Final Project Report to NWMB – November 2020

1. **NWRT Project Number:** 3-19-04

2. **Project Title:** Inferring walrus distribution and stock structure from 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:**
Current walrus (*Odobenus rosmarus rosmarus*) stock delineations in Canada have been challenged by recent 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 the northern vs. southeastern areas (e.g. the Hudson Bay-Davis Strait and Southeastern 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. Collection of additional samples will allow us to assess with more certainty the degree of similarity and differences among walruses within stocks and among stocks, which will help to determine whether current stock definitions are appropriate.

Our use of trace elements, particularly in tusks, is a novel scientific approach to address these questions. Unlike previous telemetry studies, which are limited in scope (i.e., providing a 'snapshot' of movements), long-term trace element profiles in tusks can allow for reconstructions of individual animal movements and distribution over many years. The long-term nature of these trace element datasets will therefore allow for determination of long-term variability in movements and distribution that will ultimately provide better data to inform stock structure. Previous research using lead isotope ratios in tooth cementum growth layers from a small sample of 12 walruses in Foxe Basin, showed isotope ratio profiles across the teeth of most of the walruses were constant, meaning that they were likely resident to Foxe Basin their whole lives. However, three of the 12 walruses showed isotopic patterns that implied movements between Foxe Basin and other regions. Our proposed research will greatly expand on this previous study by 1) increasing the sample size to include walruses from other neighboring regions/stocks; 2) measuring a suite (not just one) of trace element concentrations and isotope ratios, and 3) match regional variation in measurements of bivalves (clams) with variation in walrus tusks to understand the spatial context of their movements and distributions. Our study will therefore provide a

much greater degree of power with which to understand the types of movements that trace element variation in walrus tusk represents. Further, although we will also couple our study with trace elements and genetics analyses of skin, tusks grown throughout an individual's lifetime will allow for reconstruction of longer distribution and movement histories.

5. Project Objectives:

Our main scientific objective is to address uncertainties in the current stock definitions of walrus in Hudson Bay and Foxe Basin using trace element profiles in tusks to reconstruct long-term (i.e. lifetime) individual movements within and among areas with different baseline values. This 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 Northern collaborators with respect to walrus research. Specifically, we would like to engage Northern research participants in our field work and community-based sampling. We would like to hire and train local research assistants who could direct and carry-out future field work objectives on their own. Similarly, we would like to hire community-based monitoring coordinators in walrus-harvesting communities to organize sample collection. This proposal expands on a community-based walrus monitoring program implemented in Sanirajak/Hall Beach in 2018.

6. Materials and Methods:

*note this funding proposal and report is focused on year 1 of an anticipated 5-year study. Year 1 was focused primarily on collecting walrus tusks and bivalve samples. These components relied heavily on the participation of our Northern collaborators through hiring and training of research assistants and community-based monitoring co-ordinators. We worked closely local HTOs of four communities in Hudson Bay and Foxe Basin that are near known walrus haul-out sites (Sanikiluaq, Coral Harbour, Sanirajak/Hall Beach, and Igloolik). Walrus tusks were obtained from harvested animals using a community-based sample collection approach by purchasing samples directly from hunters or community co-ops. Bivalves were also collected from key areas (e.g. major haul-out sites near communities from which walruses are harvested) throughout the sampled walrus range.

Although sample collection for this project is still ongoing, all tusks collected in 2019-2020 have been sectioned longitudinally to expose the central core of dentine. We have also already started to drill dentine from annual growth layer groups (GLGs) using a micromill, which will allow for construction of long-term chronological histories of variation in trace element concentrations and isotope ratios over the lifetime of each individual walrus (years 3-5).

7. Results:

In 2019-2021, we were able to collect just over 60 tusks and 12 completed sample kits from Foxe Basin and Hudson Bay communities. We were also able to hire one community-based hunt coordinator who facilitated sample collections, and we plan to expand on that model to improve returns in future years.

We have proceeded with preparing the tusks for analysis, ahead of the scheduled year 2 of this project. We have developed an innovative way to section the tusks using a high powered water saw, as the tusks are too large to use conventional saws typically used to section teeth. All tusks collected in 2019-2020 have been sectioned, and sampling of individual GLGs for trace element analysis was initiated in January 2020. This work was suspended in March 2020 due to COVID-19 constraints on laboratory access.

While we do not anticipate scientific results (e.g. trace element concentrations or stable isotope ratios) for 2-3 more years, we are close to meeting expectations for the first year of this project (e.g. acquire a sufficient sample size of tusks and engage hunters and other community members in our research).

8. Discussion/Management Implications:

DFO Fisheries Protection Program and their co-management partners, including the Nunavut Wildlife Management Board (NWMB), can use baseline variation on walrus distribution and genetic relatedness with which to validate current delineation of stocks for hunt management. The long-term data derived from annual growth layers can also be used to reconstruct past movements and distribution with respect to a variety of natural and anthropogenic factors (e.g., comparison of trace elements in tusk growth during periods of low vs. high shipping, or contaminant exposure before and after a major mine development). Science advice resulting from this project will allow DFO Resource Management clients to refine boundaries of walrus stocks and management areas, contribute to the identification of Designatable Units for an upcoming SARA listing process, and address requests from the Policy sector for recommendations required in the Nunavut Land Use Plan, particularly with respect to impacts of shipping and other habitat disturbances.

Participation at working groups with countries like Greenland and Denmark allows Canada to provide updated science advice relevant to the management of harvested species within and outside Canadian waters (those shared between Nunavut and other jurisdictions). Walrus, although not yet subject to the same CITES regulations as narwhals, are under increasing international scrutiny due to the ivory trade, and understanding their stock structure will eventually be important for demonstrating sustainable harvesting in Canada.

9. Report by Inuit participants:

Inuit participants have not provided a written report. However, our project is heavily reliant on the engagement and participation of local communities that harvest walrus, and as such, there has been a strong focus on engaging Inuit from key communities on the importance of this research. We have had community meetings in Sanirajak/Hall Beach and Coral Harbour to promote our goals of building long-term science/research capacity in these communities. In 2019-20, we were able to hire a local coordinator in Sanirajak/Hall Beach to help organize samples from hunted walrus, and to pay over 30 hunters directly or indirectly for contributed samples.

10. Reporting to Communities/Resource Users:

Consultation	Date	Type	Status/Changes
Before Research	January-June 2019	Email and phone communication with the HTO/As of Sanikiluaq, Coral Harbour, Sanirajak/Hall Beach, and Igloolik proposing project and requesting support. In-person meeting Iqaluit (May 2019). Walrus Working Group Meeting with representatives from several different communities and Inuit organisations. Went over research plans for walrus tusks and plans to develop true community-based science capacity.	Completed
During Research	August-September 2019	Email and phone communication to provide and receive updates on progress.	Completed
Completion of Research	November 2019 - February 2020	In-person meeting Sanirajak/Hall Beach (November 2019) In-person meeting Coral Harbour (February 2020)	Completed (all communities updated via email and phone; in-person visits delayed due to COVID-19 are pending).