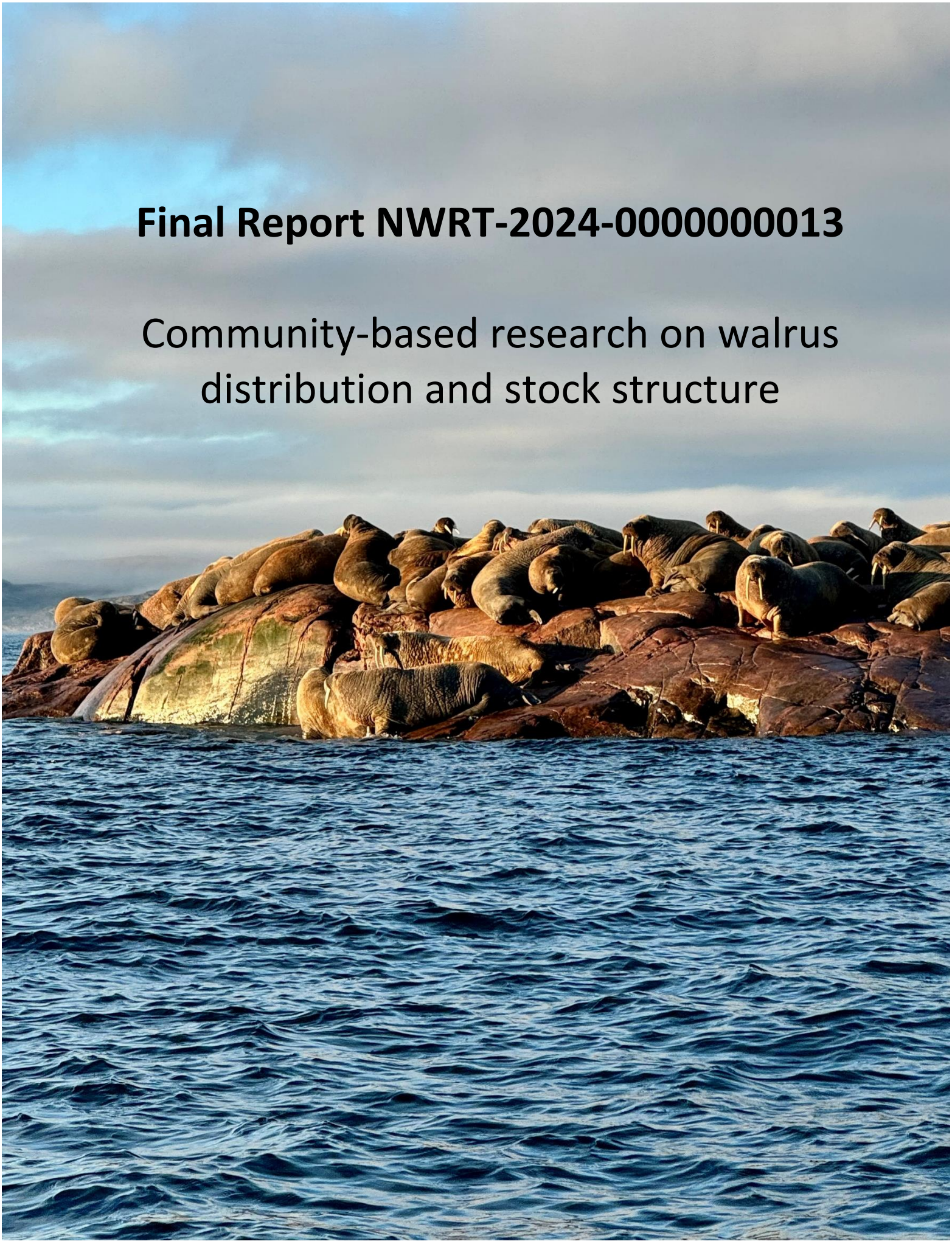
Final Report NWRT-2024-0000000013

Community-based research on walrus distribution and stock structure



Nunavut Wildlife Management Board Final Project Report – December 15, 2024

1. **NWRT Project Number:** NWRT-2024-0000000013

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

3. **Project Leader:**

Cory Matthews
Fisheries and Oceans Canada
501 University Crescent, Winnipeg Manitoba
Email: Cory.Matthews@dfo-mpo.gc.ca
Phone: +1 (204) 955-5514

4. **Summary:**

Atlantic walruses (*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, 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.

