EMRWB RESEARCH FUND 2022-2023 REPORT:
INVESTIGATING POLAR BEAR ECOLOGY IN THE EEYOU MARINE REGION

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PROJECT SUMMARY

In community consultations, polar bears were identified as a high research priority following observed changes in abundance and habitat use along the coast. Polar bears are important predators in arctic and subarctic systems and their behaviour and distribution on the landscape can have large impacts on plant, animal, and human communities. Globally, polar bears are threatened by rapidly changing environmental conditions that reduce sea ice habitat which is critical to polar bear movement and foraging.

At the southern edge of global polar bear range, the polar bears in James Bay and the Eeyou Marine Region (EMR) are particularly vulnerable to warming conditions but little information is available about their population. Past studies summarizing trends in polar bear subpopulations worldwide suggest that these bears may be genetically distinct from the Southern Hudson Bay (SH) management unit they are currently included in, but additional information is needed to draw conclusions. At the southern edge of global polar bear range, the James Bay bears have access to potential boreal prey items that are unavailable to populations farther north, and the importance of these species in James Bay polar bear diet is unknown. Understanding the possible genetic distinctions of James Bay bears from SH bears, as well as their distribution, diet, and body condition in the EMR is a key component to future conservation and management decisions.

To collect baseline information on the polar bears in the EMR, we launched a field-based polar bear research program in 2021 with the communities of Waskaganish, Eastmain, Wemindji and Chisasibi. We used non-invasive hair snare and camera trap sampling methods to gather information about polar bear genetics, diet, body condition and distribution. In 2021, Alexandra Langwieder and 4 Cree community field teams deployed 37 sampling stations across 400km of eastern James Bay to collect 117 hair samples and 138 polar bear observations. In 2022, we continued this work by deploying 40 stations across the same area to collect an additional 215 hair samples and hundreds of observations. While in the field, teams surveyed for polar bears and polar bear dens and identified an additional area of polar bear denning activity on South Twin Island. The information collected will contribute to polar bear management and wildlife monitoring in the EMR and will answer community and academic questions about polar bear ecology in James Bay.

| OBJECTIVES	PROGRESS & ACHIEVEMENTS
Continue gathering polar bear hair samples and photos from offshore, nearshore and mainland habitats in eastern James Bay	■ Deployed 40 sampling stations across 400km of eastern James Bay with 4 community field teams ■ Collected 215 polar bear hair samples and >200 polar bear observations
Develop strategy for efficiently processing large amounts of camera trap data	■ Hired a Cree undergraduate student to enter camera trap data with Camelot software. The student is developing a complementary independent project based on this data to investigate other species distribution in the EMR
Secure flexible and cost effective housing in the EMR during the field season	■ Purchased camping trailer to provide mobile housing while moving between communities which reduced housing costs and increased scheduling flexibility
Match polar bears identified in the EMR with previously handled bears in the Southern Hudson Bay management unit	■ Accessed genetic database from the Ontario Ministry of Natural Resources and did not find any matches between bears identified in the EMR and previously handled bears ■ Contacted biologists leading the Western Hudson Bay management team to investigate matches from Western Hudson Bay
Develop plan for stable isotope analyses to determine polar bear diet in the EMR	■ Completed intensive course focused on the use of stable isotopes to answer ecological questions ■ Worked closely with leading experts in the field to determine appropriate lab analyses

