FINAL PROJECT AND FINANCIAL REPORT

TO THE NUNAVUT WILDLIFE MANAGEMENT BOARD

1. Project: NWRT-0000000026

2. Project Title:

Estimating abundance of the Lancaster Sound polar bear subpopulation

3. Project Leader:

Previously: Dr. Jasmine Ware (Polar Bear Biologist, Department of Environment, Government of Nunavut)

Current: Amélie Roberto-Charron (High Arctic Biologist, Department of Environment, Government of Nunavut)

4. Summary:

The Lancaster Sound (LS) polar bear subpopulation is one of Nunavut's largest polar bear subpopulations – it spans a geographical area of about 470 000 km^2 (with about approximately 250 000 km^2 of sea-ice) and is home to an estimated 2541 ± 391(mean ± 1 SE) polar bears. There are no recent data for LS; the last population estimated was derived from data collected ending in 1997. Environmental changes and a male-biased harvest due to sport hunts creates further need to evaluate this subpopulation. To fulfill mandated wildlife monitoring objectives, provide management advice to the Nunavut Wildlife Management Board, and address community-identified research priorities, we continued the study initiated in 2021 by using independent double observer and distance sampling via aerial survey to estimate the size of the LS polar bear subpopulation. Following consultations with affected communities in October 2022, the project was scheduled to continue March 2023 as a hybrid aerial abundance survey and biopsy darting program. The project took place from March 7th to March 29th, 2023, and was based in the communities of Arctic Bay, Grise Fiord and Resolute Bay. As aerial surveys provide less information about the status of a population, statistical mark recovery models were used in combination to investigate Lancaster Sound bear survival and potentially bear movement among the surrounding subpopulations as all surrounding subpopulations have had full capture-mark recapture studies completed within the last decade with complete harvest reporting. A total of 38 bears were biopsy darted as part of the project.

5. Project Objectives:

The purpose of this study is to evaluate the status of the LS polar bear subpopulation. The results of this study will influence the management objectives in consultation with the affected communities.

The objectives of the proposed continuation of the LS study are to:

1) Work with community HTOs, either virtually or physically, to design and implement a comprehensive survey that prioritizes human safety while achieving research goals. Given the large amount of data collected over the last decade through genetic mark-recapture in surrounding subpopulations, these goals can be best achieved in LS using aerial survey in combination with biopsy darting.

2) Estimate the current population size and composition of the LS polar bear subpopulation.

3) Estimate survival and reproductive parameters (to the extent possible) in-order to facilitate population viability analyses through a meta analysis of LS data and surrounding subpopulation data.

4) Evaluate on-ice polar bear distribution.

5) Enhance public participation and provide HTO-designated personnel with training in survey methods.

6. Materials and Methods:

The last LS population study (Taylor et al. 2008a) was conducted during the spring time using capture mark-recapture methods. During the 1990s, the research team had relatively safe access to available bears on the sea-ice platform and this study was initiated as using genetic capture-mark-recapture (project #02-14-21) because it provides the most robust data while respecting Inuit perspectives on wildlife handling and would allow comparison to the last population study conducted in the area. However, following the tragedy in 2021 field season, re-evaluation of the study methods occurred.

According to local Indigenous knowledge, personal experience, and knowledge of logistics coordinators (Polar Continental Shelf Program, PCSP) in the area, weather patterns have changed with climate change creating more volatility in the weather during the time when the previous surveys were done. Thus, the continuation of this study shifted survey dates into early-to-mid March, when the weather is colder and more stable and used a distance sampling aerial survey method which allows enhanced safety for researchers while still meeting the objectives of the study see Section 4.4). To cover such a large study area, and given the vagaries of spring weather, four aircrafts were used, with each team beginning operations in different areas within the study area. Field crews were based in Resolute, Grise Fiord, and Arctic Bay.

Distance sampling via aerial survey has been used to estimate abundance in several polar bear subpopulations (Aars et al., 2017, Evans et al., 2003; Obbard et al., 2015, Stapleton et al, 2015; 2016; Wiig and Derocher, 1999) and planning is underway for similarly challenging topographical and remote areas as LS (East Greenland, K. Laidre pers. com.). Distance sampling does not involve any handling of animals and thus aligns with Inuit values regarding polar bear handling. In general, transect lines are digitally laid over the survey region and observers move along the transects, recording

animal observations and their distance from the transect line. The further the animal is away from the line, the less likelihood that it will be observed and animals directly on the line are expected to be observed 100% of the time. This observation decay over distance can be mathematically modeled as a detection function. That empirically derived function is then scaled to estimate abundance (N) within the survey area, while allowing for imperfect detection.

