Final Report to the NWRT, September 2019

Note: This report is an update report on project activities. All analyses are currently underway with a final project report expected by March 2020.

1. **NWRT Project Number**: 2-18-15, 2-17-03

2. **Project Title:** Re-estimating the abundance of the Davis Strait polar bear subpopulation via genetic mark-recapture sampling

3. **Project Leader:**

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4. **Summary:**

The Davis Strait (DS) polar bear subpopulation is shared by Nunavut, Quebec (Nunavik), and Newfoundland and Labrador (Nunatsiavut). The population was first inventoried in the 1970s but likely underestimated because of poor aerial coverage. A comprehensive population study was conducted between 2005-2007 which found the abundance to be approximately 2,158 bears. In recent years, Inuit have indicated that large numbers of bears are creating public safety concerns, especially for people going out on the land. Many Inuit say that the bears are negatively impacting other wildlife by eating large numbers of young seals and eggs in bird colonies.

There is some uncertainty surrounding the current status of the DS population, in part because of known changes to the sea-ice habitat. However, it is believed that the population is either stable or has likely been increasing since the last inventory was completed in 2007. Given these factors, co-management partners supported a research study to occur between 2017 and 2018 to provide updated information on the abundance of bears in DS. This study did not involve capture nor chemical immobilization of bears, but instead utilized DNA extracted from tissue samples obtained using biopsy darts to uniquely identify individuals. The subpopulation abundance estimate and status will be assessed by means of genetic mark-recapture methods.

Between August and 10 October 2017 and 2018, the entire study area of the DS polar bear subpopulation was searched by observers for bears along the coastline and on islands. There were a total of 1030 samples between 2017 and 2018 collected, including harvest recoveries. The rate of sampling averaged 2 bears per hour of search time. We were not able to survey the entire Nunavut study area during 2018 due to extreme weather conditions which hampered field activities greatly. This also makes a direct comparison to the 2017 field season difficult, as sample sizes and study area coverage are not similar.

Litter sizes for cubs-of-the-year (COYs) and yearlings were similar in both years with 1.5 and 1.4, respectively. We encountered fewer family groups during 2018 as compared to 2017 which is likely because we were not able to survey the entire Nunavut study area. Body condition of > 80% of Nunavut bears was average or better, which was similar to 2017. We are in the process of designing population models to estimate vital rates and abundance.

5. Project Objectives:

For this project, the objectives are to:

a) Design and implement a comprehensive survey using genetic biopsy sampling to reliably estimate the abundance of polar bears in DS during the open water season (e.g., Aug – Oct) of 2017, and 2018.
b) Continue to demonstrate the utility of genetic mark-recapture as a less invasive alternative to physical capture for the purposes of population monitoring.
c) Enhance public participation and provide HTO-designated personnel with training in survey methods.
d) Foster and enhance cooperation and collaboration with the various jurisdictions and co-management partners by having them participate in field activities.
e) Estimate the current population size and composition of the DS polar bear subpopulation.
f) Compare the new abundance estimate with the previously (2005-07) derived one in order to gain insight into population trend and status of DS.
g) Estimate survival and reproductive parameters (to the extent possible) in order to facilitate population viability analyses.
h) Evaluate on-shore polar bear distribution (to the extent possible).

We were successful in accomplishing objectives a) through d), so far. As the analysis of collected data progresses, we will be able to address our progress as related to the remaining objectives, e) through h), to measure success of this project, and to fulfill these objectives, as planned.

6. MATERIALS AND METHODS

a. Study Area

The Davis Strait (DS) demographic unit of polar bears was delineated based on the movements of collared adult female bears (Taylor et al. 2001), the locations of bears marked and subsequently recaptured/harvested (Taylor and Lee 1995), and DNA analysis (Paetkau et al. 1999, Malenfant et al. 2016). Davis Strait (Figure 1) is generally ice-free from August to early November and polar bears are distributed and concentrated along the shoreline and on off-shore islands on the Canadian side of their distributional range, from Cape Dyer on eastern Baffin Island down to northern Labrador (Taylor et al. 2001). During winter and spring, bears can be found between Canada and Greenland occupying the 420,000 km2 of sea ice in Davis Strait, the Labrador Sea, Ungava Bay, Frobisher Bay and Cumberland Sound (Taylor et al. 2001, Taylor and Lee 1995).

The landscape of the study area varies greatly. In Labrador and Nunavut the coastline is characterized by steep cliffs, high mountains, a very rugged coastline with little vegetation, boulder fields, and many offshore islands. In Nunavut, for example, much of the coastline of Baffin Island is over 500 m in elevation within one kilometer of the coastline (Stirling et al. 1980), whereas in Labrador peaks reach up to 1600m (Stirling and Kiliaan 1980). The Ungava Basin and Peninsula is characterized by low relief, very few or no trees, and many rivers and creeks.

b. Field methods

This study combined genetic mark-recapture data with data from earlier physical mark-recapture research in the DS (Peacock et al. 2013), and information from harvest recoveries of marked bears. No live-captures occurred between 2007 and 2017. Genetic samples were collected from every bear that was encountered, when operating conditions were safe enough to do so. At times, the east-coast of Bylot and Baffin Islands (including off-shore islands) as well as the Labrador terrain is very steep and sampling bears can become challenging, especially when we attempted to

sample members of family groups. In such instances we attempted to collect a skin sample of the mother only rather than all members of the family group when COYS and yearlings were present in order to minimize chase times, and to avoid family group members becoming separated. However, all offspring were recorded to estimate reproductive parameters to the extent possible.