STEEL POSTS
BARBED WIRE 10m x 10m x 10m
2m
4ft
CAMERA TRAP
3ft
2ft
SCENTED BAIT
HAIR SAMPLE
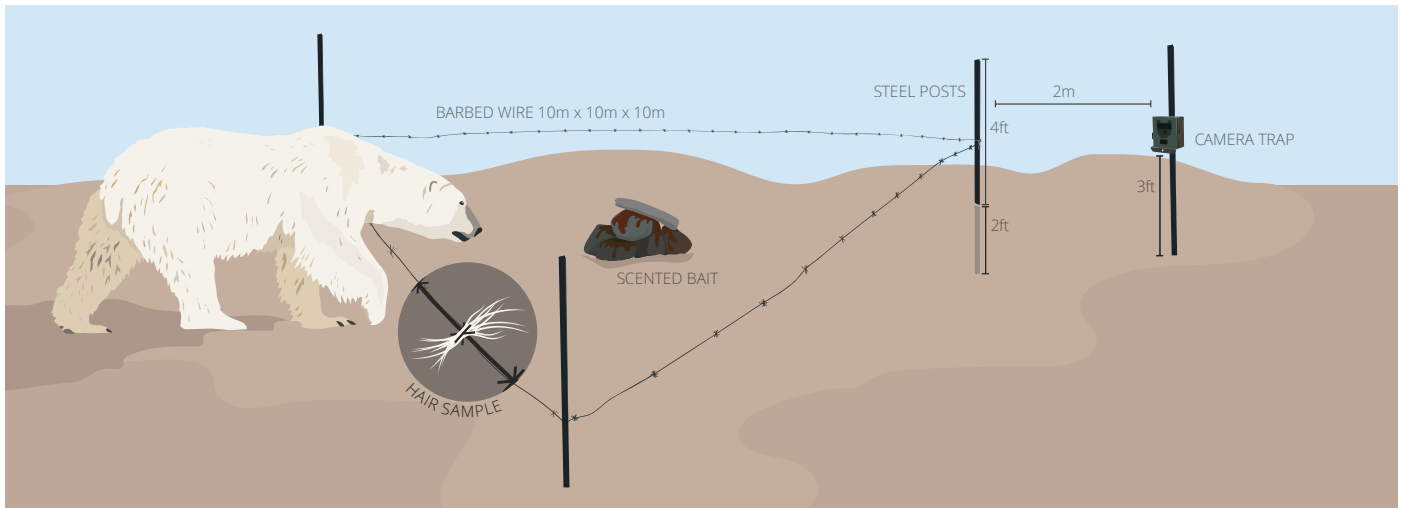
MATERIALS & METHODS

We used hair snare and camera trap sampling stations deployed on offshore islands, nearshore islands, and some mainland habitat. These methods collect hair samples and photographs which provide information on polar bear genetics, diet, body condition and habitat use. Sampling station locations were determined through consultation with tallymen to avoid proximity to areas of human occupation. We deployed 40 sampling stations for 6 weeks in July and August, 2022.

HAIR SNARES

Hair snares gather hair samples from polar bears as they pass over a barbed wire to investigate a scented bait. The bait does not provide food to the bears. Later, field teams return to collect the hair. We used 6-foot steel t-posts pounded 2 feet into the ground in the shape of a triangle. Hair samples provide information on genetics which allows us to track individual bears across the study area within and between years, understand the relatedness between individuals, and compare the bears in James Bay to bears sampled in Hudson Bay.
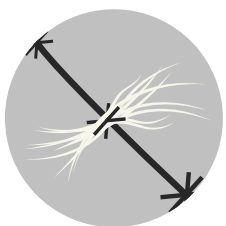
The hair samples also provide information on polar bear diet through stable isotopes which indicate what prey an individual has been feeding on and where the food items came from.
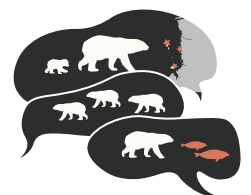
CAMERA TRAPS

Camera traps are frequently used in wildlife research to document animal presence. In this study, photos were used to detect polar bear presence at the hair snares and assess their body condition. Body condition is an important indicator of polar bear health and future survival, particularly in the summer season when they experience extreme fasting as they wait for the sea ice to freeze. To evaluate polar bear body condition, we used a standardized polar bear Fatness Index developed by Stirling et al. (2008) which scores bears from skinny to very fat. Cameras also captured information about wolves, black bears, foxes, waterfowl, other bird species, and caribou herds on different islands.