Given that bears are dispersed over a large area at lower densities during the spring sea-ice season, our field season ran from March 7, 2023, to March 29, 2023, to cover the entire area. Briefly, we included 10 strata based on IQ of bear densities and habitat usage in different habitats/areas during the spring. These strata were categorized by expected densities and were reviewed and adjusted by the affected HTOs during consultation. This allows maximization of bear encounters while efficiently allocating resources (survey effort). The western portion of LS is very low density bears in the spring and is comprised of mostly multi-year ice. Land areas identified by IQ as areas of use or migration of bears represent another strata type. Transect spacing varied among the strata from 9 km to 25 km. This spacing is similar to how the surrounding subpopulations were surveyed using genetic mark recapture to ensure repeatability and standardized coverage. Further, transect placement was principally on sea-ice, with periodic inland transects. Areas were designated to be flown by helicopter or fixed-wing principally based on topography, and were adjusted based on input from affected HTOs.

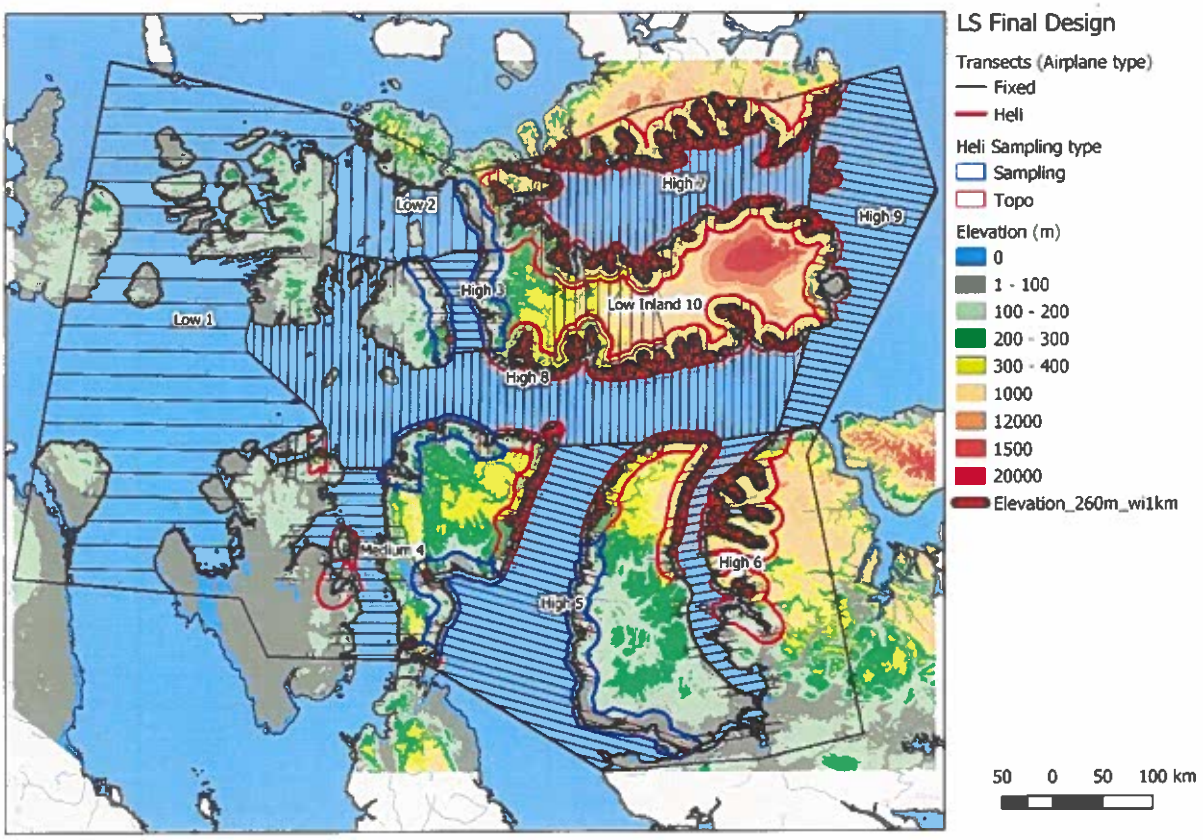

Figure 1: Lancaster Sound polar bear abundance survey design with helicopter and fixed wing transects areas denoted with topography.