Once we located a bear, a small sample of tissue (<5 mm diameter), mostly skin with some adipose tissue attached to it (Pagano et al. 2014), was taken from the rump area using a biopsy dart (Pneu-Dart Inc., DNA dart) that was fired from within a helicopter. The design and relatively low velocity of the dart means that risk of injury to a bear is minimal. Typically, bears show no or very little response to the impact of the dart and are left with no obvious visible mark. In order to facilitate easy spotting of darts on the ground, a 10-15 cm long and ~2 cm wide strip of brightly colored flagging tape (C.H. Hanson, Naperville, IL; or Johnson, Montreal, PQ) was tied and wrapped around the distal end of the dart. Cubs-of-the-year (COY) and yearlings were darted when the terrain allowed. All bears were sampled from an approximate distance (or altitude) of 4-7m. Every bear that was encountered and biopsied received a unique field identification number so that the genetic results and our field data could be cross-referenced and linked.

Apart from the collection of the biopsy sample, we recorded the date, time and location of a spotted bear (or group of bears), body condition based on aerial inspection, and a subjective standard fat index (e.g., Stirling et al. 2008; a scale from 1-5 with 1 being skinny, 3 average and 5 obese), specific markings or characteristics, group size or litter size, the estimated field age class (e.g., COY, yearling, 2-year old, subadult, adult) and estimated gender both with a confidence qualifier (e.g., a = high confidence; b = low confidence). Field age class and gender where assessed remotely from the helicopter at altitudes between 3-7m by experienced observers[1]. When we encountered mothers and their dependent offspring we distinguished COYs, yearlings, and 2-year old based on their size and physical features (e.g., blood or fecal/urine stains, scars) or their behavior to a) assign them to a field age class, and b) avoid sampling the same individual more than once. Additional cues such as body size of the individual bear in relation to its surrounding or group members, body

[1] Throughout the study period several experienced biologists assessed and recorded the body condition in Newfoundland Labrador; the same observer recorded body condition throughout Nunavut.

shape and proportions, presence of scars, secondary sexual characteristics, observation of urination, and gait were all used to determine gender and age-class.

All field-collected tissue samples were sent to Wildlife Genetics International (Nelson, BC). DNA was extracted from tissue with QIAGEN DNeasy Blood and Tissue Kits (Qiagen, Inc.). The tissue samples were genotyped at eight previously published dinucleotide microsatellite loci (REN145P07, CXX20, MU50, G10B, G10P, G10X, MU59, G10H; Paetkau and Strobeck 1994, Paetkau et al. 1995, 1998; Taberlet et al. 1997, Breen et al., 2001, Ostrander et al 1993). Analysis of individual identity followed a 3-phase protocol previously validated for bears and described elsewhere (Paetkau 2003; Kendall et al. 2009).

From all known sampled and harvested bears between 1974 to 2018, a capture history was created which will be used in the modeling. We are in the process of designing integrated population models that will allow us to integrate all available data collected over the years (e.g., Regehr et al. 2018).

Throughout this project, we were able to have local field participants from Iqaluit and Kimmirut contribute to field efforts. In addition to assisting with surveys, these individuals had opportunities to learn about field methods and techniques that were employed during the study period.

7. PROJECT SCHEDULE – Currently, project is on schedule

Output or step	Start date (dd/mm/yyyy)	End date (dd/mm/yyyy)
Logistical preparations (fuel, gear order)	Spring 2016, 2017	Spring 2017, 2018
Logistical preparations (fuel caching, cabin preparations, field equipment)	Spring 2017 Spring 2018	Early summer 2017 Early summer 2018
Biopsy darting	Aug 2017 Aug 2018	Oct 2017 Oct 2018
Harvest analyses	Aug 2017	Oct 2018
Analysis of tissue samples	Fall 2017	Spring 2019
Data analysis, preparation of reports and possible peer-reviewed publications	Spring 2019	Spring 2020

8. PRELIMINARY RESULTS AND DISCUSSION

All jurisdictions that are responsible for the management of this subpopulation worked closely together to ensure the field components could be completed as successfully as possible, weather dependent. Overall, there were about 310 hours per field season, and nearly 30,000 km per year flown in search for bears within the study area. Overall, bears sampled in all jurisdictions looked healthy. We had an encounter rate of approximately 2 bears/search hour. All bears darted provided sufficient tissue for DNA analyses and fat samples. Most bears that were not sampled were cubs of the year. Bad weather conditions throughout the study period prevented us from surveying and sampling Resolution Island and a few other portions of the Nunavut study area during the 2018 field season. There are approximately 1500 samples from the 2005-2007 study, and 1030 samples from the 2017-2018 study including harvest recoveries that have been incorporated into our capture history. Currently populations models are being created so that vital rates and an abundance can be estimated over the next several months.

