Nunavut Wildlife Management Board Final Project Report – September 30, 2024

1. **NWRT Project Number:** NWRT-2023-0000000011

2. **Project Title:** Community-based research on walrus distribution and stock structure

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4. **Summary:**
Current walrus stock delineations in Canada have been challenged recently by telemetry and genetics data that have shown movements and relatedness among Canadian walrus stocks currently thought to be spatially separated. Additional information on movements, distribution, and genetics from a larger sample size is therefore required to assess whether current stock divisions are appropriate. Satellite telemetry has been one of DFO's core approaches to evaluate walrus movements and distribution, and our plans to continue previous tagging efforts will provide detailed information on short-term walrus movements and habitat use. Our use of microchemistry, particularly trace element and stable oxygen isotope analysis of tusks, is a novel scientific approach to address questions about walrus movements. Unlike tagging studies, which are limited in scope (lasting on average 6 weeks), trace element and stable isotope profiles of tusks, which grow throughout the walrus' lifetime, can allow for reconstructions of individual animal movements and distribution over many years, and can thus provide long-term data with which to assess stock structure. Genetics analysis has also been a core DFO tool to assess stock structure, but a larger sample of walrus from the Central Arctic population is necessary to characterize genetic structure of the population. Our proposed research will build on these three themes (telemetry, microchemistry, and genetics) by increasing walrus sample sizes from across the range of the Central Arctic population, and performing novel analyses on those samples (e.g., trace elements and isotope ratios of rarely measured elements like oxygen, and more detailed genomics analysis of walrus DNA). Combined, our complementary short-term (satellite tagging) and long-term (life-time microchemistry, genetics) studies will provide a greater understanding of walrus movements, distribution, and stock structure.

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 scientific research capacity among Inuit/Northern collaborators, and to increase local community 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 through 2019-21, and expanded to include Coral Harbour in 2020, when local research assistants hired via the HTO and supported logistically by DFO collected over 100 walrus biopsies. This field work model was expanded in 2021 and 2022 to include Naujaat, Sanirajak, and Igloolik, with local research assistants successfully collecting biopsies (> 250 total from the four communities) and deploying satellite tags (19 walrus total). After the first three years of this project, we are also now proceeding with lab work (stable isotope and trace element analysis of skin samples) to address project scientific objectives.

6. Materials and Methods:

Our proposal represents the fourth year of 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. The first few years of the program focused on sample collection in the field (which will continue in 2023), and we are now working on sample analysis to provide data to assess current stock definitions. We are planning all field work in 2023 to be community-led with remote logistical support from DFO researchers based in Winnipeg, with the exception of Igloolik for which DFO employees are planning to assist local researchers with satellite tagging. Field work is planned in five communities in northern Hudson Bay and Foxe Basin (Coral Harbour, Kinngait, 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 in Igloolik, after successful tagging projects in Sanirajak (2021) and Coral Harbour (2022). 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: 20 tagged walruses in total). Skin biopsies will be collected using a Dan Inject CO_2 gun to fire biopsy darts, with a goal of up to 150 per site (i.e., 600 total). Biopsies will be collected and placed in a portable -80^{o}C freezer that will also be used to ship samples to DFO in Winnipeg. All required field equipment (e.g., satellite tags, crossbows, CO_2 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 are currently being conducted on dentine, as well as skin, via inductively coupled plasma mass spectrometry (ICPMS) at the University of Manitoba, while oxygen isotope analysis is ongoing 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 is ongoing 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. We have also initiated two additional types of analyses that may be useful in assessing walrus stock delineation, and will certainly fill data gaps with respect to walrus ecology and health. Tissue samples collected from 2020-2022 have been analysed for microplastics (**Jardine A, Matthews CJD, Provencher JF; Hornby C, Gamberg M, Bourdages M, Alexander D, Naullaq M, Vermaire J. 2023. No accumulated microplastics detected in the first assessment of walrus (*Odobenus rosmarus*) stomachs from Nunavut, Canada. Arctic Science. 00: 1–12**) and trace metals (data analysis ongoing), and are currently being analysed for a suite of other contaminants. We have also just begun a pilot study looking at walrus parasites, which are not well-characterized. Goals are to describe the numbers and types of parasites and evaluate spatial differences in occurrence to determine whether parasite communities can be valuable for assessing population structure/stock delineation.