Four aircraft were used for this survey effort, one twin-engine high endurance rotary wing aircraft designated for high relief, mountainous coastlines, and fiords (mainly in the eastern portion of the study area) and key areas identified by affected communities, and four twin engine high wing configuration fixed wing aircraft, for the sea ice. All aircraft were equipped with radar altimeters and will flew at an altitude of 122 meters and at an airspeed of 70 to 90 knots. depending on wind and terrain. Polar bear locations and flight paths were recorded and navigated using GPS and perpendicular distances from transects measured using distance bins laid out on wing struts (fixed wing) or actual waypoints of the observation collected by flying of transect directly to the observation (rotary wing).

Independent double observer was used in addition to distance sampling, which extends traditional distance sampling methods by accounting for the fact that the two observers may not detect all of the animals in the study area due to observer error, animal behavior, visibility issues, or other factors. During the survey, observers were unable to communicate or receive visual cues from the other observer on the same side. Following the survey, the observations were reconciled to confirm whether an observation was seen by one or both observers.

The analysis is proposed to commence in July, and during the analysis an individual probability of detection will be determined and used to adjust for any differences in detection probability between the two observers.

We will estimate demographic parameters (sex and age-class) to the extent possible, visually score body condition (Stirling et al. 2008), and gather co-variates for each observation including, observer name and position, speed, altitude, elevation, cloud cover, visibility, terrain type, time of day, and vegetation type.

Analysis of data is expected to occur using program Distance in the R statistical software environment based on distance sampling principles described by Buckland et al. (2015). The presence of multiple observers (mark-recapture distance sampling) will allow robustness to the assumption that detections on each transect line are perfect while inclusion of covariates in the detection function (MCDS) incorporate the understanding that factors may affect the probability of detection (Marques and Buckland, 2003). Analysis of aerial survey data will provide an estimate of abundance. Further analyses utilizing the decade of robust harvest and mark-recapture data of individuals in surrounding, or nearby, subpopulations of Baffin Bay, Kane Basin, Davis Strait, Gulf of Boothia, M'Clintock Channel, and Viscount Melville will use mark-recovery models to inform survival rates and provide some insight into movement among the central Arctic subpopulations.

Following the analysis, a report will be drafted, and the results shared with co-management partners and affected communities.

7. Project Schedule:

Output or Setup	Start Date	End Date
Logistical preparations (e.g., fuel caching, preparing, and ordering necessary equipment)	March 2020	March 2023
Ordering fuel	Spring 2020	Spring 2022
Fuel cleanup	Spring 2023	Summer 2023
Aerial survey planning	October 2022	April 2023
Consultations	Spring 2020	On-going
Harvest sampling	1990s	Spring 2023
Analysis of tissue samples	Summer 2022, 2023	Spring 2023, 2024
Analysis of survey data	Summer 2023	Fall 2024
Analysis of harvest recovery data	Fall 2023	Winter 2025
Report writing	Summer 2023	Winter 2024

Section 8.0

8. Preliminary results/discussion:

Over 46,000 km were covered by the three fixed-wing aircraft, and over 16,000 km by helicopter.

Below are figures that demonstrate the survey coverage in comparison to the planned transects, all observations made during the course of the survey (including on and off transect observations) and the locations of biopsy samples.