9. REPORTING TO COMMUNITIES AND USERS

The affected communities have been informed and consulted with about the initial research project. Updated interim field reports after each field season have been distributed to each community and co-management partner. Final community consultations are planned for early 2020, when final results from this study will be presented. Final results will also be presented to the respective RWO.

10. ACKNOWLEDGEMENTS

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Pisapio, A. Dale, J. Joyce, J. Goudie, G. Baike, M. Lougheed, N. Armstrong, B. Kovic, R. Akulukjuk.

This research was carried out under Nunavut Wildlife Research Permits (WRP 2017-011, WRP 2018-002), animal care approvals (NWTWCC 2017-003, NWTWCC 2018-006), Inuit Owned Land land-use permits (Q17X005), a Third-Party-Support licence (17-003), a Parks Canada Agency Research and Collection Permit (TMNP-2017-25357), Quebec Scientific Research Permit (2017-06-22-121-10-S-F-N/D-9053_38), NL Wildlife Research Permit (WLR 2017-38) and a Nunavik Parcs Licence.

Appendix 1

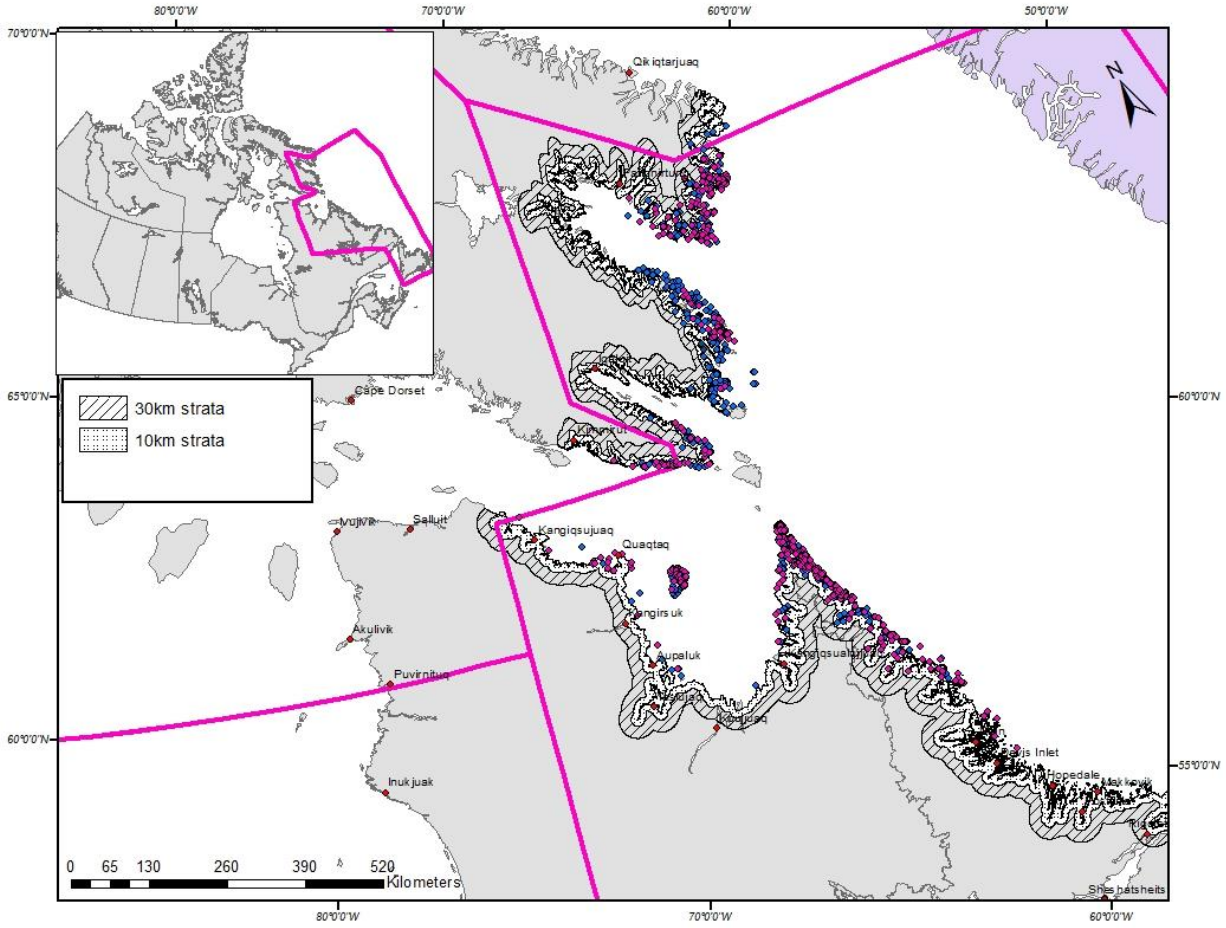

Figure 1. Overview of the study area and 2017-2018 sampling locations of the Davis Strait polar bear subpopulation (blue = 2017, purple = 2018).

Appendix 2

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