Nunavut Wildlife Management Board Interim Project Report – December 2020

1. **NWRT Project Number:** 3-20-05

2. **Project Title:** Inferring Walrus Distribution and Stock Structure from Satellite Telemetry, Trace Elements, and Genetics

3. **Project Leader:**

Cory Matthews
Fisheries and Oceans Canada
501 University Crescent, Winnipeg Manitoba
Email: Cory.Matthews@dfo-mpo.gc.ca
Phone: +1 (204) 984-4524

4. **Summary:**

Atlantic walrus (*Odobenus rosmarus rosmarus*) occur as two genetically distinct populations in the eastern Canadian Arctic. Walrus in Hudson Bay, Foxe Basin, and Hudson Strait belong to the Central Arctic population. For management purposes, this population is divided into three stocks: Foxe Basin, Hudson Bay-Davis Strait (which is shared with Greenland), and South and East Hudson Bay. Stock divisions are based on distribution and seasonal movements, growth patterns, lead isotope ratios, and contaminant profiles.

Stock divisions within the Central Arctic walrus population have recently been challenged by telemetry and genetics data (e.g. satellite tags that demonstrated movements among Canadian stocks). Within Hudson Bay, there is uncertainty in the degree of mixing between walrus in northern vs. southeastern areas (e.g. the Hudson Bay-Davis Strait and South and East Hudson Bay stocks), as well as within the Hudson Bay-Davis Strait stock itself (e.g. genetic differences between Hudson Bay and eastern Baffin Island walruses). In Foxe Basin, walruses can be separated into two groups (Northern Foxe Basin and Central Foxe Basin) based on Inuit *Qaujimajatuqangit*, distribution, tooth lead isotope ratios, and size differences, although they cannot be genetically differentiated. Additional data is needed to assess with more certainty the degree of similarity and differences among walruses within and among stocks, which will help to determine whether current stock definitions are appropriate.

5. **Project Objectives:**

The main objectives of this project are to: 1) deploy satellite tags onto walrus to collect telemetry data and 2) collect tusks and skin biopsies from walruses throughout the study area for trace elements and genetics analyses. These data will inform whether current population and stock designations are appropriate by providing information on movements and distribution (telemetry and trace elements) and genetics (analysis of skin and other tissues). Another main objective is to build science capacity in the North through training research assistants and hunt sampling coordinators in walrus-harvesting communities. Specifically, we would like to engage Northern research assistants and community-based sampling coordinators who could plan, direct, and carry-out future field work objectives in collaboration with DFO researchers.

6. Materials and Methods:

In addition to telemetry and genetics analyses, we propose an innovative research program that will provide additional science advice using lifetime profiles of trace element concentrations and isotope ratios in annual dentine growth layers of walrus tusks. Trace elements are of geologic origin, and underlying biogeochemical processes impart regionally unique baseline concentrations and isotope ratios of trace elements. These characteristics are ultimately reflected in the tissues of animals, and can be used to infer their movements and distribution within and between regions with different baseline values. Tusks are an ideal tissue for this type of study because they are laid down incrementally in annual growth layers throughout an animal's lifetime, and can therefore be profiled to reconstruct long-term movement and distribution histories that are complementary to the more detailed information gained over shorter periods of time using satellite telemetry. Our methods are briefly outlined below.

Fieldwork Locations. Potential field work locations were to have been selected with input from local HTO/As to focus research efforts based on Inuit *Qaujimajatuqangit*/Traditional Knowledge. We planned to base our field work out of four communities in Hudson Bay and Foxe Basin that are within reasonable boating distance of known walrus haul-out sites (Coral Harbour, Sanirajak (Hall Beach), Naujaat, and Cape Dorset).

