓯᒪᔪᑦ ᐊᕐᕌᒍᓄᑦ ᐱᖓᓲᕗᑦ ᐊᑑᓴᖅᑕᑦᑎᓐᓄᑦ ᖃᐅᔨᓴᖅᑕᐅᓃᑦ ᐃᒪᐃᖁᔨᓇᔭᖅᑐᑦ ᓇᓄᐃᑦ ᐃᓚᒌᒃᑐᑎᑦ ᖃᓄᖅ ᐅᓄᖅᑎᒋᖔᕐᒪᖔᖏᓐᓂᒃ ᐊᒻᒪ ᖃᓄᐃᙱᑎᑦᑎᐊᕐᓗᑎᒃ ᕿᑭᑦᑖᓘᑉ ᐃᑭᖓᓂ. ᐱᐊᕋᖃᕋᔪᓚᐅᑦᑐᑦ 1.6-ᖑᔪᑦ ᑕᒪᐃᓐᓄᑦ ᐊᑎᖅᑕᓛᕐᓄᑦ ᐊᒻᒪ ᐊᑎᖅᑕᕕᓂᕐᓄᑦ ᐊᔾᔨᖃᕐᓂᖃᕈᓐᓇᖅᑐᓂᒃ ᓇᓄᕐᓂᒃ ᓴᓂᕋᔪᐊᑦ ᑕᕆᐅᖓ, ᓯᑯᔾᔫᓚᕐᒥᐅᑦ ᑕᕆᐅᖓᓂ ᐊᒻᒪ ᓴᓐᓂᕈᑎᐅᑉ ᐃᒪᖓᓂ. ᑎᒥᖏᑦᑕ ᖃᓄᐃᓕᖓᓂᖏᑦ ᐃᓐᓇᐅᓂᖅᓴᓄᑦ ᓇᓄᐃᑦ ᐱᐅᓚᐅᖅᑐᑦ, ᑭᓯᐊᓂ, ᐊᑎᖅᑕᓛᑦ ᑕᐃᒪᐃᑐᐃᓐᓇᖃᑕᐅᖅᑰᔨᓚᐅᖅᑐᑦ.

Appendix 4

NAITUMIK TITIRAQHIMAYUQ

Talvani nayugaani Gulf of Boothiami (GB) nanuit amigaitilaangit munagiyauvakhimayut talvanga Nunavunmin. Atulihaaqtuq nunami nayugaani ihivriuqtauniaqtun talvani GBnik amigaitilaanganik nallautiqhimayut katitiqhimayut nappangit talvuuna 1998-2000mi ihivriuqtauhimayunik havaktauvikharnik imaa ituq 1,592 (SE=361) nanungnik. Nuutaanguqhimayuq 3nik ukiunik ihivriudjutikhaq havaaqhaq aulatitivakhimayuq 2015mi tuniyaangat nuutaanik naunairutingnik qaffiutilaanganik nanungnik talvani GBmi. Una naunaitkuhikhimayuq anguyauffaaqhimayunik ihviriudjutikharnik allatqinguyuq talvanga ihivriuqtauvakhimayunik kingulirmi nallaudjutiqaqhunilu havautiqtauhimayunik ingutaalaitkutingnik tamainik nanungnik tiguyauvakhimayut naunaitkuhiqtauhimayutlu. Una ihivriudjutikhaq ilaungituq taima tiguyauhimayunik nanungnik kihimi naunairutiqaqhunik pivakhimayut ihivriudjutikharnik niqainanik ihivriuqtauyukharnik atuqhutik kiplirutingnik avaliqangitunik ilitagiyauhimayunik nanungnik. Talvanga amigaitilaanganik qaffiutilaanganik nallautiqhimayut kihititirutikhangitlu ihivriuqtauniaqtun talvanga naunairutiqaqtunik. Uvani 2017mi hanigaini ukiunganik kinguliuyut ukiunganik ihivriudjutikharnik.

Akunganirmi 26mi Qitiqauyaqvia uvanilu 15mi Qiqaiyaqluarviami 2017mi, katitiqhimayut ikaakningit 115nik ikaakninik akungani 2nik tingmitingnik aulavakhimayut qiniqhimaaqhutik nanungnik talvani ihivriuqtauyukharnik nayugaini. Tamaat katitiqhimayut 162nik nanungnik allatqiinguyunik ukiuqaqtunik katitirvianganik piyauvakhimayut, taima 130nik niqainik pivaktun ihivriudjutikharnik. Ikaakningit ihivriugiagnaik naunairutiqaqtuq taima 1.6nik nanungnik ikaaknitigun qiniqtauhimayunik ikaaknikkut. Nappangit nanuit tautuktauvakhimayut talvuuna upinngami 2017mi aadjikutavyaanganik katitiqhimayunik taima 10.2 pusanmik talvaniga kinguliuyunik 1998mi- 200milu tiguyauhimavakhimayunik amigaitilaanganik nallautiqhimayut atuqtauvakhimayut anguyauhimayunik munagidjutikharnik. Kihiani talvanga naunairutingnik pigiaqaqtun taima ayungnavyaktuq naunaiyaiyaangat qanuq allatqiinguyut nanuit tautuktauvakhimayut, qanurluuniit qaffiuyut tiguyauvakhimayunik.

Naunaitun talvanga kinguliuyunik 3nik ukiunganik ihivriuqtauvakhimayut naunairutilik taima nanuit aulayuitun amigaitilaangit namaktunlu talvnai GBmi. Taima nanuinuaniqaqpaktun angitilaanganik 1.6nik tamangnin nanunuanik ukiuk tamaat nukatungitlu naunairutiqaqtun nanungit talvanig Foxe Basinmi uvanilu Baffin Baymi. Nanuit timingit Nanunguqhimayut nakuuyut, kihiani, nanunuit mikiniqaluaqtun angiktilaarutaingit.