5. **Project Objectives:**

Our proposed research is focused on the Central Arctic walrus population, and our main scientific objective is to assess current management stock structure using: 1) satellite tags for movement analysis; and 2) tissues (e.g., via biopsy and sampling of hunted animals) for stable isotopes and trace elements (both proxies for distribution and movements) and genetics analyses.

Our other main objective is to build science capacity in the North through training of research assistants 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 haul-out sites to Foxe Basin and northern Hudson Bay communities make walrus an ideal species to develop community-based research and monitoring. This proposal seeks funding for up to 24 local research assistant salaries after demonstrating successful completion of community-led walrus field work in several Foxe Basin and Hudson Bay communities (Naujaat, Igloolik, Kinngait, Coral Harbour, and Sanirajak) from 2020 to 2023 (i.e., it is a continuation of the community-based program being developed).

This year marks the fifth and final year of the current project that has been dedicated largely to expanding our databases (telemetry, microchemistry, and genetics) required to address research objectives.

6. Materials and Methods:

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. Local community members have previously deployed satellite tags near Sanirajak (2021), Coral Harbour (2022), and Igloolik (2023). 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. Since 2020, local community members working as part of this program and funded through NWRT have collected more than 300 biopsies, greatly increasing our sample size to assess distribution differences using isotopes and genetics. 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.

All field work in 2024 is planned as community-led projects, with participation of DFO researchers based in Winnipeg in some communities. 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), Coral Harbour (2022), and Igloolik (2023). 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, distributed across three communities: Naujaat, Igloolik, and Coral Harbour). Skin biopsies will be collected using a Dan Inject CO_2 gun to fire biopsy darts, with a goal of up to 100 per site (i.e., 400 total). Biopsies will be collected and placed in a portable –80°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 fieldwork. 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.

7. Project Schedule:

Output or Step	**Start Date**	**End Date**	**Status/Changes**
Contact HTO/As of focal communities	ongoing; letter with 2024plans: 2024/01/04	ongoing/ continual	Completed. All communities (Igloolik, Sanirajak, Naujaat, Coral Harbour, and Kinngait)

			responded with formal letters of support/approval.
In-person meetings with HTO/As	2024/02/26	2024/03/31	Completed. In-person meetings were held with the HTOs in Igloolik, Sanirajak, Kinngait, and Naujaat. We maintained good communications with Coral Harbour using virtual means and telephone.
Contracts in place (salaries, boat rental)	2024/04/01	2024/07/15	Completed.
Field work	2024/07/16	2024/10/31	Completed.
Reporting to NWMB, communities	2024/12/15	n/a	Completed.
Final reporting to NWMB, communities	2025/09/30	n/a	Outstanding.

8. Preliminary Results/Discussion:

Fieldwork. For the first time since the initiation of our walrus community-based research network, all five communities (Naujaat, Igloolik, Sanirajak, Coral Harbour, and Kinngait) successfully completed field programs in 2024, including satellite tag deployment (4/5 communities) and biopsy collection (4/5 communities). In an example of how this network can promote research-based programs, a local research assistant who previously worked on walrus in Igloolik moved to Sanirajak, where he was able to independently train a couple of new field teams who then went on to complete field work there for the first time since 2021.

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 five communities selected up to two research teams comprising two boats, with one captain and two or more research assistants each (for a total of approximately six contracted hires per community). Many of the researchers from previous years returned for 2024.

- Together, research teams in Igloolik, Naujaat, Coral Harbour, and Kinngait deployed a total of 25 satellite tags, the highest number since the initiation of our project (Figures 1-4). As of mid-December, several of these tags continue to transmit up to several months post-deployment, and walrus locations are included below (Figures 5,6).

- Together, research teams in Igloolik, Naujaat, Sanirajak, and Kinngait collected 126 skin and blubber biopsies from a larger geographic area than accomplished during any single previous year of our program (Figures 1-4). Biopsies are currently being held in HTA/O freezers until reliable shipping that keeps them frozen can be arranged.