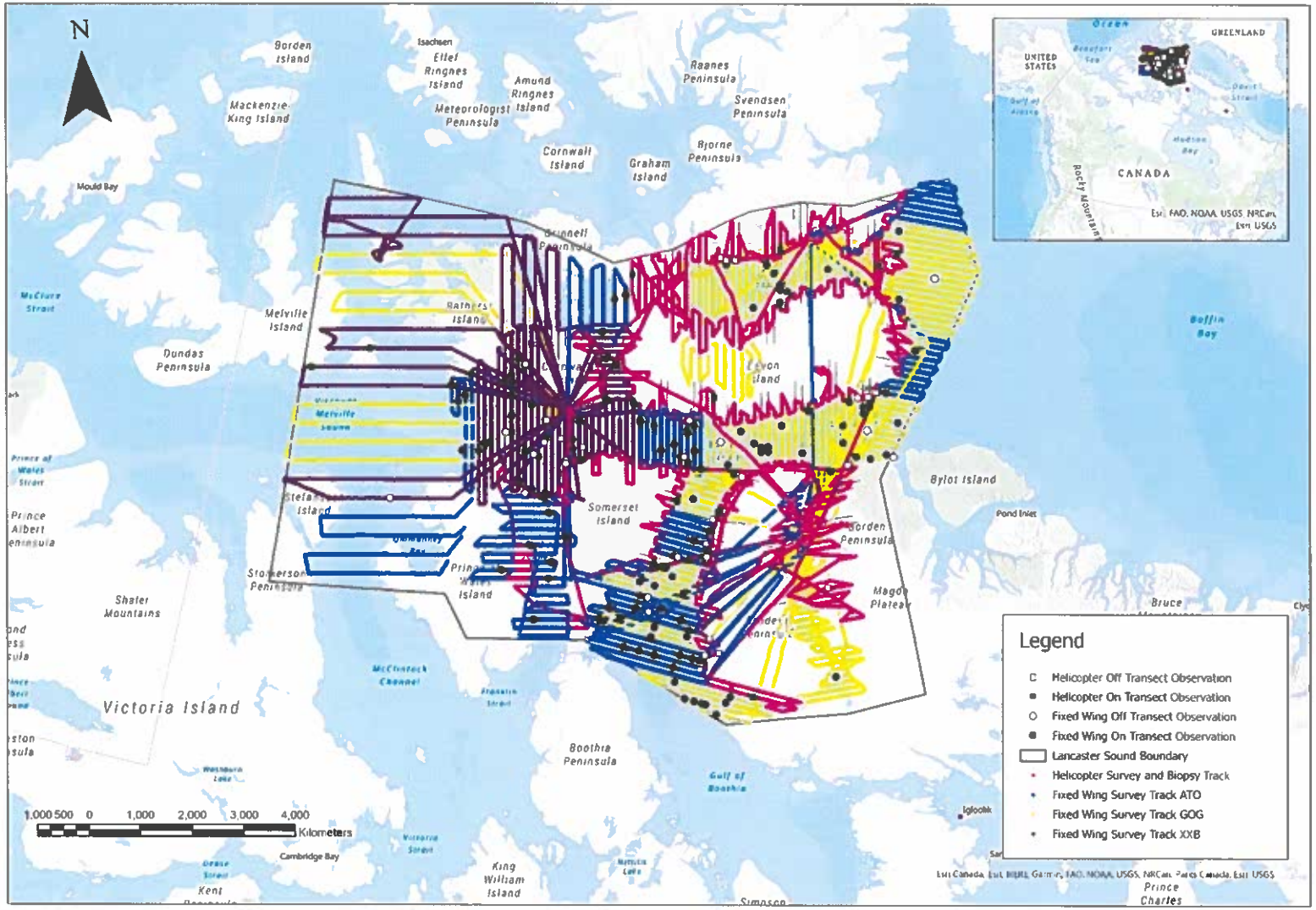

Figure 2- Map demonstrating the survey coverage of the aircraft during the Lancaster Sound polar bear abundance survey and all observations of polar bear groups both on and off transect.