7. Project Schedule:

Output or Step	Start Date	End Date	Status/Changes
Contact HTOs of focal communities	Ongoing since 2018; Formal Letter with 2023 plans: 15/01/2023	Ongoing/ continual	All communities (Igloolik, Sanirajak, Naujaat, Coral Harbour, and Kinngait) responded with formal letters of support/approval.
Meeting with HTOs	Feb and Mar 2023 (in-person)	Ongoing/ continual	In-person meetings were held with the HTOs in Coral Harbour, Igloolik, and Naujaat.
Contracts in place (salaries, boat rental)	01/04/2023	30/06/2023	Completed.
Field work	01/08/2023	31/10/2023	Completed.
Lab work	Ongoing	Ongoing	
Interim reporting to NWMB, communities	15/12/2023	/	Completed.
Final reporting to NWMB, communities	30/09/2024	/	Outstanding.

8. Preliminary Results/Discussion:

Three of five communities (Naujaat, Igloolik, and Kinngait) successfully completed field programs on walrus in 2023, including biopsy collection and/or satellite tag deployment. Sanirajak, which had participated in previous years, remained completely out of contact due to issues with filling the HTO manager position. Coral Harbour, despite several in-person meetings and a field team based in the community for over one week, failed to conduct any field work on walrus in 2023. It

is my understanding that the HTA could not find anyone who was willing to work or rent their boats on contract. Community members in Naujaat, Igloolik, and Kinngait were therefore able to work more days than anticipated, essentially claiming those that had also been allocated to 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. HTA/Os in each of the three communities who conducted work selected two research teams comprising two boats, with one captain and two research assistants each (for a total of six hires per community). Many of the researchers from previous years returned for 2023.

- Together, all three communities (Naujaat, Igloolik, and Kinngait) collected about 80 skin and blubber biopsies. These are currently being held in HTA/O freezers until reliable shipping that keeps them frozen can be arranged. All biopsies were collected from walrus in water using boats.

- The team from Igloolik deployed 6 satellite tags onto walrus in northern Foxe Basin. Tags were deployed in early summer and one transmitted for up to close to four months. Tracks of tagged animals are included below.

Figure 1. Field team approaching walrus hauled out on ice to take skin biopsies using an air gun. A biopsy dart remaining stuck in the walrus in the foreground is visible (circle).

Figure 2. Walrus swimming away from field team boat after being satellite tagged using a crossbow. The satellite tag is visible high on the back, on the upper neck.

Table 1: Summary of 5 of 6 satellite tags deployed onto walrus in Foxe Basin, summer 2023. The other two remaining tags only stayed on the walrus for less than one day and are not included here.

deploy ID	# of locations	start_date	end_date
242209	6	2023-06-23	2023-06-23
242205	38	2023-07-20	2023-07-21
242206	198	2023-07-20	2023-08-23
242220	25	2023-07-26	2023-07-27
242208	735	2023-07-27	2023-11-07

