Nunavut Wildlife Management Board Interim Project Report – September 2022

1. **NWRT Project Number:** 3-21-05

2. **Project Title:** Inferring walrus distribution and stock structure from satellite telemetry, microchemistry, and genetics

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4. **Summary:**
Atlantic walrus (*Odobenus rosmarus rosmarus*) occur as two genetically distinct populations in the eastern Canadian Arctic. In the southern portion of their range, walrus in Hudson Bay, Foxe Basin and Hudson Strait belong to the Central Arctic population. For management purposes, the Central Arctic 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, trace elements, and contaminant profiles. However, uncertainty surrounding these stock divisions requires additional data on movements, distribution, and genetics.

Our proposed research is focused on the Central Arctic walrus population, and our main objectives are to: 1) deploy satellite tags for movement analysis; 2) collect tusks and other tissues from hunted walrus for trace elements, stable isotopes, and contaminants analyses; and 3) collect skin biopsies for genetics analysis. These data will inform whether current population and stock designations are appropriate. Our larger, long-term objective is to build science capacity in the North through training of research assistants and community-based monitoring personnel in walrus-harvesting communities. Inuit communities in the study area hunt walrus year-round for food and other products such as ivory, and also benefit economically by transferring some of their hunt quota to limited sport hunts by non-Inuit. A solid understanding of walrus stock structure throughout the region is necessary to properly manage walrus hunts, and Inuit involvement in this process, particularly in the design and implementation of scientific research, is a priority of DFO's walrus research program. The proximity of walrus to several Foxe Basin and northern Hudson Bay communities makes them an ideal species to develop community-based research and monitoring.

5. **Project Objectives:**
Our main scientific objective is to address uncertainties in the current stock definitions of walrus from the Central Arctic population that is distributed across Hudson Bay, Foxe Basin, and Hudson Strait using three general approaches: satellite telemetry, tissue microchemistry, and genetics. Satellite telemetry will provide detailed, short-term movement data, while microchemistry data (e.g., trace elements and stable oxygen isotopes) will reflect long-term (lifetime) individual movement chronologies. Genetics data will reflect population structure and allow us to infer the level of relatedness of individuals within

and among stocks. Together, these data will inform the degree of mixing, if any, between currently defined stocks, and allow for updating of stock delineations where appropriate.

Another main objective is to increase science capacity among Inuit/Northern collaborators, and to increase local involvement in DFO's walrus research program. Specifically, we would like to engage Inuit/Northern researchers in our field work and community-based sampling programs. We would like to hire and train local research assistants who contribute to study design, and who direct and carry out field work objectives on their own. Similarly, we would like to contract community-based monitors to coordinate hunter sample collections in walrus-harvesting communities. This proposal expands on a community-based walrus monitoring program implemented in Sanirajak in 2018, and further developed in 2019, and expanded to include Coral Harbour in 2020. Local research assistants from Coral Harbour hired via the HTO and supported logistically by DFO also conducted walrus field work independently in 2020, collecting over 100 biopsies.

6. Materials and Methods:

We propose an innovative research program that incorporates both core (e.g., satellite telemetry and genetics) and innovative approaches (e.g., trace elements) to collect data on walrus movements, distribution, and population structure. These data will be used to assess current stock definitions. While our program objectives have always prioritized involvement of local researchers, we are planning all field work in 2021 to be community-led with remote logistical support from DFO researchers based in Winnipeg if COVID-19 pandemic guidelines restrict travel into Nunavut. Field work is planned in four communities in northern Hudson Bay and Foxe Basin (Coral Harbour, Naujaat, Sanirajak, and Igloolik) located near walrus haul-out sites. Local HTOs will determine when and where to focus research efforts based on Inuit Qaujimajatuqangit/Traditional Knowledge.

Satellite telemetry and biopsy collection: Limpet model satellite tags (Wildlife Computers) will be deployed onto the upper back of walruses using crossbows. Walruses in water will be slowly approached by boat, and tags will be surface-mounted using a 4-cm metal dart that will anchor the tag below the tough skin into the blubber upon contact (goal: 40 tagged walruses in total, with efforts focused on Walrus Island south of Coral Harbour, where a majority of the Hudson Bay-Davis Strait stock is found during summer). Skin biopsies will be collected using a Dan Inject CO2 gun to fire biopsy darts at walrus, with a goal of up to 150 per site (i.e., 600 total). Biopsies will be collected and placed in a portable -80oC freezer that will also be used to ship samples to DFO in Winnipeg. All required field equipment (e.g., satellite tags, crossbows, CO2 guns, biopsy darts, portable freezers, etc) will be readied in Winnipeg and shipped to respective community HTO/As prior to scheduled field work. Contracts for hiring local research assistants will also be in place prior to scheduled field work.