Figure 1. Symiuny Jaw (Kinngait) prepares to biopsy walrus using a CO_2 gun.

Figure 2. Bryanna Sherbo (DFO Winnipeg) prepares to deploy a satellite tag onto walrus using a crossbow near Kinngait, Sept 2024.

Figure 3. William Kringayark (Naujaat) approaching walrus to deploy a Limpet satellite tag to collect telemetry data.

Figure 4. Limpet satellite tag visible high up on the upper back of a walrus tagged using a crossbow at a terrestrial haulout near Igloolik. Tagging was done by Travis Qaunaq (Igloolik).

Satellite telemetry and stock delineation. Late summer movements of walrus in Foxe Basin and northern Hudson Bay have been consistent with current stock delineations (Figures 5,6). That is, so far, no walrus satellite tagged in Foxe Basin have moved into the geographic range of the Hudson Bay-Davis Strait stock to the south (although some positions of walrus tagged in Foxe Basin have come close to those tagged near Kinngait (Figures 5,6). The Hudson Bay-Davis Strait management stock encompasses walrus from around Southampton Island, including those that were tagged by the Naujaat field team. Movements of walrus around this area, both from Naujaat area to Coral Harbour area and vice versa, are therefore consistent with current understanding of walrus movements within that management stock. Satellite tags of several walrus continue to transmit at the time of this report and results will be updated in our final report.