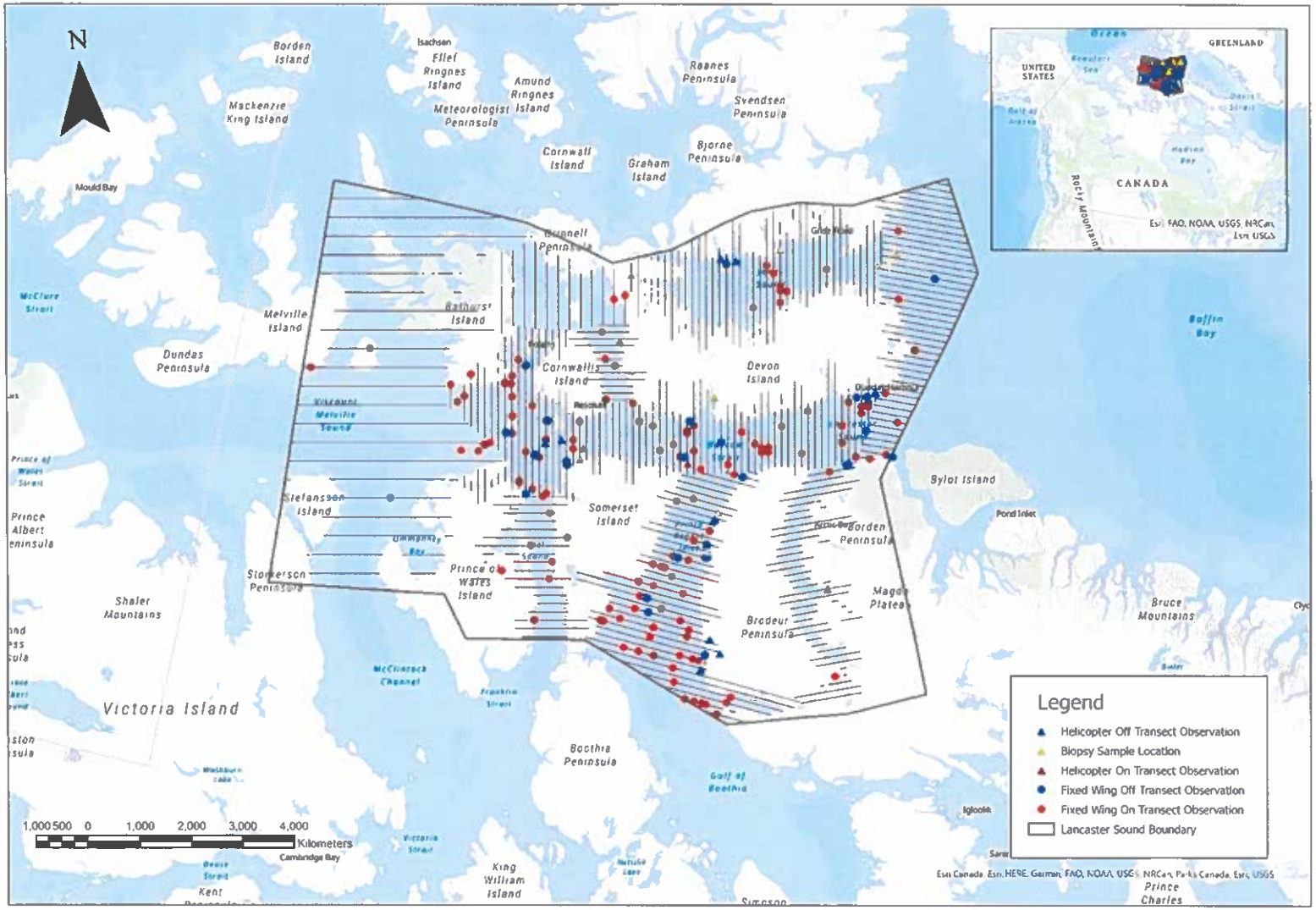

Figure 3- Map demonstrating the observations and locations of biopsy samples collected during the Lancaster Sound polar bear abundance survey and the transects flown.

9. Reporting to the Communities/Resource Users:

Consultations with the affected communities of Grise Fiord, Resolute Bay and Arctic Bay took place in October 2022. During these consultations, communities were invited to provide feedback on the study design and the project. Feedback on survey areas were incorporated into the survey planning.

All affected communities (Grise Fiord Resolute Bay, and Arctic Bay) provided letters of support for the project.

Additionally, on December 2022, the project was presented to the Qikiqtaaluk Wildlife Board at their Annual General Meeting.

During the aerial abundance survey updates were provided by email to co-management partners (NTI and QWB) and affected communities through the Grise Fiord, Resolute Bay and Arctic Bay HTOs.