CREE KNOWLEDGE INTERVIEWS

With support from the Regional CTA, Cree Knowledge interviews for this project will be scheduled in 2023. Interview questions are prepared, lists of potential interview participants have been gathered, and new workshop ideas are being planned to effectively document Cree Knowledge of polar bears in a way that can be used by the EMRWB in future reporting.

COMMUNITY FIELD TEAMS

Cree community teams are essential to the success of this project. Teams deployed hair snares, programmed camera traps, as well as collected hair samples and maintained sampling stations throughout the sampling period.

Alexandra Langwieder and Catherine Geoffroy (research professional) travelled to each community to deploy the first stations and collect the first samples with each team, but teams deployed subsequent stations and collected samples independently as the field season progressed. Alexandra and Catherine moved between communities during the season where needed.

Most team members from 2021 returned to the project for 2022 which facilitated local leadership. Harry Erless, Dinah Hester, and Bernard Diamond led work in Waskaganish, Wilfrid Cheezo led work in Eastmain, Henry Stewart, Ernie Hughboy and Cody Mark led work in Wemindji, and Elmer and Steven Bobbish led work in Chisasibi. Additional team members were hired in each community as needed. CTA-EMR Local Officers coordinated teams and field logistics in each community. Field teams were compensated according to rates set by the CTA and most team members completed between 10 and 16 days of work on the project.

SAMPLING STATION LOCATIONS 2022

🟠 Sampling station deployed from Chisasibi

🟡 Sampling station deployed from Wemindji

🟢 Sampling station deployed from Eastmain

🔴 Sampling station deployed from Waskaganish

0   50   100km
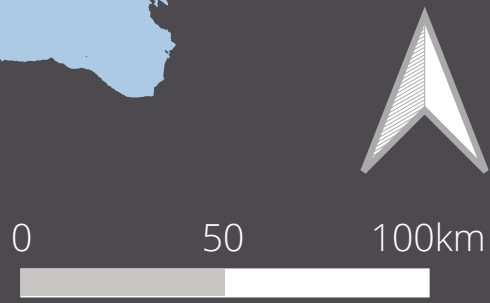
2022 RESULTS
POLAR BEAR GENETICS

In 2022 we received the genetic results from the 2021 samples. To genotype the polar bears sampled in 2021, we used a standard panel of 24 microsatellites at the University of Alberta Molecular Biology Facility to ensure comparability between previously handled bears in other subpopulations. We identified 35 individuals from the 2021 samples, 17 males and 18 females, with little observed movements between stations.

We were unable to obtain genotypes from approximately 50% of samples. This was likely related to samples being exposed to the elements on the barbed wire between sample collections combined with small quantities of hair in each sample. We modified the sampling station design in 2022 to increase polar bear contact with the wire as well as station strength to withstand the increased contact. This resulted in more and larger hair samples which we expect will lead to improved genotyping success.

In 2022 we received access to the Southern Hudson Bay subpopulation database from Ontario Ministry of Natural Resources and Forestry to match bears identified in the EMR with previously captured bears in Southern Hudson Bay. We did not find any matches to the Ontario database and will next be looking for matches in the Western Hudson Bay subpopulation database.

Lab analyses of the 2022 samples are currently delayed but are estimated to be finished in late summer 2023 at the University of Alberta.

2022 SAMPLING STATION MODIFICATIONS

In 2022 we modified the sampling station design to increase the size and quantity of hair samples and improve genotyping success. Modifications successfully increased the number of samples collected from 117 in 2021 to 215 in 2022. Modifications also increased the amount of hair in each sample, from 10 to 12 hairs on average, as well as the percentage of follicles containing genetic material in each sample, from 30% in 2021 to 50% in 2022. Upcoming lab results will reveal if these changes impacted genotyping success.

Raised barbed wire to increase polar bear contact with wire. Bears would then go both over and under wire, leading to larger hair samples.