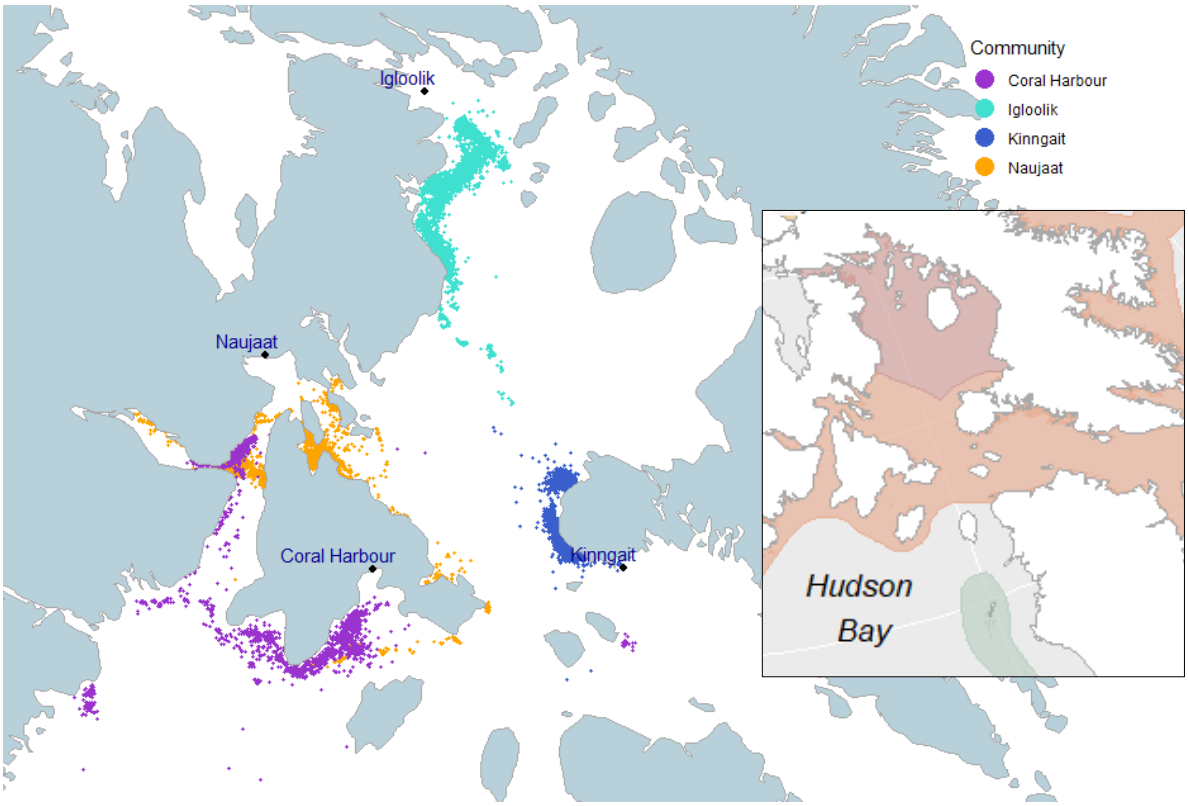


Figure 5: Walrus satellite tagged in Foxe Basin (out of Igloolik, turquoise points) remained within their respective management stock range (Foxe Basin, shown in red in inset map). Walruses satellite tagged near Naujaat (orange), Coral Harbour (purple), and Kinngait (blue) also remained within the geographic boundaries of their management stock (Hudson Bay-Davis Strait, shown in orange in inset map), but exhibited evidence of even finer scale spatial structuring (e.g., no mixing between walrus tagged near Kinngait and the other two locations). Movements of some walrus around Southampton Island are consistent with previous knowledge.

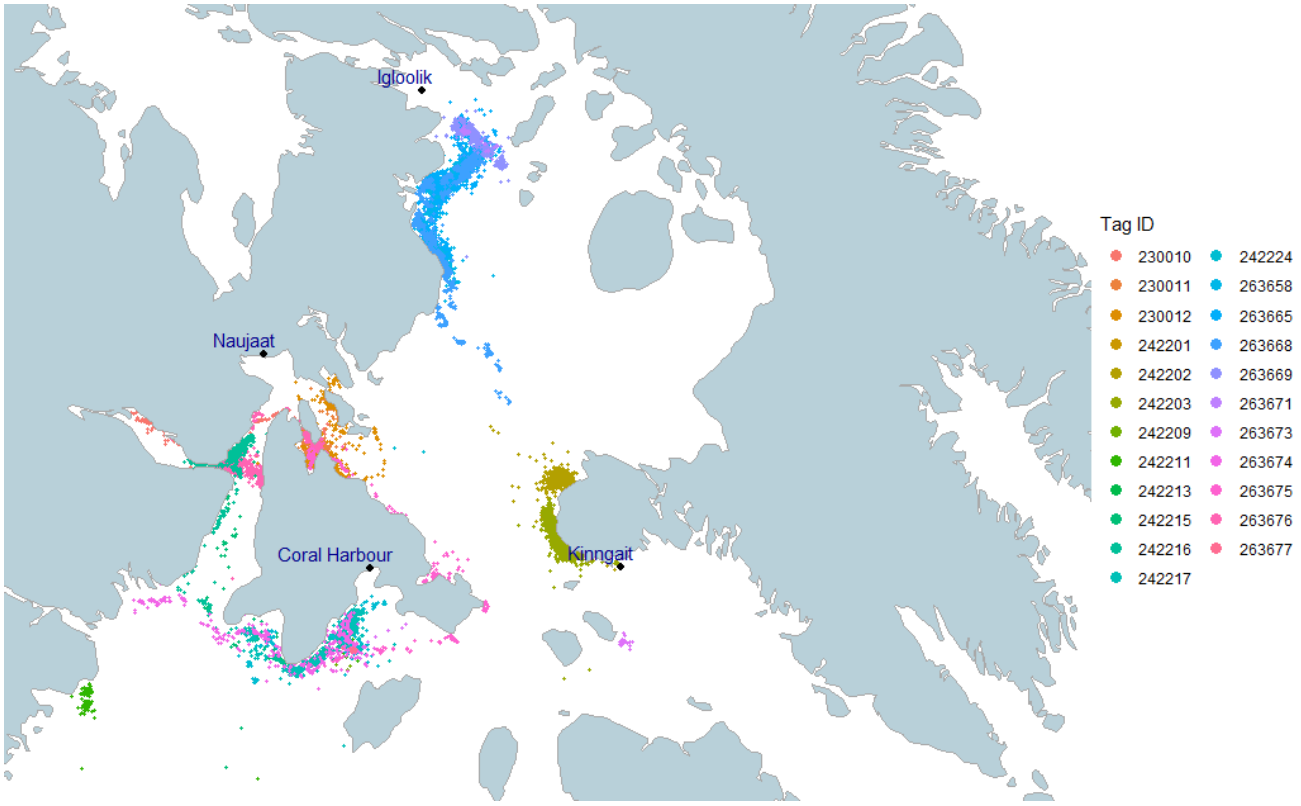


Figure 6: Same walrus telemetry data presented in Figure 5 showing individual walrus locations.