10. Original Project Budget:

	Expenditure Classes:	Item:	Additional details (specific use, number of units if applicable, cost per unit, etc.)	NWRT funding used:	Other sources of funding used (*cash):	Other sources of funding used (in-kind):	Total funding (excluding in-kind)
	contracted services	survey design, field support		0	30000		30000
	fuel caching	fuel caching 65hrs ($2,800/hr)		0	182000		182000
	fuel move	fuel drum moving/loading		0	5000		5000
	fly time	fixed wing 220 hrs at		100000	420000		420000

		$2,800/hr machine)					
	fly time	rotary wing 60 hrs at $3,000/hr		0	180000		180000
	community contracts	HTO assistants ($350/day x 42 days)		0	50400		50400
	travel, food, and accommodations	3-4 biologists for 6 weeks at 170 per diem per day plus $250 hotel		0	52000		52000
	field equipment	GPS subscription, field gear		0	6000		6000
	laboratory analysis	harvest tissue DNA analysis for analysis (mark-recovery model; ~1000 samples)		0	38000		38000
	shipping	shipping gear to communities for work		0	1500		1500

11. Original Contributions:

Contributor	Funds ($K)
GN	405000
ECCC	400000
NWMB	100000
PC	40000
WWF	20000
	965000.0

13. Explanation of changes:

Updated budget:

Expenditure	**2022/2023**	**Funding Contributors**						
Aerial Survey		GN	EC	NWMB	NTI	PCSP	WWF	in-kind
Contracted services -- survey design	$30,000	$30,000						
Fuel caching ($2,800/hr)	$195,123	$76,960		$100,000	$18,163			
Fuel drum moving/loading	$5,000	$5,000						
3 fixed wing at $2,800/hr plus positioning	$1,023,564	$524,486	$400,241		$98,837			
Rotary wing at $2,995/hr plus positioning	$521,928	$372,169	$24,759		$125,000			
Contracted help (biologist)	$40,000	$40,000						
Contracted help (ECCC biologist, in kind)	$10,000							$10,000
Field assistants GN	$45,000							$45,000
DFO computer and camera tech (salary, travel in kind)	$15,000							$15,000
HTO members	$42,000	$42,000						
Travel and per diems	$109,700	$109,700						
Shipping	$1,500	$1,500						
Field equipment and subscriptions	$6,000	$6,000						
Fuel cache cleanup	$207,660	$117,967				$89,693		
Subtotal aerial survey	**$2,252,475**	**$1,325,782**	**$425,000**	**$100,000**	**$242,000**	**$89,693**		**$70,000**

Data analysis								
Contracted services -- data analysis support	$60,000	$60,000						
Harvest tissue analysis for analysis (mark-recovery model)	$40,000	$20,000					$20,000	
Subtotal data analysis	**$100,000**	**$80,000**					**$20,000**	
Totals	**$2,352,475**	**$1,405,782**	**$425,000**	**$100,000**	**$242,000**	**$89,693**	**$20,000**	**$70,000**

The financial changes in the proposed project budget have changed due to the added costs of air charters, and additional funds that were provided by NTI and the GN.

Additionally, the support from PCSP changed to include fuel cleanup rather than fuel caching or accommodations. Furthermore, the flying time were adjusted for the project needs.

14. Financial Report:

Budget Item	Budgeted	Disbursed	Variance
Contracted services -- survey design	$30,000	$30,000	$0
Fuel caching	$182,000	$195,123	-$13,123
Fuel drum moving/loading	$5,000	$5,000	$0
Fixed wing air charters	$420,000	$1,023,564	-$603,564
Rotary wing air charter	$180,000	$521,928	-$341,928
Contracted help (biologist)		$40,000	-$40,000
Contracted help (ECCC biologist, in kind)		$10,000	In-kind
Field assistants GN		$45,000	In-kind
DFO equipment and technician		$15,000	In-kind
HTO members	$50,400	$51,359	-$959
Travel and per diems	$52,000	$109,700	-$57,700
Shipping	$1,500	$1,500	$0
Field equipment and subscriptions	$6,000	$6,000	$0
Fuel cache cleanup		$207,660	-$207,660
Contracted services -- data analysis support		$60,000	-$60,000
Harvest tissue analysis for analysis (mark-recovery model)	$38,000	$40,000	-$2,000
TOTAL	**$964,900**	**$2,352,475**	**-$1,387,575**

The entire NWMB contribution was used towards air charters for the Lancaster Sound polar bear abundance survey.

Explanation of variance:

Variance was due to several factors:

- Several staffing changes occurred during the project, and contracted help was required.

- Air charter costs were higher than expected.
- Fuel caching was not originally included as part of the project.
- More funding support was made available through the GN and NTI to expand the project.

15. Verification of information provided:

I certify that this is an accurate statement of the Board project funds received and disbursed in accordance with the joint contribution agreement.

A. Roberto-Charron

Project leader

Wei Zhu (Acting) June 5, 2023.

Finance department signature