Sample collection from hunted walrus: Tissues, organs, and structures (e.g., tusks, stomachs, livers, muscle, etc) will be collected from harvested animals using a community-based sample collection approach. Well before the open-water season when the bulk of the walrus hunt is conducted, sample kits prepared by DFO researchers in Winnipeg will be shipped to the respective community HTO/As. In this program, walrus samples are purchased directly from hunters who fill the sample kits during animal butchering. Our anticipated total sample size ranges from 10-25 animals from each community.

Sample and data analysis: A suite of microchemistry (e.g., trace element and oxygen isotopes) and genetics analyses will be conducted on collected tissues. Lifetime profiles of concentrations and stable isotope ratios of over 30 trace elements (e.g., lead, strontium) and oxygen will be measured 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 elements. These characteristics are ultimately reflected in animal tissues, and can thus be used to infer their movements and distribution within and between regions with different baseline values. Tusks are an ideal structure 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, chronological movement and distribution histories that span much longer time periods than telemetry studies. Previous studies have indicated sufficient regional variation in baseline trace element characteristics to discern distribution differences of walruses. Tusks will be sectioned longitudinally to expose dentine, which will be drilled from annual growth layer groups using a micromill (DFO, Winnipeg). A micromill allows sampling at very fine spatial scales (e.g. 300 µm widths), which will allow for annual layers to be sampled at annual and even sub-annual resolution. Trace element analyses will be conducted on dentine, as well as skin, via inductively coupled plasma mass spectrometry (ICPMS) at the University of Manitoba, while oxygen isotope analysis will be conducted at the University of Western Ontario. Mixed effects, time series, and Bayesian stable isotope mixing models will be used to tease apart differences among individuals and stocks.

Genetics analysis will be conducted at the University of Copenhagen on approximately 80 muscle samples collected from harvested walruses (and from biopsied skin in cases where additional samples are needed). Nuclear and mitochondrial DNA will be extracted and entire genomes will be sequenced. 10-20 samples from both Hudson Bay and Foxe Basin will be analysed, with 1-2 samples from each region selected for very high-quality genomic analysis.

7. Project Schedule:

Output or Step	Start Date	End Date	Status/Changes
Contact HTOs of focal communities	has been ongoing since 2018; initiated in Jan 2021 to go over summer 2021 plans	N/A	All communities with whom we wanted to work as part of this NWRT proposal were contact in early January 2021, with follow up virtual meetings in late winter and early spring.
Meeting with HTO reps	Feb 2021 to ongoing	N/A	Virtual (e.g., Zoom) and/or phone meetings were held with each of the community HTA/Os and/or their managers.
Set-up contracts for research assistants and sample collection	April/2021	Aug/2021	Completed.
Conduct field work and sample collection	Aug/2021	Oct/2021	Completed.

Email and phone updates to communities	Aug/2021 to ongoing	N/A	Ongoing.
NWMB Interim Report	15 Dec 2021	15 Dec 2021	Completed.
NWMB Interim Financial Report	15 Dec 2021	15 Dec 2021	Completed.
NWMB Final Project Report	30 Sep 2022	-	Completed.

8. Preliminary Results/Discussion:

Plans for expansion of community-led walrus field work in 2021 were successful. Four communities (Naujaat, Igloolik, Sanirajak, and Coral Harbour) all successfully completed 1 or more field programs on walrus, compared to just Coral Harbour in 2020. DFO researchers from Winnipeg, who were again unable to participate in field work due to the continuing COVID-19 pandemic, spent April-June prepping the required field equipment and paperwork for contracts. Field work plans included biopsy collection in all four communities, along with satellite tag deployment and stationary camera set up at haul out sites at Sanirajak and Coral Harbour. All necessary equipment was shipped to the respective HTO/As by early August, and contracts to pay local research assistant salaries were approved and in place in time for scheduled field work. C Matthews prepared detailed operation manuals for all equipment. At the same time, lab work, including sectioning and sampling of tusks for trace element analysis and skin for genetics analysis continued at DFO Winnipeg research labs, largely free of pandemic restrictions.