Added guy lines attached to buried sand bags to provide counter tension to accommodate additional force on wire.

Added height marker at 1 meter on each post to measure bear size in photos.

Attached barbed wire and camera trap with heavy duty zip ties to prevent bears from disturbing the station.

Increased bait volume to 1 litre and poured bait on both driftwood and rocks to increase the longevity between sample collections. Alternated bait type between bacon and fish scent to maintain bears interest throughout the sampling period and increase the amount of recaptures.

GENETIC DIFFERENTIATION OF EMR POLAR BEARS

Preliminary analyses of genetic data from this project and previously handled polar bears from the Southern Hudson Bay subpopulation revealed little differentiation between polar bears identified in James Bay, as a whole, and polar bears identified in Hudson Bay, as a whole. However, we did find potential differentiation when individuals were assigned a more specific region (the EMR region of James Bay, the Ontario James Bay coast, or the Ontario Hudson Bay coast) in a Discriminate Analysis of Principle Components, a method that identifies and describes clusters of individuals based on genetic similarity. Additional work is needed to form conclusions and this will be the focus of summer and fall 2023.

Ontario James Bay (n=202)

Ontario Hudson Bay (n= 636)

EMR James Bay (n=64)
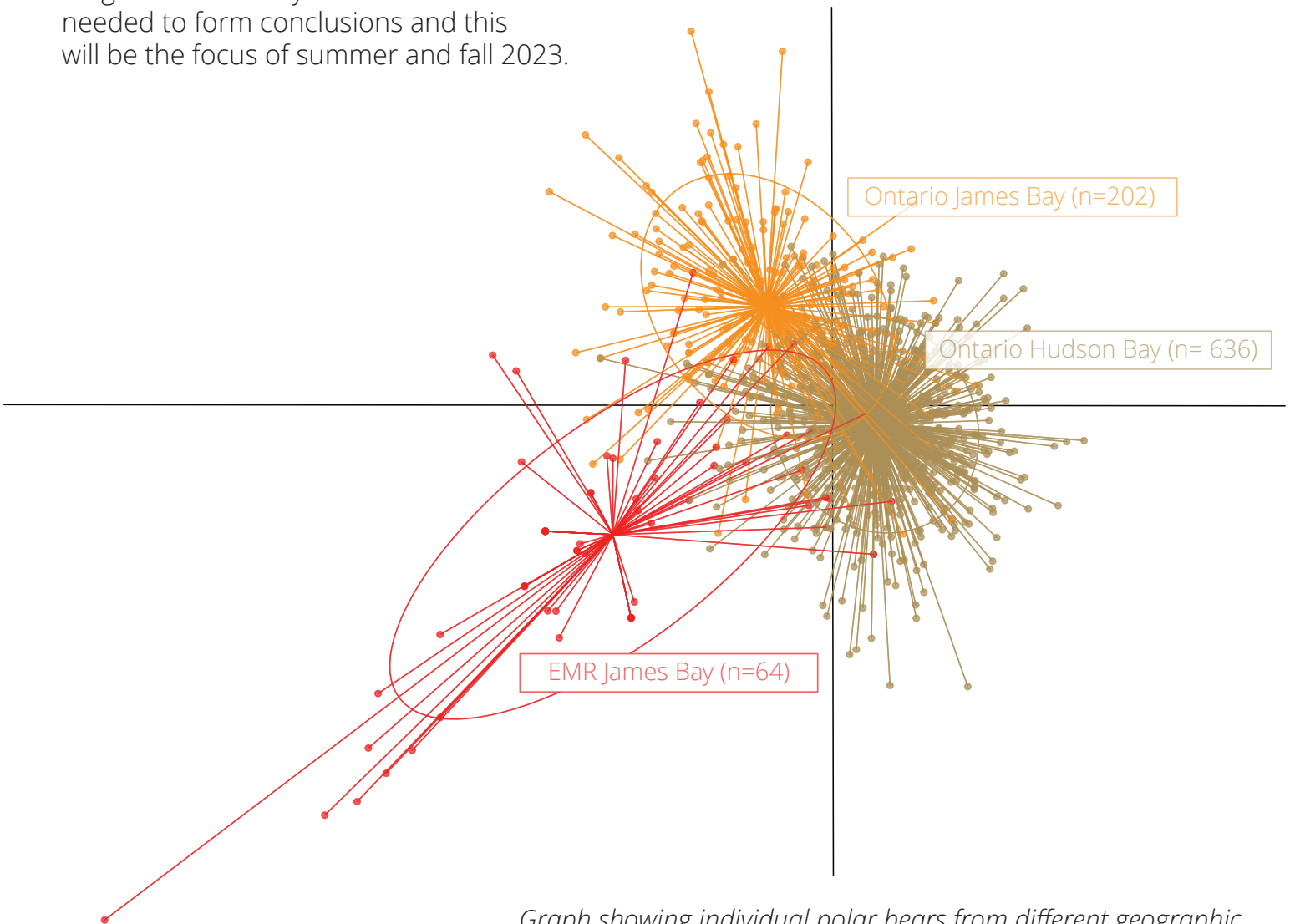