Satellite telemetry. Briefly, we planned to deploy satellite tags onto walrus in water to avoid disturbance of walrus at terrestrial haul-out sites. Limpet model satellite tags (Wildlife Computers, Seattle, Washington, USA) were to be affixed to the upper backs of swimming walruses using crossbows from boats. Tags are surface-mounted using a 4-cm metal dart that anchors the tag below the tough skin into the blubber upon contact. Tags start transmitting location to orbiting satellites as soon as they are wet, and are programmed to withhold transmissions when walrus are hauled out on land or ice. Tags deployed in this manner can last on walrus approximately 1-4 months, providing data on haul-out patterns and critical habitat (e.g., foraging) during that period.

Sample collection. We planned to collect several tissues of primary focus for this study. First, the collection of skin and other tissues (e.g. muscle) for genetics analyses was a priority, collected using either biopsies or sampling of harvested animals. Skin biopsies were to be collected using Pneu-dart CO_2 projectors (guns) to fire hollow tubular sterile metal biopsy darts at the upper back of swimming walrus (again, to avoid disturbance of animals hauled out at terrestrial haul out sites). All darts are sterilized using methods approved beforehand by DFO's Freshwater Institute Animal Care Committee. Biopsy darts bounce off the animal upon contact and float at the water surface. They are collected immediately and are stored frozen or chilled on the boat until they can be frozen in electric freezers within 12 hours of collection.

We planned to collect larger tissue samples (e.g., skin, muscle, organs), including tusks, from harvested walruses using a community-based sample collection approach. Samples were either purchased from hunters who completed sample kits prepared by DFO and administered via the local HTO/A. A suite of tissues are routinely collected during this jointly operated program, and communities were informed of the various research purposes to which the collected samples contribute (e.g., genetics analysis of skin and muscle or trace element analysis of tusks). Sample kits prepared by DFO with sample storage

materials (e.g., plastic bags and glass vials) and labels in English and Inuktitut were sent to each community during the spring and early summer, in advance of the main period when walrus are harvested. In addition to routinely collected samples (e.g., skin and muscle), we made a concerted effort to collect tusks for the trace element component of this project. Our goal was to acquire at least 60 walrus tusks from communities throughout their range, particularly those harvesting from the Hudson Bay-Davis Strait stock shared with Greenland.

7. Project Schedule:

Output or Step	Start Date	End Date	Status/Changes
Contact HTOs of focal communities	has been ongoing since 2018	N/A	All communities with whom we wanted to work as part of this NWRT proposal were contacted in early January 2020, with follow ups in late spring and early summer with those who did not respond.
Meeting with HTO reps	Nov/2019 (Sanirajak) and Feb/2020 (Coral Harbour)	Nov/2019 (Sanirajak) and Feb/2020 (Coral Harbour)	The Sanirajak and Coral Harbour community in-person meetings were held prior to the pandemic. All other scheduled or planned community meetings were cancelled in 2020 due to COVID-19 pandemic restrictions.
Set-up contracts for research assistants and sample collection	April/2020	July/2020	Completed.
Conduct field work and sample collection	July/2020	Aug/2020 (fieldwork) Oct/2020 (community-based hunt collections)	Completed.
Email and phone updates to communities	Aug/2020	Dec/2020	Completed.
NWMB Interim Report	15 Dec 2020	15 Dec 2020	Completed.
NWMB Interim Financial Report	15 Dec 2020	15 Dec 2020	Completed.
NWMB Final Project Report	30 Sep 2021	-	Present document.

8. Preliminary Results/Discussion:

All aspects of our proposed research were affected by the COVID-19 global pandemic and restrictions put in place to limit its spread throughout the Canadian Arctic. Notably, all DFO researchers from Winnipeg were unable to participate in field work. While this restricted some components of the project, objectives with respect to community engagement in research were exceeded in Coral

Harbour, where local research teams completed field work objectives. Further, despite local restrictions on DFO building access in Winnipeg, we were able to make some inroads on sample preparation for several lab analyses related to this project.