Tissue microchemistry and stock delineation. We have completed trace element analysis of 52 paired walrus blubber and muscle samples from Naujaat, Coral Harbour, and Iqaluit and Pangnirtung (collected in a related study), representing the Hudson Bay-Davis Strait stock, and Sanirajak, representing the Foxe Basin management stock. A principal component analysis (PCA) followed by linear discriminant analyses (LDA), revealed separation among the different locations based on trace element concentrations in both tissues (Figure 7). Sanirajak/Foxe Basin walrus clustered apart from all other locations, consistent with telemetry data for Foxe Basin, and previous stock structure knowledge. Walrus from southeast Baffin Island, however, representing the extreme eastern range of the Hudson Bay-Davis Strait stock, were the most distinct from other regions, particularly for muscle. Walrus hunted near Coral Harbour and Naujaat generally occupied similar space, but exhibited clustering at smaller scales. This is largely consistent with telemetry data that showed movements of small numbers of walrus around Southampton Island, but that most locations were localized to areas in which walrus were initially tagged.

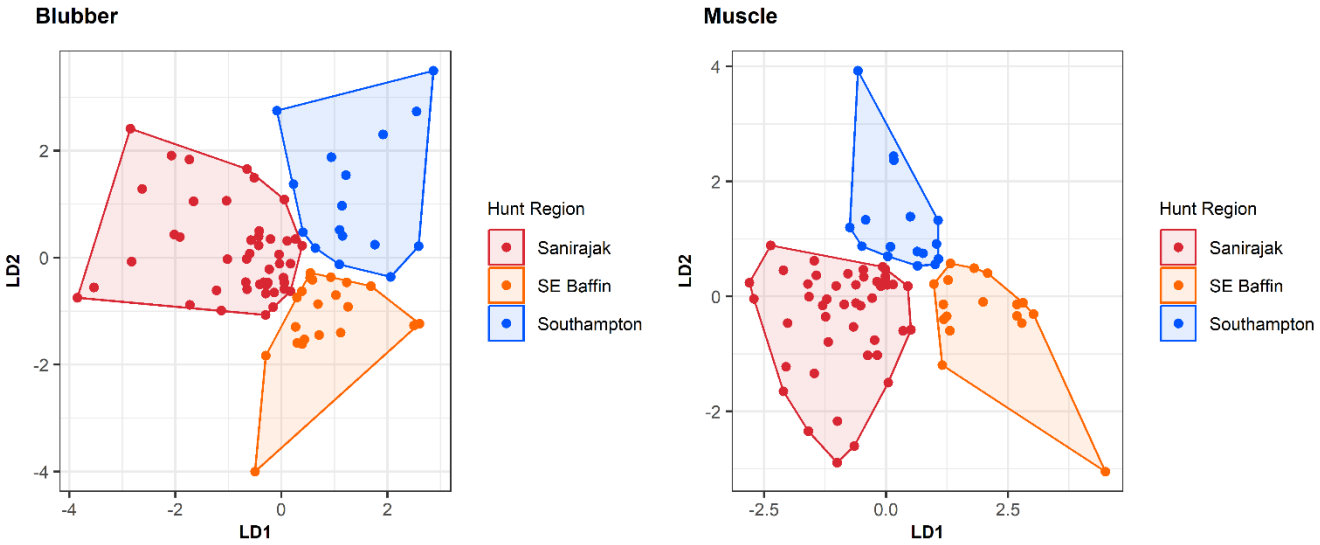


Figure 7: Tissue microchemistry (concentrations of 30 trace elements) revealed additional ecological substructure (distribution differences) not evident in the telemetry and genetics data. Linear Discriminant Analysis (LDA) shows walrus from Iqaluit ('SE Baffin') were the most distinct from other regions, suggesting they occupy a different distribution than the rest of the HB-DS stock ('Southampton'). This finding is relevant to walrus stock assessment, as walrus that migrate between southeast Baffin Island and Greenland may represent a sub-component of the HB-DS stock that should be managed separately.