Graph showing individual polar bears from different geographic regions (the EMR of James Bay, Ontario James Bay, and Ontario Hudson Bay) grouped based on genetic similarity using a Discriminate Analysis of Principle Components. Points that are closer together are more genetically similar.
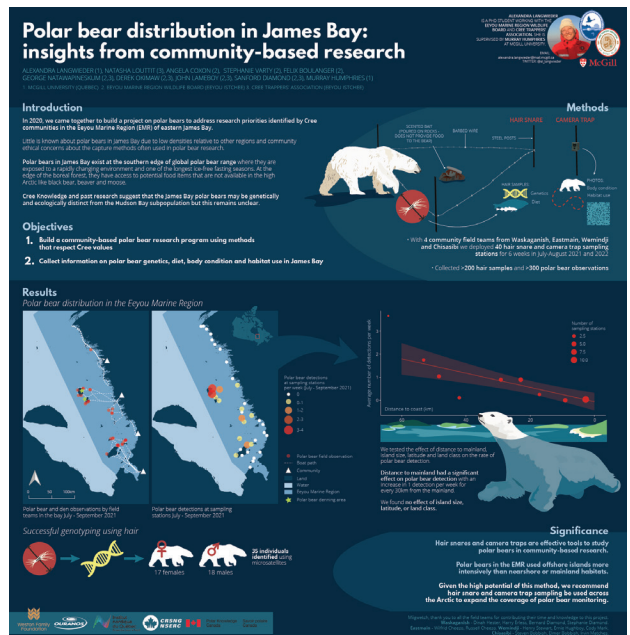
COMMUNICATION

In 2022 the polar bear distribution and body condition results of the project were presented through infographics, oral presentations, posters, and scientific publications.

- EMRWB website infographic, *audience: general public*

- ArcticNet Annual Meeting oral presentation by George Natawapineskum and Alexandra Langwieder, *audience: community leaders and researchers from across the Arctic*

- ArcticNet Annual Meeting poster presentation by George Natawapineskum and Alexandra Langwieder, *audience: community leaders and researchers from across the Arctic, the team was awarded first prize in the marine science category*

- British Ecological Society Annual Meeting poster presentation by Alexandra Langwieder, *audience: international researchers*

- Polar Bear Technical Committee oral presentation by Alexandra Langwieder, *audience: polar bear researchers and managers (from both northern communities and government) across Canada*

- Environment and Climate Change Canada and Canadian Wildlife Service Polar Bear Research Group oral presentation by Alexandra Langwieder, *audience: polar bear scientists at the federal government*