Tagging plans were unfortunately postponed because tag programming and deployment required experienced personnel who were unable to travel for field work. However, plans for biopsying walrus in Coral Harbour and community-based sampling of harvested walrus in all communities went ahead with logistical support from DFO researchers. The Coral Harbour HTA met and approved revised plans to have local research assistants complete walrus field work (biopsies). DFO researchers in Winnipeg prepared all equipment (e.g., CO_2 guns and biopsy darts) and manuals and videos for their operation, and shipped them to the HTO. Research assistants and boat captains/boats were contracted by DFO via the HTO, who arranged several telephone meetings to go over research plans and equipment. At the end of August, the local research team collected biopsies from ~130 walruses near the primary haul-out site Walrus Island. Notably, this number exceeds the number of samples collected during a typical field season, and moreover, the research team collected these biopsies from animals in water (thereby avoiding disturbance of hauled-out animals) over a period of just 1.5 days. These samples will contribute to genetics analyses to assess walrus stock structure in the region and walrus abundance (via genetic capture-mark-recapture); analyses, however, are not planned until collection of additional samples from Hudson Bay and Foxe Basin communities are collected over the next several years to acquire sufficient sample size. The research team expressed interest in doing field work again in 2021, and have offered to expand the program to other sites and seasons (e.g., earlier in the summer on the opposite site of Southampton Island). The success of the Coral Harbour field work is driving expansion plans next year as part of a 5-yr research plan to collect a large number of skin biopsies for genetics research.

Community-based sampling of harvested walruses went ahead largely as planned. DFO contracted a coordinator in Sanirajak, and sent sample kits to all planned communities. As of December 2020, over 30 kits have been returned from the communities of Sanirajak, Naujaat, and Coral Harbour. Almost all kits were returned with at least one tusk, pushing the total tusks available for the trace element component of this study to over 70. As of December, we remain focused on outreach to communities via HTOs/HTAs to ensure hunters are aware of our call for samples.

COVID-19 restrictions also severely impacted our ability to proceed with sample processing and lab analyses, as DFO researchers and technicians in Winnipeg have largely been under work-from-home orders since March 2020. However, in addition to being granted building access to prepare field equipment (see above), researchers have been able to enter the building to receive and process returned sample kits and prepare samples for analysis. The approximately 30 or so new tusks acquired in 2020 have been sectioned using high-powered water saw by a contracted company in Winnipeg. We have also started sampling sectioned tusks currently in our collection from 2019. Annual dentine growth layer groups of approximately 10 tusk sections have been drilled and are ready for pilot trace element analysis once commercial labs are able to conduct the work (anticipated early 2022).

Finally, other components of returned hunt sample kits have been processed and will be sent to collaborators for genetics and trace element analyses once building restrictions allow. Approximately

50 muscle samples from walrus harvested in 2020 and previous years are being sent to collaborators in Copenhagen, Denmark for genomics analysis (e.g., whole genome) that will shed light on stock delineation and demographic history (e.g., past population size and current trends). Stomach and liver samples are also being sent to collaborators in Ottawa (ECCC and Carleton University) as part of a microplastics and contaminants study. Initial stages (i.e., quantification of stomach/gastrointestinal tract microplastics) have been completed, to be followed by the second stage in which microplastic-associated contaminants are being measured in several tissues.

Overall, despite COVID-19 restrictions, we have been able to complete much of the anticipated field and lab work objectives associated with this project, with the exception of the cancelled satellite tag deployment.

9. Reporting to Communities/Resource Users:

Consultation	**Date**	**Type**	**Status/Changes**
Before Research	January to June 2020	In-person meeting (Coral Harbour); emails and phone calls (all communities).	Completed.
During Research	July and August 2020	Daily emails and phone calls with community HTO/As. Daily texts with field team as they practiced with biopsy equipment and sampled walrus.	Completed.
Post Research	August 2020 to present	Emails and phone calls with HTO/As. Conference call with DFO and NWMB and NTI.	Completed.