Genetics and stock delineation. Genetics analysis has largely been delayed until we have collected an appropriate number of biopsy samples (accomplished this summer). Below we present completed analyses on an initial subset of samples.

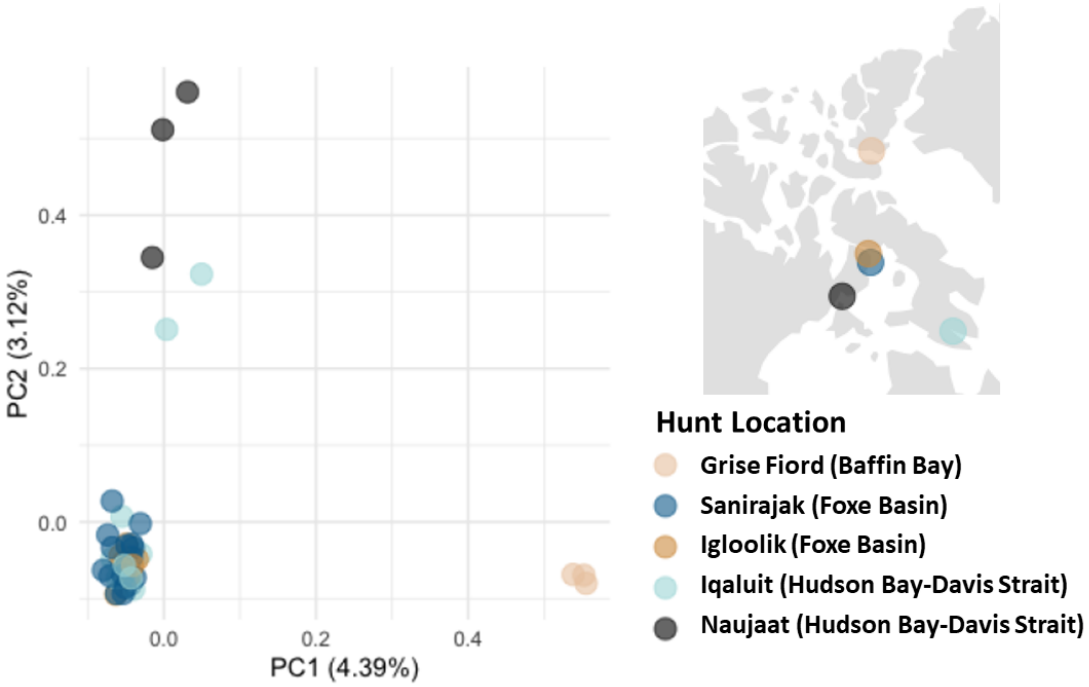


Figure 8: Analysis of whole-genome sequences largely corroborate telemetry findings, indicating two to three genetically distinct clusters largely (although not completely) divided along stock lines. Notably, walrus from northern Foxe Basin (Igloolik and Sanirajak) are genetically differentiated from walrus harvest in Naujaat, which are considered to belong to the Hudson Bay-Davis Strait (HB-DS) stock. Walrus from Grise Fiord, part of the High Arctic population, separate completely from the Central Arctic population as expected.

General Interim Conclusions. Although our telemetry, genetics, and microchemistry analysis all indicated genetic or ecological (i.e., distribution) differences that are consistent with current walrus management stock divisions, microchemistry analysis in particular revealed additional structuring within the Hudson Bay-Davis Strait (HB-DS) stock that could be relevant for walrus stock assessment. In particular, distinct trace element profiles of walruses harvested in Iqaluit and Sanirajak compared with other locations across the range of the HB-DS stock (Coral Harbour, Naujaat, and Pangnirtung) suggests Southeast Baffin represents a spatially segregated component independent of the rest of the stock. This is relevant because walrus migrate from Southeast Baffin to Greenland, where they are also hunted and may therefore be subjected to different removal pressures than the rest of the HB-DS stock, and may therefore require independent management.

9. Reporting to Communities/Resource Users:

Consultation	Date	Type	Status/Changes
Before Research	January to August 2024.	Emails, Phone calls. In-person meetings with Coral Harbour and Igloolik.	Completed.
During Research	August to October 2024.	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.	Ongoing – virtual visits tentatively scheduled for winter 2025.