- Scientific publication in the journal FACETS, accepted with publication date expected in summer 2023, *audience: researchers, general public (open access article)*
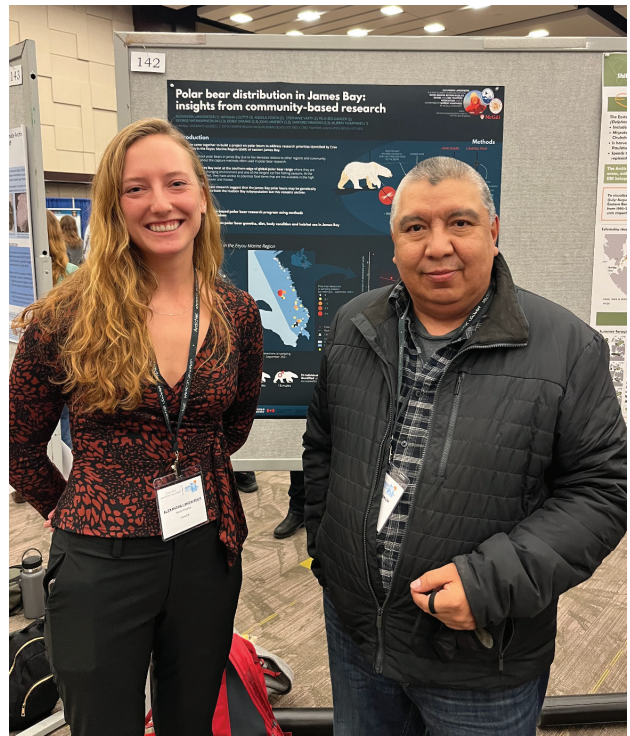
Through these presentations, the project has received highly positive feedback from local, regional, and national polar bear management organizations and opportunities have arisen for additional funding from Polar Bears International that would support further work in 2023 and 2024. Presentations of the results to date for the Regional Cree Trappers' Association, local Cree Trappers' Associations, and each community Chief and Council are being scheduled in 2023.

FACETS

Community-led non-invasive polar bear monitoring in the Eeyou Marine Region of James Bay, Canada: insights on distribution and body condition during the ice-free season

Alexandra Langwieder [a], **Angela Coxon**[b], **Natasha Louttit**[c], **Stephanie Varty**[b], **Felix Boulanger**[b], **Sanford Diamond**[b,c], **John Lameboy**[b,c], **Anderson Jolly**[d], **George Natawapineskum**[b,c], **Derek Okimaw**[b,c], and **Murray M. Humphries**[a]

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Abstract

Wildlife conservation is informed by detailed understanding of species demographics, habitat use, and interactions with environmental drivers. Challenges to collecting this information, particularly in remote places and on widely ranging species, can contribute to data deficiencies that detract from conservation status assessment and the effectiveness of management actions. Polar bears in James Bay face rapidly changing environmental conditions at the southern edge of their global range, but studying their ecology has been limited by community concerns about the methods typically used in polar bear research. Using a community-led and non-invasive approach, we deployed hair snare and camera trap sampling stations across 400 km of the Eeyou Marine Region in eastern James Bay. Stations collected >100 hair samples and thousands of photographs in one eight-week period that allowed for a novel investigation of this population's distribution and body condition during the ice-free season. Polar bears were in average to above average body condition, and model selection of detections at stations revealed distance to mainland as a significant predictor of polar bear presence. Given its high potential, we suggest community-based monitoring using this method become a standard protocol to expand the scope and local leadership of polar bear research across the North.