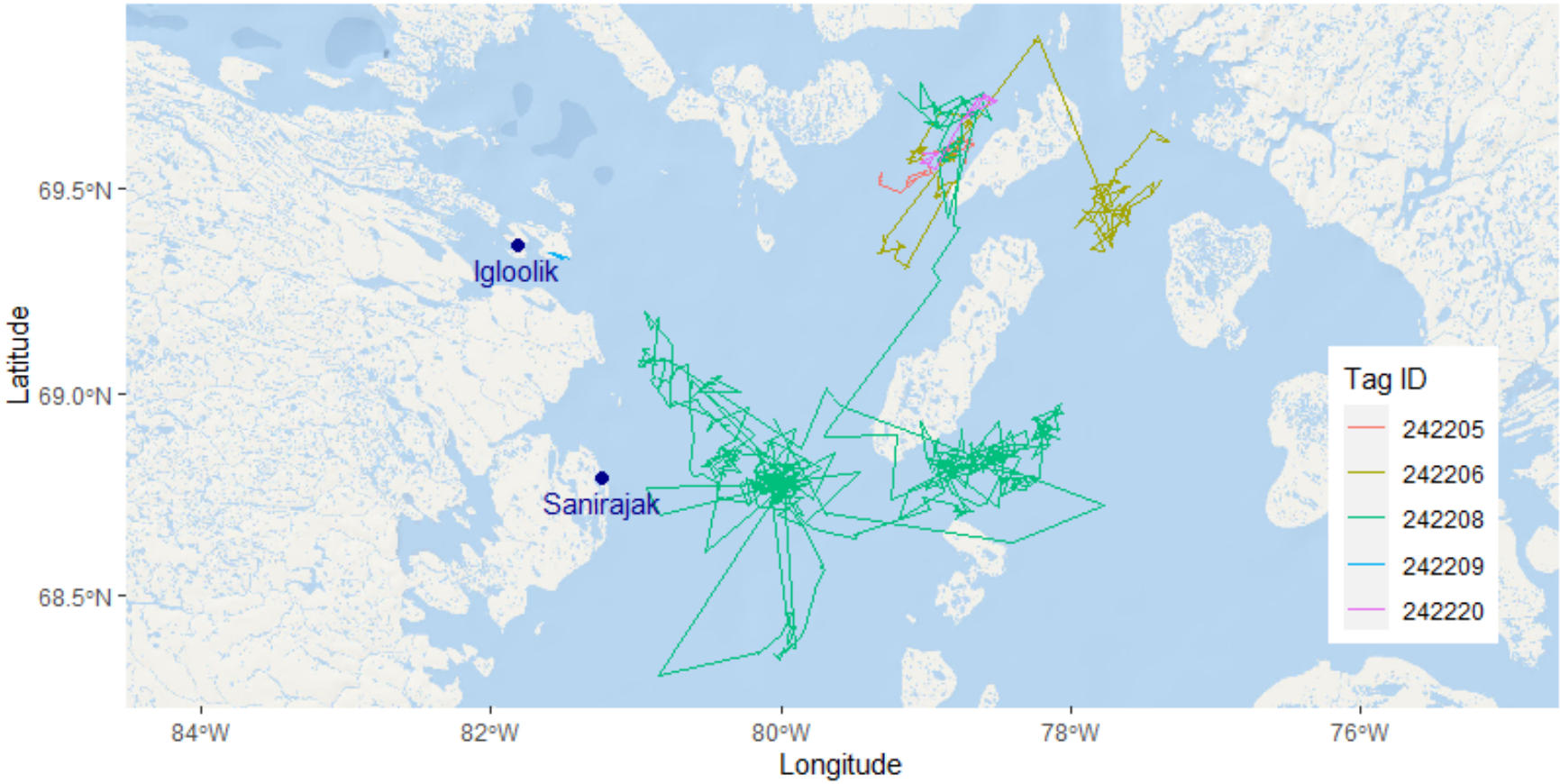

Figure 3. Satellite tracks of the five walruses tagged in Foxe Basin during summer 2023 (see Table 1 above).

9. Reporting to Communities/Resource Users:

Consultation	Date	Type	Status/Changes
Before Research	January to August 2023	Emails, Phone calls. In-person meetings with Coral Harbour and Igloolik.	Completed.
During Research	August to October 2023	Daily texts with multiple field team members as they practiced with biopsy equipment and conducted field work.	Completed.
Post Research	October to present	Emails and phone calls with HTO/As.	Completed.