HTA/Os in each of the four communities selected two research teams comprising two boats, with one captain and two research assistants each (for a total of six hires per community). Field research assistants in Naujaat and Sanirajak completed all biopsy work within a period of 3-6 days, collecting between 50-100 biopsies from walrus at the end of August and early September. Sanirajak additionally deployed four stationary cameras at haulout sites near the community, and successfully deployed six satellite tags onto walrus. The longest lasting of these tags transmitted location and dive data for close to three weeks (Figure 1). This telemetry data is currently inventoried at DFO and will be analysed along with additional data acquired over the upcoming 1-2 years.

Local research assistants in Igloolik collected approximately 50 biopsies from walrus over a period of 5 days in early to mid September. Coral Harbour researchers were delayed in starting field work due to a local outbreak of COVID-19, and could not initiate planned field work until October. This unfortunately led to the cancellation of satellite tag and stationary camera deployments. However, the research team was able to make four different trips to Walrus Island where they were able to collect biopsies from approximately 10 walruses. At that time of year, low numbers of walrus are at the haul-out site and harsh weather conditions have set in. Therefore, it was decided to wrap up field work by the end of October.

Communities have returned equipment to DFO in Winnipeg, with some HTA/Os offices retaining frozen biopsies until they can be reliably transported frozen. Biopsies received by DFO have been inventoried and are currently frozen in –80°C freezers. Work has begun on initial processing of samples (e.g., sub-sectioning for genetics and stable isotopes, fatty acids) for analysis.

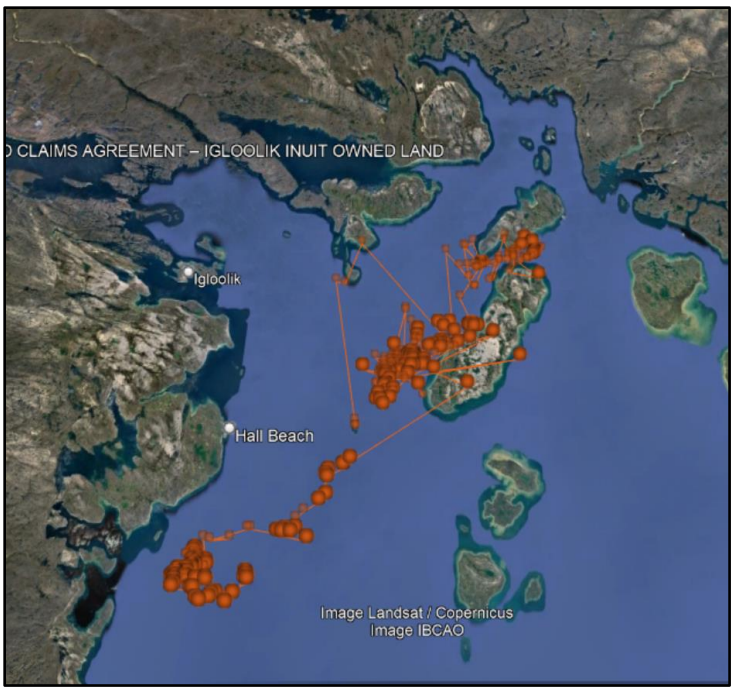

Figure 1: Satellite track of walrus satellite tagged by local research assistants from Sanirajak, NU, during August 21 to Sept 10 2021. The tag transmitted for close to 3 weeks, providing data for assessments of critical habitat use (e.g., foraging), distribution, and haul-out patterns.

9. Reporting to Communities/Resource Users:

Consultation	Date	Type	Status/Changes
Before Research	January to August 2021	Virtual (Zoom) meetings with Sanirajak and Coral Harbour; email and phone communications with all community HTA/Os.	Completed.
During Research	August to October 2021	Daily emails and phone calls with community HTO/As. Daily texts with multiple field team as they practiced with biopsy equipment and conducted field work.	Completed.
Post Research	October 2021 to present	Emails and phone calls with HTO/As; in-person if COVID guidelines allow.	Completed. In-person meetings were held in Coral Harbour (May) and Igloolik (June) 2022.