Key words: Indigenous-led research, non-invasive monitoring, polar bear, Eeyou Marine Region, hair snares, camera traps

POSITIONALITY AND CONTRIBUTION STATEMENT FROM THE ARTICLE

Positionality and contributions

In this statement, we present the background, expertise, and contributions of the author team to share the context of this paper and its authorship with the reader. Our team consists of Indigenous and non-Indigenous wildlife scientists and land stewards who have come together to better understand polar bear ecology in the EMR of eastern James Bay. Four authors are Local Officers with the Eeyou Marine Region Department of the Cree Trappers' Association (CTA-EMR), all of whom self-identify as Cree and Indigenous, and provide local support for wildlife data collection and monitoring in the four coastal Cree communities in eastern James Bay (Waskaganish: Sanford Diamond [SD], Eastmain: Derek Okimaw [DO], Wemindji: George Natawapineskum [GN], and Chisasibi: John Lameboy [JL]). Three authors (Angela Coxon [AC] the EMRWB Director, Stephanie Varty [SV], and Felix Boulanger [FB]) are wildlife biologists at the EMRWB, the Cree wildlife management organization in the EMR, an Institute of Public Government created under the *Eeyou Marine Region Land Claims Agreement* that is responsible for making wildlife management decisions, identifying research priorities, and supporting wildlife research in the EMR. Natasha Louttit [NL], who self-identifies as Cree and Indigenous, is the CTA-EMR Wildlife Liaison Officer and is responsible for the coordination of wildlife research and monitoring activities between the EMRWB and CTA-EMR Local Officers. Anderson Jolly [AJ] is the Cree tallyman responsible for land stewardship and wildlife monitoring on Charlton Island and has been observing polar bears in the region for the last six decades. Two authors are academic scholars: Murray Humphries [MH] is a professor and wildlife biologist with experience supporting collaborative research with communities in northern Canada and Alexandra Langwieder [AL] is a graduate student who has been building the project with this team in the EMR since June 2020.

All authors contributed knowledge, expertise, and effort that allowed this work to be possible. Local Cree Knowledge of the eastern James Bay system (AJ, SD, GN, JL, DO, NL), knowledge of polar bear ecology and conservation (all), and knowledge of non-invasive wildlife sampling methods (AL, MH) facilitated the launch of this research program and the work presented here. All authors contributed substantially to the study design and reviewing the manuscript. AL, GN, JL, DO, AJ, SD, FB and SV collected data in the field and coordinated fieldwork activities in each community. AL and MH led data analysis and manuscript writing, while AC, SV, and FB provided edits and confirmation of support for the research on behalf of the EMRWB. Securing project funding was led by MH, AL, and AC.

EXPANDING TO WHAPMAGOOSTUI AND KUUJJUARAPIK

Following the Polar Bear Technical Committee Meeting in January 2023, the Nunavik Marine Region Wildlife Board (NMRWB) expressed interest in expanding the project to Inuit communities in Nunavik. This would allow communities in the Cree-Inuit overlap zones to gather local data on polar bears which can contribute to this project as well as ongoing government monitoring efforts and regional wildlife management decision making. Data from hair sampled in the Cree-Inuit overlap zones would contribute to our understanding of polar bear movement, distribution and foraging ecology throughout the EMR.

Through meetings with NMRWB and EMRWB staff in February, it was determined that the first step to expansion is hosting a workshop in Whapmagoostui and Kuujjuarapik to share knowledge about the hair snare and camera trap methods between community members from the James Bay field teams and potential teams in Whapmagoostui and Kuujjuarapik. Depending on interest following the workshop, a field season could be launched in 2024.

CTA-EMR Local Officer, Robert Fireman, will be helping coordinate these activities in Whapmagoostui and partners from Makivvik and the NMRWB will assist in Kuujjuarapik. Funding has been secured from both the NMRWB and EMRWB to host the workshop.
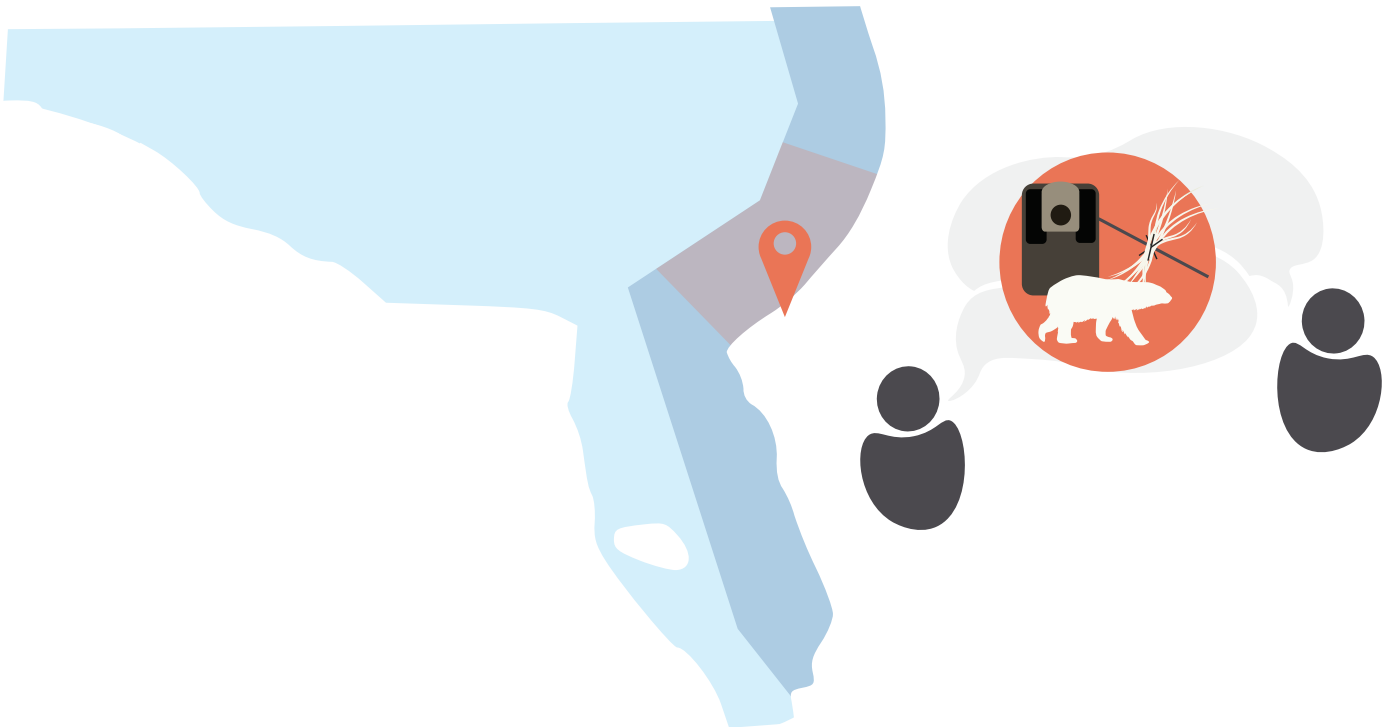
CONCLUSIONS AND NEXT STEPS

We found that the sampling station design presented here is an effective method to collect both hair samples and photographs of polar bears in the EMR and is an appropriate tool for use in community-based polar bear monitoring. Modifications to the sampling stations resulted in larger hair samples, more hair follicles in each sample, which contain genetic material needed to identify individuals, and increased station strength.

Preliminary genetic analyses using the 2021 data suggest that polar bears in the EMR of James Bay may be genetically different from bears on the Ontario James Bay and Hudson Bay coasts but further work is needed to form conclusions.

Communication of this work through conferences and presentations has led to additional funding opportunities from Polar Bears International. Given the success of the teams in James Bay, the Nunavik Marine Region Wildlife Board has expressed interest in expanding the project into the Cree-Inuit overlap zones of eastern Hudson Bay and training additional community members in the field sampling methods. This would allow us to track bears that potentially move along the coast between regions.

The next steps in this work are to complete a third field season in summer 2023 with returning community field teams. In fall 2023 and winter 2024, we will complete Cree Knowledge interviews, further investigate the potential genetic differentiation from other regions, assess polar bear abundance using data between sampling years, and begin stable isotope diet analyses.